Distribution and Systematics of the Rabbits (*Sylvilagus*) of West-Central Mexico

VICTOR E. DIERSING
and
DON E. WILSON

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY · NUMBER 297

SERIES PUBLICATIONS OF THE SMITHSONIAN INSTITUTION

Emphasis upon publication as a means of "diffusing knowledge" was expressed by the first Secretary of the Smithsonian. In his formal plan for the Institution, Joseph Henry outlined a program that included the following statement: "It is proposed to publish a series of reports, giving an account of the new discoveries in science, and of the changes made from year to year in all branches of knowledge." This theme of basic research has been adhered to through the years by thousands of titles issued in series publications under the Smithsonian imprint, commencing with *Smithsonian Contributions to Knowledge* in 1848 and continuing with the following active series:

Smithsonian Contributions to Anthropology
Smithsonian Contributions to Astrophysics
Smithsonian Contributions to Botany
Smithsonian Contributions to the Earth Sciences
Smithsonian Contributions to Paleobiology
Smithsonian Contributions to Zoology
Smithsonian Studies in Air and Space
Smithsonian Studies in History and Technology

In these series, the Institution publishes small papers and full-scale monographs that report the research and collections of its various museums and bureaux or of professional colleagues in the world of science and scholarship. The publications are distributed by mailing lists to libraries, universities, and similar institutions throughout the world.

Papers or monographs submitted for series publication are received by the Smithsonian Institution Press, subject to its own review for format and style, only through departments of the various Smithsonian museums or bureaux, where the manuscripts are given substantive review. Press requirements for manuscript and art preparation are outlined on the inside back cover.

S. Dillon Ripley
Secretary
Smithsonian Institution

SMITHSONIAN CONTRIBUTIONS TO ZOOLOGY • NUMBER 297

Distribution and Systematics of the Rabbits (*Sylvilagus*) of West-Central Mexico

Victor E. Diersing
and Don E. Wilson

SMITHSONIAN INSTITUTION PRESS
City of Washington
1980

ABSTRACT

Diersing, Victor E., and Don E. Wilson. Distribution and Systematics of the Rabbits (*Sylvilagus*) of West-Central Mexico. *Smithsonian Contributions to Zoology,* number 297, 34 pages, 12 figures, 3 tables, 1980.—Distribution patterns of *Sylvilagus cunicularius, S. floridanus, S. graysoni,* and *S. audubonii* are documented for west-central Mexico including the states of Sinaloa, Durango, Nayarit, Zacatecas, Aguascalientes, Jalisco, Guanajuato, Colima, and Michoacan. A taxonomic revision of the four species in this area is presented recognizing two subspecies of *S. cunicularius,* three of *S. floridanus,* two of *S. graysoni,* and two of *S. audubonii.* Two subspecies of *S. floridanus* (*S. f. restrictus* and *S. f. subcinctus*) are relegated to the synonomy of *S. f. orizabae.* Two subspecies are described as new, one each of *S. graysoni* and *S. floridanus.* The karyotype of *S. graysoni* is presented and figured. External and cranial measurements for all species and subspecies are presented.

OFFICIAL PUBLICATION DATE is handstamped in a limited number of initial copies and is recorded in the Institution's annual report, *Smithsonian Year.* SERIES COVER DESIGN: The coral *Montastrea cavernosa* (Linnaeus).

Library of Congress cataloging in Publication Data
Diersing, Victor E
Distribution and systematics of the rabbits (Sylvilagus) of west-central Mexico.
(Smithsonian contributions to zoology ; no. 297
Bibliography: p.
1. Cottontails—Classification. 2. Cottontails—Geographical distribution. 3. Mammals—Classification. 4. Mammals—Geographical distribution. 5. Mammals—Mexico. I. Wilson, Don E., joint author. II. Title. III. Series: Smithsonian Institution. Smithsonian contributions to zoology ; no. 297.
QL737.L32D53 599'.322 79-607046

Contents

Distribution and Systematics of the Rabbits (*Sylvilagus*) of West-Central Mexico

Victor E. Diersing
and Don E. Wilson

Introduction

There has been no comprehensive account of the rabbits of west-central Mexico since Nelson's (1909) revision of North American rabbits. More recent regional studies within west-central Mexico include a survey of the rabbits of Sinaloa by Armstrong and Jones (1971) and notes on the rabbits of Jalisco by Genoways and Jones (1973).

Presently, four species of rabbits are known from west-central Mexico: Mexican cottontail, *Sylvilagus cunicularius* (Waterhouse, 1848); eastern cottontail, *S. floridanus* (J. A. Allen, 1890); Tres Marias cottontail, *S. graysoni* (J. A. Allen, 1877); and desert cottontail, *S. audubonii* (Baird, 1857). West-central Mexico is that area including Sinaloa and Durango southward through Nayarit, Zacatecas, Aguascalientes, Jalisco, Guanajuato, Colima, and Michoacan.

Recent collecting in Nayarit by personnel of the National Fish and Wildlife Laboratory, and on the Tres Marias Islands (approximately 86 km west of mainland Nayarit), has yielded specimens representing three of the four species known from west-central Mexico. This material, combined with that available in other collections, makes it possible to more clearly define the distribution and relationships of members of the genus *Sylvilagus* in west-central Mexico.

Victor E. Diersing, Museum of Natural History, University of Illinois, Urbana, Illinois, 61801. Don E. Wilson, U. S. Fish and Wildlife Service, National Fish and Wildlife Laboratory, National Museum of Natural History, Washington, D. C. 20560.

Many individuals of *S. floridanus* and *S. cunicularius* from mainland Nayarit and adjacent areas, could not be assigned to either species using published methods. Also, the rabbits from San Juanito Island differ markedly from those on adjacent Maria Madre Island. This report presents distributional data and methods for recognizing all species of *Sylvilagus* throughout west-central Mexico. The insular *S. graysoni* is compared to the mainland species.

