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THE GREATER HORSESHOE BAT, RHINOLOPHUS FERRUMEQUINUM (SCHREBER, 1774), IN GREECE, WITH DESCRIPTION OF A NEW SUBSPECIES

JOAN ILIOPOULOU-GEORGUDAKI AND JOHN C. ONDRIAS

The greater horseshoe bat, *Rhinolophus ferrumequinum*, is widely distributed in Europe, Asia Minor, Persia, and the Arabian Peninsula, eastward through southern Asia to Japan. In North Africa, it is known from Algeria and Morocco and may occur elsewhere on that continent as well. A number of subspecies have been described (Felten *et al.*, 1977), of which the most acceptable seem to be *R. f. ferrumequinum* (Schreber, 1774), *R. f. martinoi* Petrov, 1941, and *R. f. proximus* Andersen, 1905. The recognition of other named races is questionable.

The species has been recorded from Greece from the following localities: Parnassos and Syros (Miller, 1912); Rhodos (de Beaux, 1928; Festa, 1914); Olympos (Chaworth-Musters, 1932); Skyros (Pohle, 1953); Kimmeria (Thrace) (Linderg, 1955); Corfu (Niethammer, 1962); Ioannina (Epirus) (Felten *et al.*, 1977); Crete (Bate, 1906; Felten *et al.*, 1977; Kahmann, 1959; Miller, 1912; Pieper, 1977).

MATERIALS AND METHODS

The present study is based on examination of 120 specimens from continental Greece and 17 from the Island of Crete. The localities of collection are listed in the accounts beyond. Most specimens are preserved in alcohol and are deposited in the Zoological Museum of the University of Patras (ZMUP), Greece.

TABLE 1.—*Body and skull measurements of* Rhinolophus ferrumequinum *from the Island of Crete and North, Central, and South Greece, with* t*-values comparing Cretan samples with each of Grecian ones. Significant* t*-values* ($P < 0.01$) *are indicated by an asterisk.*

	Crete			North Greece				Central Greece				South Greece			
Characters	*N*	Mean	SD	*N*	Mean	SD	*t*-values	*N*	Mean	SD	*t*-values	*N*	Mean	SD	*t*-values
TL	13	99.30	3.46	8	110.38	4.50	6.37*	57	106.70	4.84	5.20*	44	104.75	3.71	4.72*
HB	13	62.00	2.76	8	70.19	2.48	6.85*	55	67.01	2.01	5.63*	44	65.22	2.74	3.72*
T	13	37.30	2.42	8	40.19	4.74	1.86	55	39.23	3.66	1.80	44	39.53	2.73	2.64
HF	13	10.61	0.85	8	11.34	0.56	2.84	57	11.16	0.64	2.62	44	11.04	0.49	3.02*
E	13	22.46	1.60	8	25.68	0.76	5.31*	61	23.81	1.08	3.74*	44	22.47	3.20	0.01
FA	15	55.51	1.64	8	58.16	0.64	4.32*	61	57.71	1.29	5.60*	42	58.14	1.40	5.99*
GLS	10	21.63	0.27	7	22.69	0.30	7.17*	54	22.60	0.39	7.51*	27	22.43	0.38	6.00*
CL	10	19.55	0.45	7	20.51	0.30	4.91*	57	20.37	0.32	7.01*	27	20.21	0.32	3.86*
ZB	11	12.10	0.26	7	12.54	0.25	3.50*	60	12.41	0.26	3.64*	34	12.34	0.24	2.76*
BB	12	8.82	0.29	7	9.06	0.24	1.85	59	9.10	0.22	3.80*	32	9.12	0.24	3.42*
PC	14	2.59	0.16	7	2.67	0.19	1.00	62	2.66	0.15	1.56	38	2.62	0.18	0.59
CM3	14	7.97	0.12	7	8.38	0.23	5.93*	63	8.38	0.19	7.72*	42	8.35	0.16	7.69*
MTR	14	8.98	0.14	7	9.25	0.12	5.27*	58	9.45	0.22	7.61*	42	9.41	0.20	7.32*
M	13	15.31	0.26	7	15.98	0.24	5.72*	59	15.89	0.28	6.84*	39	15.81	0.27	6.00*

Key to characters: TL, total length; HB, length of head and body; T, length of tail; HF, length of hind foot; E, length of ears; FA, length of forearm; GLS, greatest length of skull; CL, condylobasal length; ZB, zygomatic breadth; BB, breadth of braincase; PC, postorbital constriction; CM3, maxillary toothrow; MTR, mandibular toothrow; M, length of mandible.