ACKNOWLEDGMENTS.—The research on which this report is based was assisted by a Smithsonian Institution summer fellowship awarded to Diersing in 1975. In addition, funds for Diersing's travel to examine rabbits housed in collections throughout the United States and Canada were made available by the Theodore Roosevelt Fund of the American Museum of Natural History. Our appreciation is extended to those people who gave their permission to examine specimens under their care. These people and their institutions (abbreviations used in listing specimens examined follow the name of each collection) are: Sidney Anderson, American Museum of Natural History (AMNH), New York; Richard D. Estes, Philadelphia Academy of Natural Sciences (ANSP); Robert T. Orr, California Academy of Sciences (CAS), Golden Gate Park, San Francisco; David G. Huckaby, Biology Department, California State University (CSLB), Long Beach; Luis de la Torre, Field Museum of Natural History (FMNH), Chicago; Robert S. Hoffmann, Museum

of Natural History (KU), University of Kansas, Lawrence; Donald R. Patten, Los Angeles County Museum (LACM), Los Angeles; James S. Findley, Museum of Southwestern Biology (MSB), University of New Mexico, Albuquerque; Rollin H. Baker, The Museum, Michigan State University (MSU), East Lansing; William Z. Lidicker, Jr., Museum of Vertebrate Zoology (MVZ), University of California, Berkeley; J. Mary Taylor, Vertebrate Museum, University of British Columbia (UBC), Vancouver; William H. Burt, University of Colorado Museum (UCM), Boulder; Donald F. Hoffmeister, Museum of Natural History, University of Illinois (UIMNH), Urbana; Emmet T. Hooper, Museum of Zoology, University of Michigan (UMMZ), Ann Arbor; National Museum of Natural History, Smithsonian Institution (USNM, collection of the former United States National Museum).

Our studies in Mexico were facilitated by permits and other assistance provided by the Direccion General de la Fauna Silvestre, and especially by the former Director, Mario Luis Gabucio. Field and museum assistance was provided by B. A. Bacon, C. A. Blount, R. D. Fisher, K. N. Geluso, P. Huerta, C. B. Robbins, and N. J. Scott, Jr.; A. L. Gardner provided laboratory assistance with the karyotypic analysis; M. A. Bogan, A. L. Gardner, C. Jones, and R. W. Thorington, Jr. helpfully criticized earlier versions of this report.

Methods

When available, total length, tail length, hind foot length, and ear length from the notch were taken from the original skin tag. Body length was calculated by subtracting tail length from the total length. Dry ear length was measured from the notch to the tip of the fleshy ear. All 26 quantitative cranial measurements were taken to the nearest 0.5 mm using dial calipers. The cranial measurements and methods for taking them are: upper incisor length, I^1 (first upper incisor) length measured along its groove; palatal length, least length; greatest skull length, anterior face of I^1 to the posterior point of the supraoccipital shield; basal length, ventromedian notch of the foramen magnum to the anterior face of I^1; zygomatic breadth, greatest breadth across both zygomatic arches; braincase breadth, greatest breadth usually taken underneath the free projection of each zygomatic arch; nasal length, greatest length of a nasal bone; greatest nasal breadth, greatest breadth across both nasals; maxillary toothrow, alveolar length of the toothrow, PM^2-M^3; maxillary toothrow breadth, taken across both toothrows at the labial alveolus of PM^3; postdental breadth, least breadth across the pterygoid processes posterior to the maxillary toothrows; incisive foramen, greatest length of an incisive foramen; basioccipital length, midventral length of the basioccipital; basioccipital breadth, greatest breadth between the auditory bullae; diastema length, posterior alveolar border of I^2 to the anterior alveolar border of PM^2; rostrum depth, taken from the most ventral point of the rostrum (the point where the suture is formed by the premaxillary and maxillary) dorsally in a line perpendicular to the length of the ventral surface of the rostrum to the most dorsal surfaces of the nasals; bullar length, greatest anteroposterior length of the bulla; bullae breadth, distance between the most lateral margins of both bullae; shield-bullae depth, depth of the skull from the postero-dorsal surface of the supraoccipital shield to a plain across the antero-ventral surfaces of both auditory bullae; skull depth, greatest height of the skull above a glass slide positioned such that the upper incisors and mastoid processes rest upon the slide; carotid foramina breadth, distance between the two foramina; infraorbital canals breadth, distance between the canals taken across the ridge of bone forming the lateral border of each canal; mandible height, most anteroventral extension of the angular process to the most dorsal part of the coronoid process; mandible length, anterior point of the alveolus of PM_3 to the most posterior extension of the angular process; ramus height, taken according to Findley, et al. (1975:86), from the bottom of the most anterior labial notch of the alveolus of PM^4 ventrally to the most ventral extent of the ramus; mandibular toothrow, anterior alveolar border of PM_3 to the posterior alveolar of M_3. Methods for taking these measurements are further explained in Diersing (1978). The color of the dorsal and tail pelages were recorded as grayish or reddish.

Statistical procedures include discriminant function analysis, principal components analysis, Student's *t*-test of means, scattergrams, means, standard deviations, and coefficients of variation. All computer techniques were employed on the University of Illinois IBM 360 computer.

All specimens were aged by the method of Hoffmeister and Zimmerman (1967). Only adults were used in statistical analyses. Because females averaged only slightly larger than males, both sexes were combined in statistical treatments.

Recognition of Species

Four species of rabbits are known from west-central Mexico, *S. floridanus, S. cunicularius, S. audubonii,* and *S. graysoni.* The Omilteme rabbit, *S. insonus,* and forest rabbit, *S. brasiliensis,* are known from areas to the south in Guerrero and Oaxaca, respectively. In the interior Mexican Plateau of west-central Mexico, the geographic range of *S. floridanus* partially overlaps that of *S. audubonii.* Along the lower western foothills of the Sierra Madre Occidental and the Transverse Volcanic Axis, the ranges of *S. floridanus* and *S. cunicularius* are parapatric. In most of these areas these species are distinguished from one another with difficulty, and some specimens have been misidentified. *Sylvilagus graysoni* is known only from the Tres Marias Islands of Nayarit. *Sylvilagus audubonii* also occurs in the arid sections of northwestern Sinaloa, where it is parapatric with *S. floridanus* of the adjacent Sierra Madre. The best methods for distinguishing these species are presented below. Refer to Table A for additional quantitative data. Geographic variation within each species is discussed under "Taxonomy."

Sylvilagus floridanus from *S. cunicularius:* In southern Sinaloa southward to western Michoacan, *S. floridanus* occurs on the western forested slopes of the Sierra Madre Occidental and western margins of the Transverse Volcanic Axis. Immediately west of the mountains, *S. cunicularius* occurs on the tropical coastal plain from the sea to mountain slopes. These two species are parapatric and are difficult to distinguish where the tropical coastal plain meets the western mountain slopes. From southern Sinaloa southward to western Michoacan, each species increases in overall size, which complicates recognition of the two species.

In Sinoloa, Nayarit, western Jalisco, Colima, and western Michoacan, *S. cunicularius* has long ears and a short tail with short reddish-colored hairs dorsally. *Sylvilagus floridanus* has medium-sized ears and medium-sized tail with long reddish to reddish black hairs dorsally. In general, the breadth of the tail of *S. cunicularius* (including the hairs) is less than 35 mm and the ears (as measured dry from the notch) are usually longer than 61 mm, whereas in *S. floridanus* the breadth of the tail is usually greater than 40 mm and the ears are usually shorter than 61 mm. The two species can usually be separated on the basis of these two external differences.

Cranially, *S. cunicularius* differs from *S. floridanus* primarily in having a larger skull (especially in greatest length) with a much deeper mandible, larger auditory bullae, longer maxillary and mandibular toothrows, and greater breadth across the carotid foramina. A scattergram analysis (Figure 1) plotting mandibular depth and bullar length against alveolar lengths of the mandibular and maxillary toothrows, separates the two species. Individuals of grouped samples 2 (Sinaloa specimens only), 3, and 4 of *S. floridanus,* and samples 1, 2, and 3 of *S. cunicularius* were used. Grouped samples within the figure correspond to those of Fig-

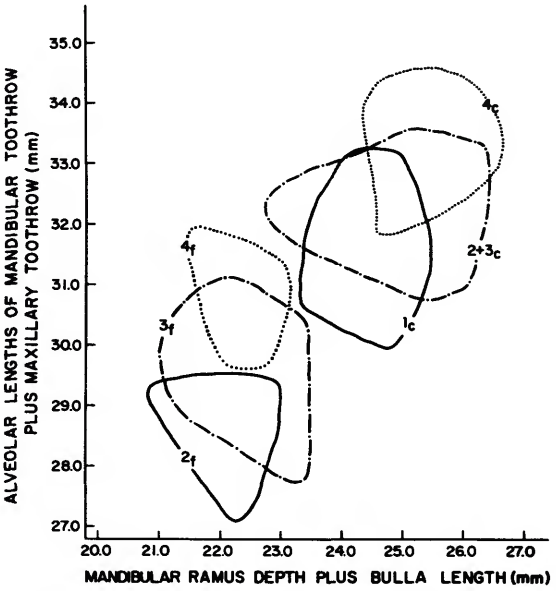

FIGURE 1.—Scattergram analysis comparing individuals of *S. cunicularius* with *S. floridanus* from extreme western Mexico (encircled area = morphological dispersion of pooled sample; number associated with each sample corresponds to number used in Figures 3 and 4; subscripts "c" or "f" by each number refer to *cunicularius* or *floridanus;* sample 2f is composed only of specimens from Sinaloa; within each species, southern samples are morphologically larger than northern samples).