All measurements are recorded in millimeters. Color variation was analyzed by comparing skins of similarly aged animals directly with the color plates of Ridgway (1885). For each specimen, external and cranial measurements, sex, and date and locality of collection were recorded. Only adults, as determined by complete ossification of the phalanges and by at least some wear on the teeth, were included in statistical treatment of mensural data.

Initial analysis involved computation of standard statistics (mean, range, standard deviation, and standard error of the mean) for 14 variables of all specimens from Greek localities. The same metric data were subjected also to a *t*-test (Table 1). Morphological data from each of the comparable samples were analyzed using a computer program that generated coefficients of average taxonomic distance (ATD) among samples from standardized character values, as well as by the unweighted pair-group method using arithmetic averages (UPGMA) based on the distance coefficient (Fig. 1). A data matrix was formed using localities as OTU's (Operational Taxonomic Units) and size characters as variables. The distance matrices and dendrograms facilitated interpretation of overall similarities between OTU's.

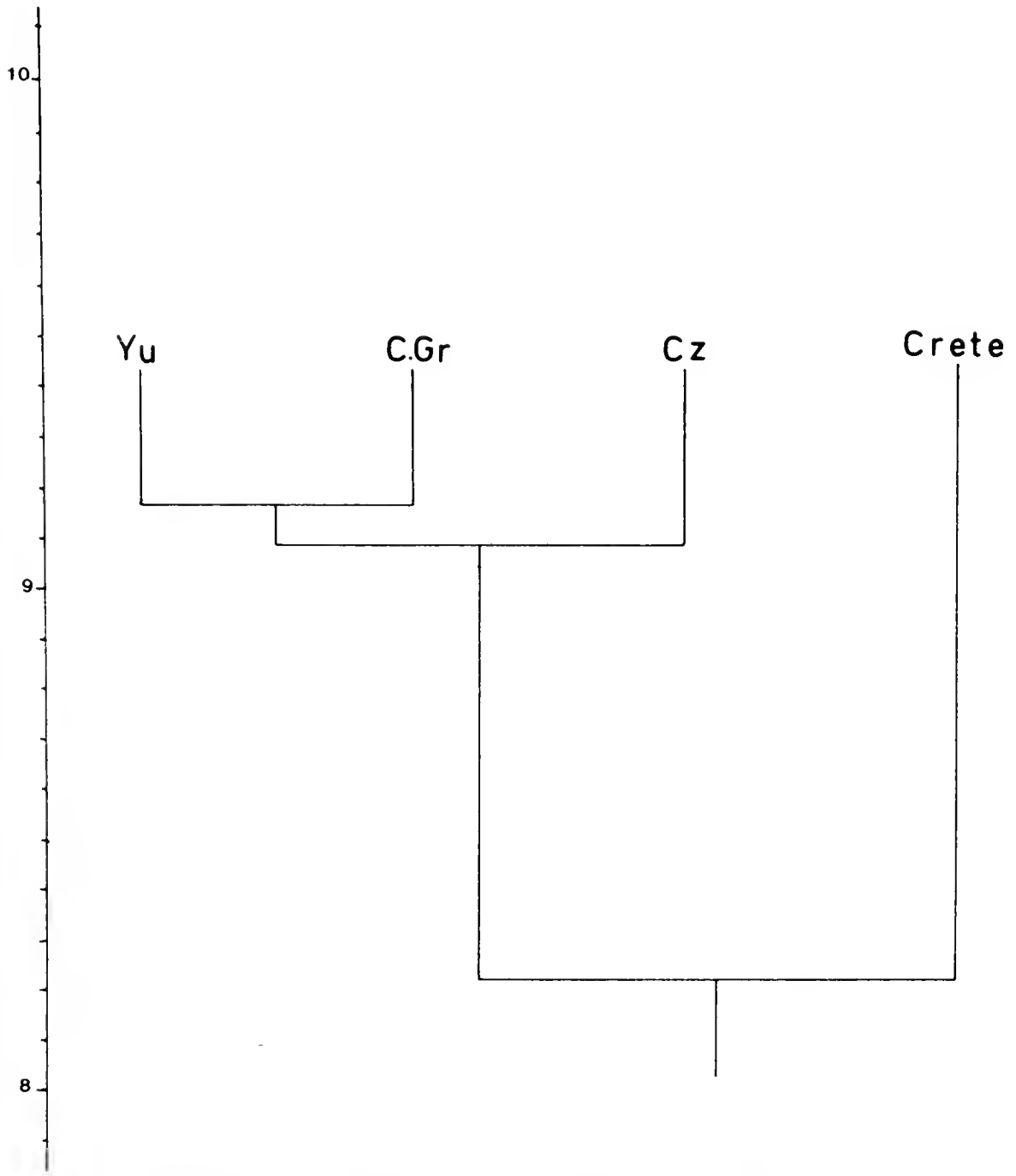

FIG. 1. Phenogram computed from distance matrix based on standardized characters and clustered by unweighted pair-group method using simple averages (UPGMA). Yu, Yugoslavia; C.Gr, central Greece; Cz, Czechoslovakia.