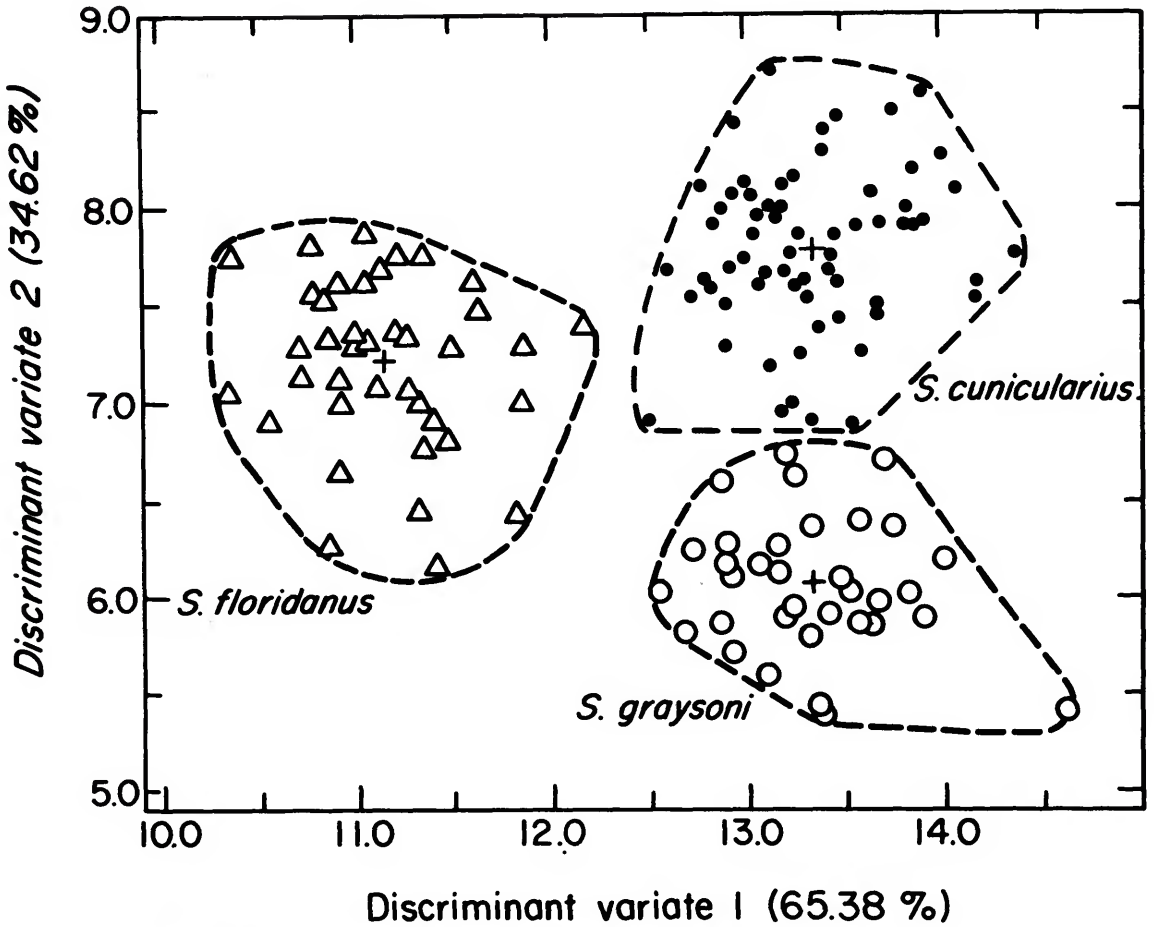

FIGURE 2.—Discriminant function analysis comparing individuals of *S. cunicularius*, *S. floridanus*, and *S. graysoni*. (Individuals within the analysis are: *S. cunicularius*, samples 1, 2, and 3 of Figure 3; *floridanus*, samples 2 (only those from Sinaloa), 3, and 4 of Figure 4; and *S. graysoni*, samples 1 and 2 of Figure 10. Refer to Table B for discriminant multipliers of each cranial character used in the analysis; solid circle = individuals of *S. cunicularius*, triangles = *S. floridanus*, open circles = *S. graysoni*; species centroid is indicated by a plus sign.)

ures 4 and 8. All adults are separable using this method. The north to south size increase in these characters is evident in Figure 1.

A discriminant function analysis was also used to evaluate the species' morphological differences using all 26 cranial characters. *Sylvilagus graysoni* from the Tres Marias Islands was also included in the analysis and is discussed below. External measurements were not used because this information was missing for many individuals. All cranial characters and their discriminant multipliers are given in Table B. Within the analysis, those characters having the greatest univariate differences, as expressed by F ratios, were: mandibular depth, 101.57; breadth across the carotid foramina, 92.83; shield-bullae depth, 78.37; and greatest skull length, 76.56. All individuals were separated on the first discriminant variate (Figure 2).

An additional discriminant analysis (not shown) was performed without *S. graysoni*, and those univariate characters with the highest F ratios were the same as the four listed for the three-species analysis. Thus, the characters with the most discriminatory power, in these analyses are those dis-

tinguishing *S. floridanus* from the other two species.

Armstrong and Jones (1971) considered *S. floridanus* and *S. cunicularius* to be allopatric in Sinaloa except at San Ignacio, 215 m, where two specimens of *S. cunicularius* and one of *S. floridanus* were recorded. The two specimens referred to *S. cunicularius* (KU 90781 and 90782) were included in our discriminant function analysis as *S. floridanus*? and have individual discriminant scores on the first axis of 11.65 and 11.40, typical for *S. floridanus* rather than *S. cunicularius*. Examination of these specimens confirmed their identity.

Allen (1906:212) referred a specimen (AMNH 24694) from Sinaloa, Arroyo de Taquaco, 1220 m, to *S. cunicularius*. This is an unusually high elevation for the species in Sinaloa and Nayarit. All other records from these two states are from elevations under 90 m. The recorded elevation of this specimen (individual discriminant score of 13.52 on the first discriminant variate) is probably incorrect. The town "Escuinapa", written on the skull box, has an elevation of approximately 30 m.

In interior Mexico, *S. floridanus* is smaller than it is in the west and *S. cunicularius* is larger. Therefore, the difference in overall size between the two species is much greater. For example, in the northern half of Michoacan and southern Jalisco (samples 8 and 10 of Figure 4), the largest individual of *S. floridanus* measured 75.85 mm and 66.7 mm in greatest skull and dry ear length, respectively. The smallest specimen of *S. cunicularius* (sample 4 of Figure 3) from the same general area measured 82.30 mm and 70.0 mm. There is no overlap in these characters and the two species are easily distinguished from one another.

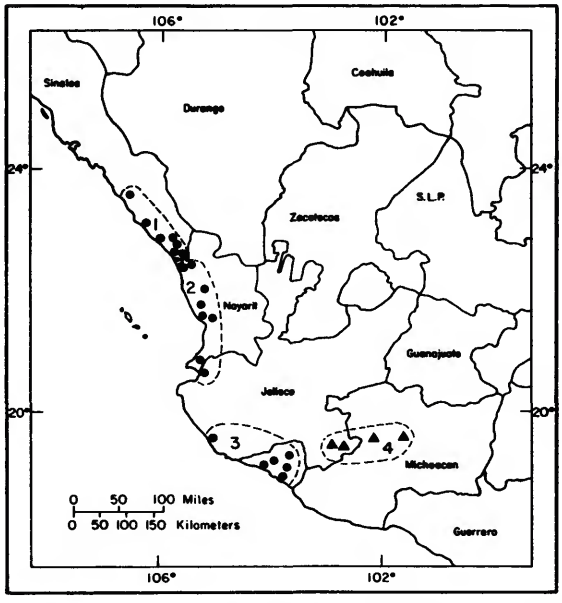

FIGURE 3.—Geographic distribution of *S. cunicularius* in West-Central Mexico (circles = individual localities of *S. cunicularius insolitus;* triangles = *S. cunicularius cunicularius;* number enclosed by dashes = pooled sample used in all statistical comparisons; see Table A).

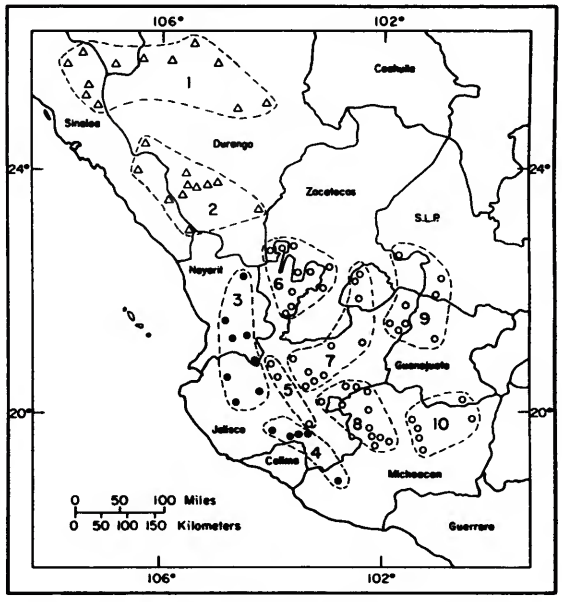

FIGURE 4.—Geographic distribution of *S. floridanus* in West-Central Mexico (triangles = individual localities of *S. floridanus holzneri;* solid circles = *S. f. macrocopus;* open circles = *S. F. orizabae;* number enclosed by dashes = pooled sample used in statistical comparisons in Table A; distribution of *S. floridanus holzneri* in extreme northeastern Sinaloa is not shown).

Sylvilagus graysoni from *S. floridanus:* Externally, these species differ little. Cranially, *S. graysoni* differs in being slightly larger with a markedly deeper mandible, longer palate, greater breadth across the maxillary toothrows, and greater breadth across the carotid foramina.

A scattergram analysis (not shown), plotting depth of the mandible against palatal length, sepa-

rated 61 of 63 individuals of the two species. *Sylvilagus floridanus* from samples 2 (Sinaloa specimens only), 3, and 4 were used in the scattergram. In the discriminant function analysis, all individuals of the two species are separable on the first discriminant function (Figure 2). There is additional separation on the second discriminant function.

Sylvilagus graysoni from *S. cunicularius:* Externally, *S. graysoni* differs in having markedly shorter ears, which range in length (dry) from 50.8 to 60.4 mm; whereas ear lengths of *S. cunicularius* (samples 1, 2, and 3) range from 59.8 to 74.4 mm. A single specimen of *S. cunicularius* is responsible for the overlap. Cranially, *S. graysoni* differs primarily in having much shorter and narrower nasals. The discriminant function analysis, (Figure 2; Table B) correctly allocated all individuals of the two species.

Sylvilagus floridanus and *S. audubonii:* On the Mexican Plateau, *S. floridanus* always has a well-pigmented rufous tail, whereas in *S. audubonii* the tail has a narrow middorsal gray streak bordered by white. Externally and cranially, *S. floridanus* is larger, especially in greatest skull length, nasal length, palate length, maxillary toothrow (no overlap), and mandibular toothrow. *Sylvilagus audubonii* has relatively longer ears and larger auditory bullae. Detailed measurements are given in Table A.

Sylvilagus floridanus of the Sierra Madre of Sinaloa and adjacent Durango differs from *S. audubonii* from northwestern Sinaloa in the same ways that the two species differ in interior Mexico, except that *S. audubonii* is slightly larger, with smaller auditory bullae. However, the grayish tail of *S. audubonii* and the rufous tail of *S. floridanus* readily distinguishes the two species.

Evolution of *Sylvilagus graysoni*

The Tres Marias Islands are continental islands separated from mainland Nayarit by water depths of up to approximately 365 m. During maximum Pleistocene glaciation when ocean levels may have been lowered by as much as 120 m (Zweifel, 1960), these islands may either have been connected to the mainland or separated by a narrow strait of water. The presence of fresh water fish (Nelson, 1899) on the islands suggests a land connection. Rabbits most likely colonized the islands during this period.

Morphologically, *S. graysoni* is more like *S. cunicularius* than *S. floridanus. Sylvilagus graysoni* and *S. cunicularius* both differ from *S. floridanus* in having a markedly deeper mandible, greater breadth across the carotid foramina, and larger skulls. These differences from *S. floridanus* were evident in the discriminant function analysis (Figure 2) where *S. floridanus* was separated from *S. graysoni* and *S. cunicularius* on the first discriminant function.

Biogeographical evidence supports the origin of *S. graysoni* from *S. cunicularius*-like stock. *Sylvilagus cunicularius* occurs along the coastal plain of mainland Mexico whereas *S. floridanus* occupies the higher foothills of the Sierra Madre. The dispersal of *S. cunicularius*-like rabbits from coastal Mexico to the Tres Marias Islands is, therefore, much more likely than is the dispersal of *S. floridanus*-like stock to the islands. Nelson (1909:238) maintained that *S. graysoni* "was probably derived from *S. c. insolitus* of the adjacent mainland" but presented no definite supportive evidence.

When and how the progenitors of *S. graysoni* arrived on the islands is unknown. However, based on the comparisons of the morphology of *S. graysoni* and mainland *S. cunicularius* it is evident that individuals of *S. graysoni* from all four islands share several morphological properties (chiefly short and narrow nasals and short ears) indicating gene exchange between the island populations after isolation from the mainland stock. Gene exchange may have been accomplished by any of the following methods: (1) passive dispersal between islands by man, or rafting; (2) active dispersal between islands by swimming; or (3) dispersal when the four islands comprised a larger single island. Subsequently, the rabbits on San Juanito Island, the northernmost of the four islands, have secondarily differentiated (see species account, page 15.)