RESULTS

Sexual variation.—We detected no statistically significant sexual differences in measurements or coloration in any of the available samples. Consequently, data relating to both sexes were combined in subsequent analyses.

Age variation.—We noted no significant differences among adults in the several samples except increased wear on teeth with age.

Seasonal variation.—At localities from which specimens were available from more than one time of the year, a slight seasonal variation in color was discernible. Thus, in specimens from Peloponnesus we found darker shades of brown in the winter (intermediate between hair brown and drab) than were found in the spring (natal brown).

Geographic variation.—There is variation in color and mensural values among samples. Evidence of such variation is depicted in Fig. 2, in which length of forearm is compared between samples from mainland Greece and Crete. Furthermore, the color of individuals in samples from continental Greece is a darker shade of brown from south to north. Specimens from Crete are noticeably paler and more brownish than are those from continental Greece, verona and benzo brown in winter.

Discussion and Taxonomic Assessment of Samples

For taxonomic assessment of Greek populations (especially for the one on Crete) of *R. ferrumequinum*, we compared samples from four geographic areas, each within the range of a single subspecies as currently recognized: Czechoslovakia (Hanak, 1964), Yugoslavian Macedonia (Mirić, 1960), continental Greece, and the Island of Crete. Smaller samples from separate Greek localities have been incorporated into larger categories representing the northern, central, and southern parts of the country.

Czechoslovakia is occupied by *R. ferrumequinum ferrumequinum* and southern Yugoslavia and continental Greece by *R. ferrumequinum martinoi*, whereas the Island of Crete is occupied by a new subspecies described in this paper. Average measurements for the four samples are presented in Table 2.

On the basis of nine cranial and external measurements the sample from Crete is separable from the samples of *R. f. ferrumequinum* and *R. f. martinoi* by an average taxonomic distance of 8.22. A dendrogram indicating levels of morphologic difference, based on the largest sample, that from central Greece, places the population from Crete as distinct at the subspecific level (Fig. 1). These differences as well as differences between specimens from Crete and continental Greece, as concluded by the *t*-test, lead us to propose the following taxonomic arrangement of Greek specimens of *R. ferrumequinum*.