The karyotype (Figure 5) of *S. graysoni* may be described as follows: $2n=42$, FN=78, 15 pairs of medium-sized to small meta- and submetacentrics, and 5 pairs of small acrocentric or subtelocentric autosomes. Some of these latter 5 pairs may bear satellites on the short arms as noted for *S. floridanus* by Hsu and Benirschke (1971). The X chromosome is a small acrocentric or subtelocentric and the Y is a very small acrocentric. The sex

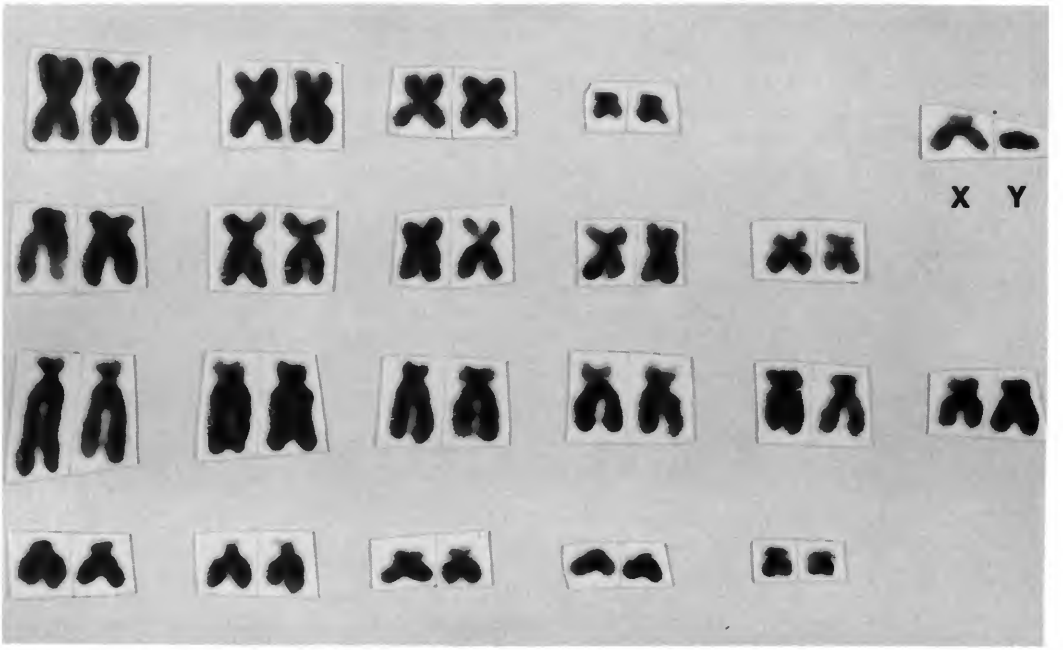

FIGURE 5.—Karyotype of *Sylvilagus graysoni*.

chromosomes are morphologically distinct from those figured for *S. floridanus* by Hsu and Benirschke (1971).

Unfortunately, *S. cunicularius* has not been karyotyped, precluding comparison with that species. We would predict that *S. cunicularius* will be found to share the diploid number of 42 with *S. graysoni* and *S. floridanus*, and the morphology of the sex chromosomes or banding patterns of the autosomes may be useful in further elucidating relationships among *S. graysoni*, *S. cunicularius*, and *S. floridanus*.

In addition to the morphological distinctness of *S. graysoni*, it is relatively unafraid of man. This lack of escape behavior was particularly apparent in *S. graysoni* from San Juanito Island, although rabbits from the other islands showed far less fear of man than do their mainland counterparts. Because of the above reasons, *S. graysoni* seems best considered a distinct species.

Sylvilagus cunicularius insolitus (J. A. Allen)

Lepus insolitus J. A. Allen, 1890:189.
Sylvilagus cunicularius insolitus.—Nelson, 1909:243.

TYPE.—AMNH 2655/2133, adult, male, skin and skull, from the plains of Colima, Mexico. Holotype examined.

RANGE.—Coastal plains of the southern third of Sinaloa, as well as Nayarit, Jalisco, and Colima. Marginal records are: SINALOA: El Limon; Rosario; 9.7 km W La Concha. NAYARIT: Acaponeta; Platanares, 16.1 km E. Ruiz; 29 km E San Blas; 3.2 km SW San Juan de Abajo. JALISCO: Ixtepa; Chamala Bay. COLIMA: Colima; Armeria.

DIAGNOSIS.—Externally: size small for the species; small tail and short ears. Skull: small in most measurements, especially in length of upper incisor, greatest skull length, breadth of the braincase, and mandibular height. Color: body reddish dorsally with black hairs intermixed, tail bright reddish dorsally.

COMPARISONS.—*Sylvilagus c. insolitus* differs from *S. c. cunicularius* from south-central Jalisco and Michoacan as follows: externally smaller, especially in ear and tail length; cranially smaller, particuarly in greatest skull length and braincase breadth; and color of body and tail reddish dorsally rather than grayish. All individuals of the two subspecies can be easily distinguished using these characters (see Table A).

REMARKS.—Genoways and Jones (1973:4) referred specimens from Jilotlan de los Dolores and 12.8 km E Jilotlan de los Dolores in south-central Jalisco to *S. c. insolitus*. These specimens instead represent *S. c. cunicularius* as shown by large size, long grayish tail (KU 111660), and broad braincases.

There is some geographic variation within *S. c. insolitus*. Specimens from the northern part of the range are slightly smaller in overall dimensions than are individuals from the southern parts of the range in Colima.

SPECIMENS EXAMINED (74).—COLIMA: Armeria, sea level to 60 m, 6 (USNM); Colima, 1 (USNM); plains of Colima, 1 (AMNH); Hacienda Magdalena, 455 m, 2 (USNM); Manzanillo, 15 m, 1 (USNM).

JALISCO: Chamala Bay, 4 (UMMZ); Ixtepa, 90 m, 3 (USNM).

NAYARIT: Acaponeta, 60 m, 5 (USNM); Chacala, 1 (USNM); Paso de Soquilpa, 14.2 km E San Blas, 1 (USNM); Platanares, 16.1 km E Ruiz, 2 (KU); San Blas, 30 m, 1 (USNM); 8.1 km E, 6.4 km S San Blas, 1 (MSB); 20.8 km (by road) E San Blas, 1 (KU); 29 km E San Blas, 1 (CSLB); 3.2 km SW San Juan de Abajo, 2 (USNM); Santiago, 61 m, 4 (USNM); 2.3 km (by road) Tacote, 3 (USNM).

SINALOA: Arroyo de Taquaco, 1220 m (probably incorrect; see page 5), 1 (AMNH); 32.2 km SE Autlan, Isla Palmito de la Virgin, 1 (UMMZ); 9.7 km W La Concha, 3 m, 3 (KU); Escuinapa, 13 (12 AMNH, 1 UCM); El Limon, 1 (LACM); Mazatlan, 7 (6 FMNH, 1 CAS); near Mazatlan, 30 to 90 m, 2 (USNM); Palmito, 6 m, 2 (KU); Rosario, 30 m, 2 (USNM); 9.7 km NNW Teacapan, 2 (KU).

Sylvilagus cunicularius cunicularius (Waterhouse)

Lepus cunicularius cunicularius Waterhouse, 1848:132.
Sylvilagus cunicularius.—Nelson, 1909:239.
Lepus verae-crucis Thomas, 1890:74. [Type from Las Vigas, Veracruz, Mexico. Holotype not examined.]

RANGE.—Mountains of the Transverse Volcanic Axis from southern Jalisco eastward to Veracruz, Sierra Madre del Sur of Guerrero, and Sistema Montanoso of northern Oaxaca. Marginal records in western Mexico are: JALISCO: Jilotlan de los Dolores, 730 m. MICHOACAN: Cerro Tancitaro; Patzcuaro.

DIAGNOSIS.—Externally: large in all features. Skull: large in all characters, particularly greatest skull length, braincase breadth, and mandibular height. Color: body grayish dorsally, tail with a narrow middorsal gray streak bordered by much white.

COMPARISONS.—For comparisons of *S. c. cunicularius* with *S. c. insolitus*, see the latter subspecies.

REMARKS.—Although not presented here, comparisons of *S. c. cunicularius* from Jalisco and Michoacan with samples to the east across the Mexican Plateau reveal little differentiation. In addition, specimens from coastal Guerrero differ from both *S. c. insolitus* and *S. c. cunicularius* and are referable to *S. c. pacificus*.

SPECIMENS EXAMINED (15).—JALISCO: Jilotlan de los Dolores, 730 m, 1 (KU); 12.9 km E Jilotlan de los Dolores, 610 m, 2 (KU).

MICHOACAN: Cerro Tancitaro, vicinity Apo, 1 (UMMZ); Patzcuaro, 2130 m, 10 (USNM); Tancitaro, 1 (FMNH).

Sylvilagus floridanus macrocorpus, new subspecies

TYPE.—USNM 509011, adult, female, skin and skull, from Estanzuela, 1372 m, Nayarit, Mexico, collected 20 March 1975 by Clyde Jones, original no. 5251.

RANGE.—Mountains of extreme southwestern Michoacan, mountains of southwestern Jalisco, and Nayarit. Marginal records are: NAYARIT: Mesa del Nayar, 1372 m; Estanzuela; Estancia (possibly across the border in Jalisco). JALISCO: La Cienega; Volcan de Fuego, 2985 m; Las Canoas. MICHOACAN: 22.6 km W Aquililla, Dos Aguas, 2130 m. JALISCO: 32.2 km SE Autlan, 2740 m; 24.2 km S, 14.5 km E Talpa de Allende, 2105 m; La Laguna, Sierra de Juanacatlan, 1980 m. NAYARIT: 3.2 km E San Pedro Lagunillas, E side lake; Tepic.

DIAGOSIS.—Externally: large body with medium-sized ears. Skull: large in all measured features except with medium-sized auditory bullae, but especially large in length of the maxillary toothrow, length of the mandibular toothrow, postdental breadth, rostral depth, and breadth across the maxillary toothrows. Color: varying geographically, in Michoacan and extreme southwestern Jalisco all specimens are reddish dorsally with numerous blackish hairs intermixed, grayish and ochraceous on the body sides, and whitish ventrally with a dusky neck patch. In Nayarit and bordering Jalisco some specimens are grayer dorsally than reddish and all have grayish body sides.

COMPARISONS.—*Sylvilagus f. macrocorpus* differs from *S. f. orizabae* primarily in larger size, particularly in greatest skull length, length of the maxillary toothrow, postdental breadth, and breadth across the maxillary toothrows. In addition, *S. f.*

macrocorpus has relatively shorter ears. Both subspecies are polychromic and color is not a reliable character for distinguishing between them.

The larger size of *S. f. macrocorpus* relative to *S. f. orizabae* is shown in Figure 6. Individuals of *S. f. orizabae* from central and eastern Jalisco and north-central Michoacan (samples 6, 7, and 8 of Figure 3) are almost completely separable from individuals of *S. f. macrocorpus* from western Michoacan, western Jalisco, and Nayarit (samples 3 and 4 of Figure 3). The open triangles (sample 5 of Figure 3) represent the holotype, topotypes, and near topotypes of *S. f. restrictus* (now referred to *S. f. orizabae*). These specimens cluster more closely with *S. f. orizabae*.

Discriminant function analysis also affirms the designation of *S. f. restrictus* as a synonym of *S. f. orizabae*. For the analysis, the reference sample of *S. f. macrocorpus* consisted of samples 3 and 4 from Nayarit, western Jalisco, and northwestern Michoacan. The reference sample of *S. f. orizabae* consisted of samples 7 and 8 from northern Michoacan, east-central Jalisco, and Aguascalientes. The test sample (sample 5) consisted of the holotype, topotypes, and near topotypes of *S. f. restrictus* from central Jalisco. The 26 cranial measurements used and their discriminant multipliers are given in Table C. The individual discriminant scores for the reference samples and the test sample are given in Figure 7. All but one of the individuals in the test sample are referable to *S. f. orizabae*.