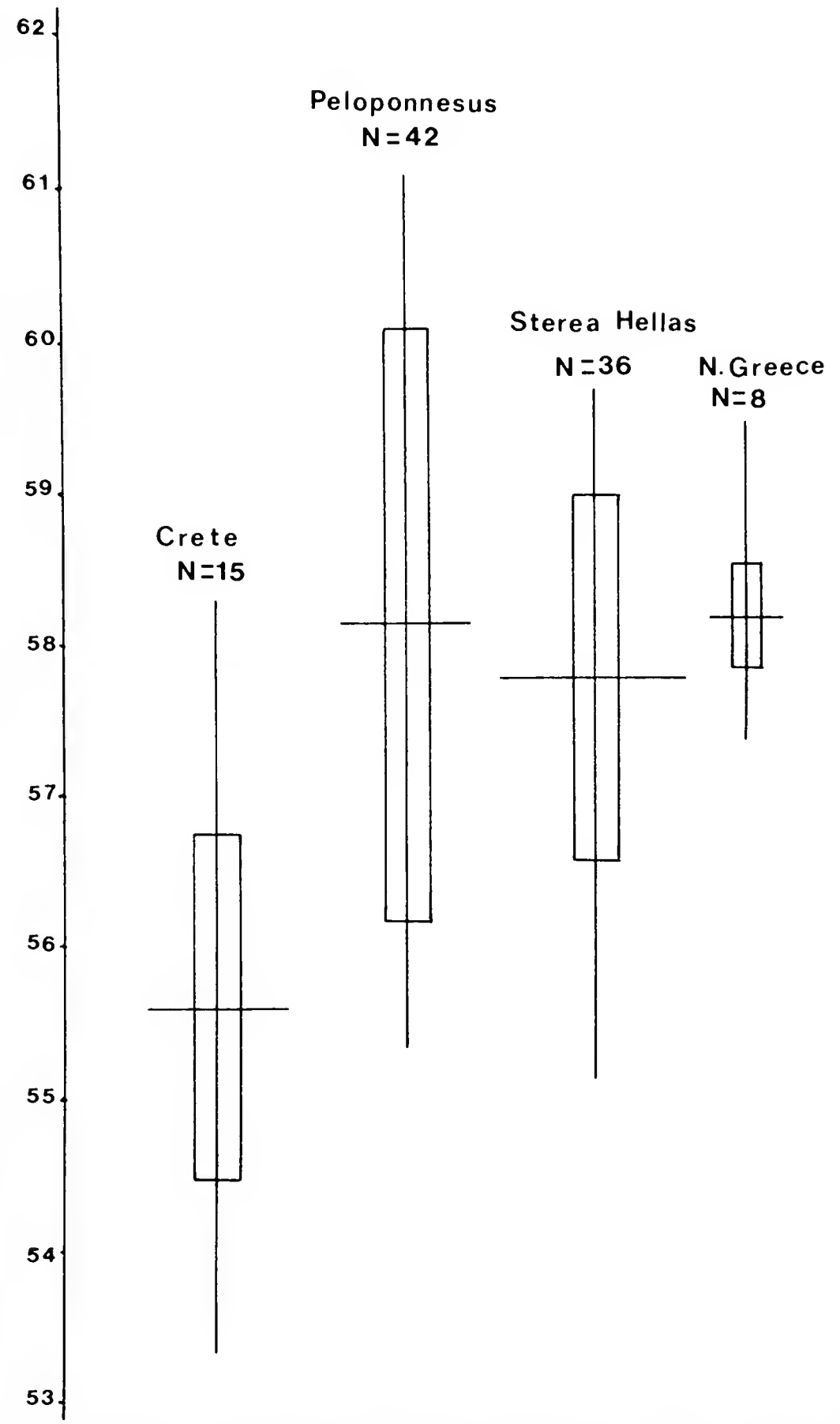

FIG. 2. Geographic and individual variation in length of forearm in four Greek samples of *Rhinolophus ferrumequinum*. The bar represents one standard deviation on either side of the mean (horizontal line) in each sample, whereas the vertical line indicates the extremes in variation.

TABLE 2.—*Means for the specimens of* R. f. creticum *(Crete),* R. f. martinoi *(Central Greece, Yugoslavia) and of* R. f. ferrumequinum *(Czechoslovakia).*

	OTU's			
Characters	Crete	Central Greece	Yugoslovia	Czechoslovakia
HB	62.0	66.9	67.8	63.5
T	37.3	41.6	39.0	40.2
FA	55.5	57.8	58.2	57.4
E	22.5	24.0	24.7	24.3
GLS	21.6	22.6	22.9	22.4
CL	19.5	20.4	20.2	19.9
ZB	12.1	12.4	12.2	12.2
PC	2.6	2.7	2.8	2.8
CM3	15.3	15.9	16.0	15.7

See Table 1 for key to characters.

Rhinolophus ferrumequinum martinoi Petrov, 1941

Holotype.—Adult female, no. 214, collection of B. Petrov; obtained in April 1939 at Trifunovicevo Brdo, Pepeliste, Yugoslavia.

Distribution.—Southeastern Yugoslavia southward through continental Greece, and on Sicily.

Diagnosis.—Larger than *R. f. ferrumequinum.* Mean length of forearm varying from 57.71 to 58.16 in samples from Greece; mean condylobasal length in the same samples varying from 20.21 to 20.51; mean zygomatic breadth varying from 12.23 to 12.54.

Remarks.—Compared with *R. f. ferrumequinum,* the subspecies *martinoi* is larger in most mensural variates. Of the following measurements (type first, then mean values of topotypes with extremes in parentheses), only five measurements of the holotype are greater than the average measurements of four topotypes (Petrov, 1941): length of head and body, 67.0, 69.37 (68.0-71.5); length of tail, 36.0, 36.25 (35.0-38.0); length of hind foot, 12.0, 12.17 (12.0-12.5); length of ear, 23.7, 23.45 (22.5-24.0); length of forearm, 58.5, 56.27 (54.4-58.2); condylobasal length, 20.8, 20.6 (19.6-21.4); zygomatic breadth, 12.6, 12.57 (12.5-12.7); postorbital constriction, 2.4, 2.45 (2.2-2.6); length of maxillary toothrow, 9.0, 9.0 (9.1-9.6); length of mandibular toothrow, 9.6, 9.6 (9.5-9.7); length of mandible, 16.2, 15.82 (15.2-16.2).

Specimens examined (total 120, all from Greece).—Thrace: Alexandroupolis, Cave Avantos, 1♀. Macedonia: Kastoria, Cave Drakos, 3♂, 4♀. Thessaly: Elasson, Cave Pythion, 1♀. Sterea Hellas: Mesologgi, Vil. Thermos, 2♂; Mesologgi, Cave Varasova, 31♂, 29♀; Naupactos, Castle of Naupactos, 1♀. Peloponnesus: Achaia, Cave Limnon, 2♂, 1♀; Tripolis, Nea Chora, Cave Ag. Heleousa, 14♂, 31♀.

Rhinolophus ferrumequinum creticum, new subspecies

Holotype.—Adult female, skin and skull no. 5558 ZMUP, obtained on 23 February 1974, in Cave "Milatos," Lasithi, Crete, by J. Iliopoulou-Georgudaki.

Distribution.—Known only from the Island of Crete.

Diagnosis.—A small (see Table 1), pale-colored representative of *R. ferrumequinum*. Measurements of the holotype, followed by the mean for 15 individuals from Crete (extremes in parentheses) are: total length, 104.0, 99.30 (92.2-105.0); length of head and body, 63.0, 62.0 (58.4-67.0); length of tail, 41.0, 37.3 (32.6-41.0); length of hind foot, 11.0, 10.61 (9.0-11.4); length of ear, 24.0, 22.46 (20.2-26.0); length of forearm, 58.0, 55.51 (53.3-58.3); greatest length of skull, 21.7, 21.3 (21.2-22.0); condylobasal length, 19.6, 19.55 (18.9-20.4); zygomatic breadth, 12.15, 12.10 (11.6-12.6); breadth of braincase, 8.5, 8.82 (8.35-9.20); postorbital constriction, 2.4, 2.59 (2.35-2.80); length of maxillary toothrow, 8.2, 7.97 (7.8-8.0); length of mandibular toothrow, 9.0, 8.98 (8.7-9.2); length of mandible, 15.4, 15.31 (15.0-16.0).

Remarks.—Compared with *R. f. ferrumequinum* and *R. f. martinoi*, the new subspecies *creticum* is smaller in most measurements and paler in color. The name *creticum* alludes to the distribution of this new race.

Specimens examined (total 17, all from Crete).—Cave "Milatos," Lasithi, 1♀; Cave "Labyrinth," Heraclion, 2♂, 1♀; Starochori Vil., Setia, 5♂, 7♀, 1 juv.

Summary

In this study, the taxonomic status of specimens of *Rhinolophus ferrumequinum* from continental Greece and the island of Crete were investigated, using biostatistical methods. The distribution of *R. f. martinoi* in continental Greece is confirmed, whereas a new subspecies, *R. f. creticum*, is recognized as occurring on Crete.

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Address of authors: *Department of Biology, University of Patras, Patra, Greece.*
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SYNOPSIS OF THE RICE RATS (GENUS ORYZOMYS) OF NICARAGUA

J. Knox Jones, Jr., and Mark D. Engstrom

Rice rats of the cricetine genus *Oryzomys* occur from the southeastern United States southward to southern South America; they represent a taxonomically complex group in which a varying number of subgenera are recognized, depending on authority consulted. The genus evidently first was reported from Nicaragua by Oldfield Thomas (1895:57), who recorded both *Oryzomys couesi* and *O. gracilis* (=*O. alfaroi*) from Managua. Later, C. Hart Merriam (1901:284) named and described *Oryzomys richmondi,* now a synonym of *O. couesi,* and Thomas (1905:586) described the distinctive *O. dimidiatus* from the Escondido River near Rama. Subsequently (see especially J. A. Allen, 1908, 1910), five additional species of *Oryzomys* have been found to occur in the country, and we here provide a synopsis of the distribution, systematics, and natural history of those taxa currently known from Nicaragua.

Although there is a diversity of rice rats in Nicaragua (eight species representing at least four subgenera), no species, with the possible exception of *O. dimidiatus,* is endemic to the country. Nicaraguan *Oryzomys* comprise a mixture of taxa that are distributed primarily in northern Middle America (*O. alfaroi, O. couesi, O. fulvescens,* and *O. melanotis*) with others that occur primarily in southern Central America and adjacent South America (*O. alfari, O. bombycinus, O. caliginosus,* and possibly *O. dimidiatus*). Other than *dimidiatus,* only one species, *melanotis,* might reach distributional limits (southern) in Nicaragua.