Sylvilagus f. macrocorpus differs from *S. f. holzneri* in larger size except in bullar and ear length. *Sylvilagus f. macrocorpus* is considerably larger in greatest skull length, depth of the rostrum, and in the lengths of the maxillary and mandibular toothrows (Table C). Typically, *S. f. macrocorpus* is reddish dorsally and *S. f. holzneri* is grayish dorsally. A scattergram analysis (Figure 8) illustrates the larger size of *S. f. macrocorpus*.

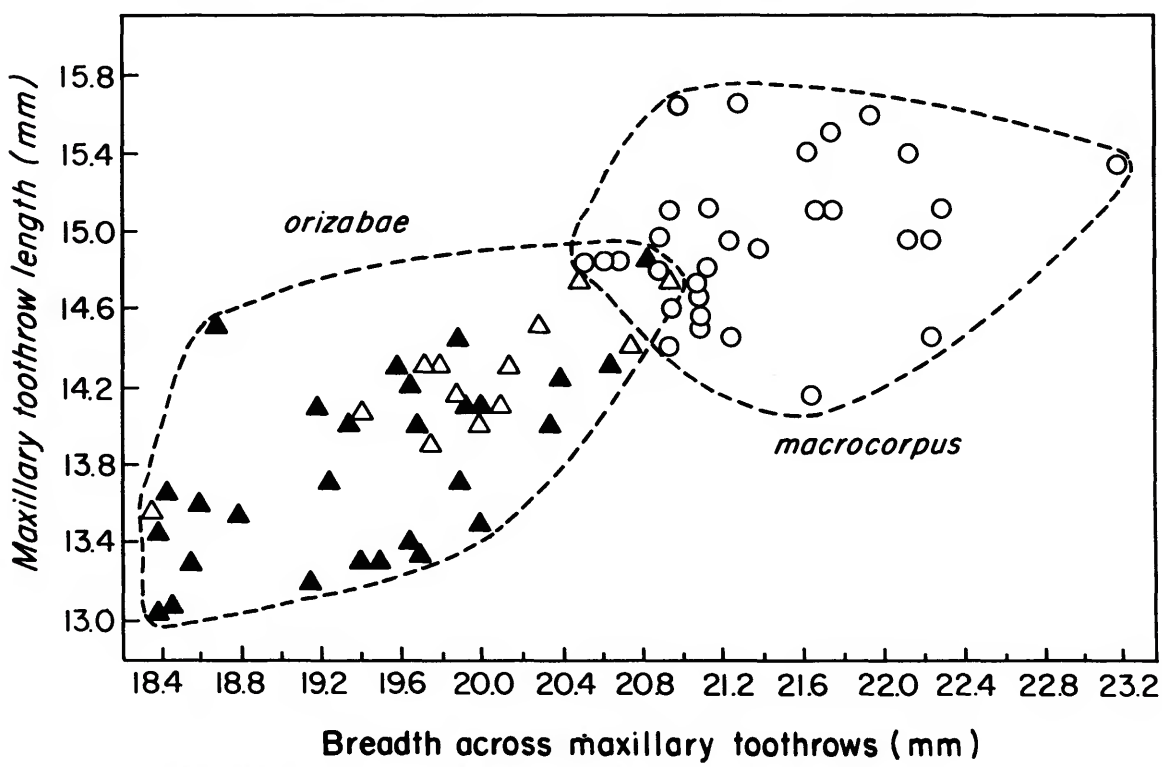

FIGURE 6.—Scattergram used to compare *S. f. orizabae* and *S. f. macrocorpus* (circles = *Sylvilagus f. macrocorpus* (Figure 4, samples 3, 4); solid triangles = *S. f. orizabae* (Figure 4, samples 7, 8); open triangles = the type, topotypes, and near topotypes of *S. f. restrictus* (Figure 4, sample 5) herein considered a synonym of *S. f. orizabae;* see also "Comparisons," page 8).

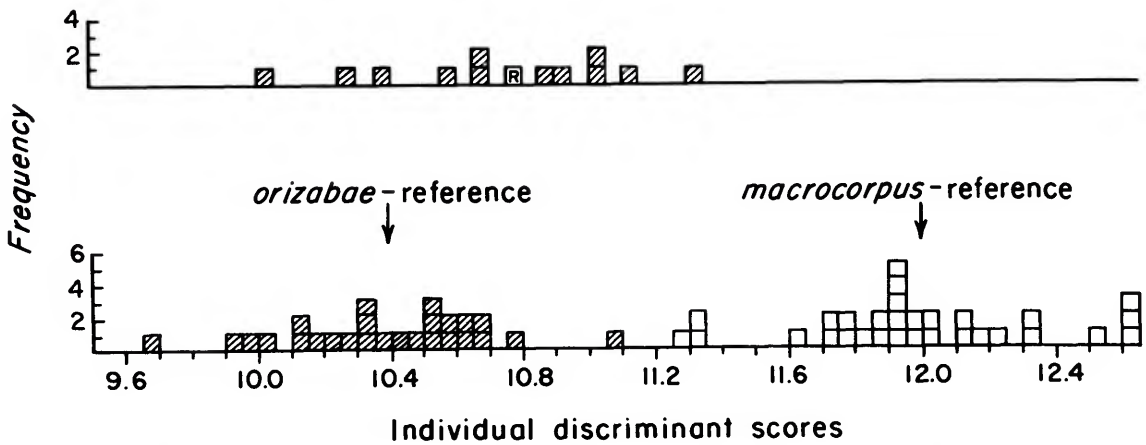

FIGURE 7.—Discriminant function analysis of *S. f. macrocorpus* (Figure 4, samples 3, 4) with *S. f. orizabae* (samples 7, 8). (Sample 5 of *S. f. orizabae*, top graph, was used as a test sample; square containing the symbol "R" = the type of *S. f. restrictus*.)

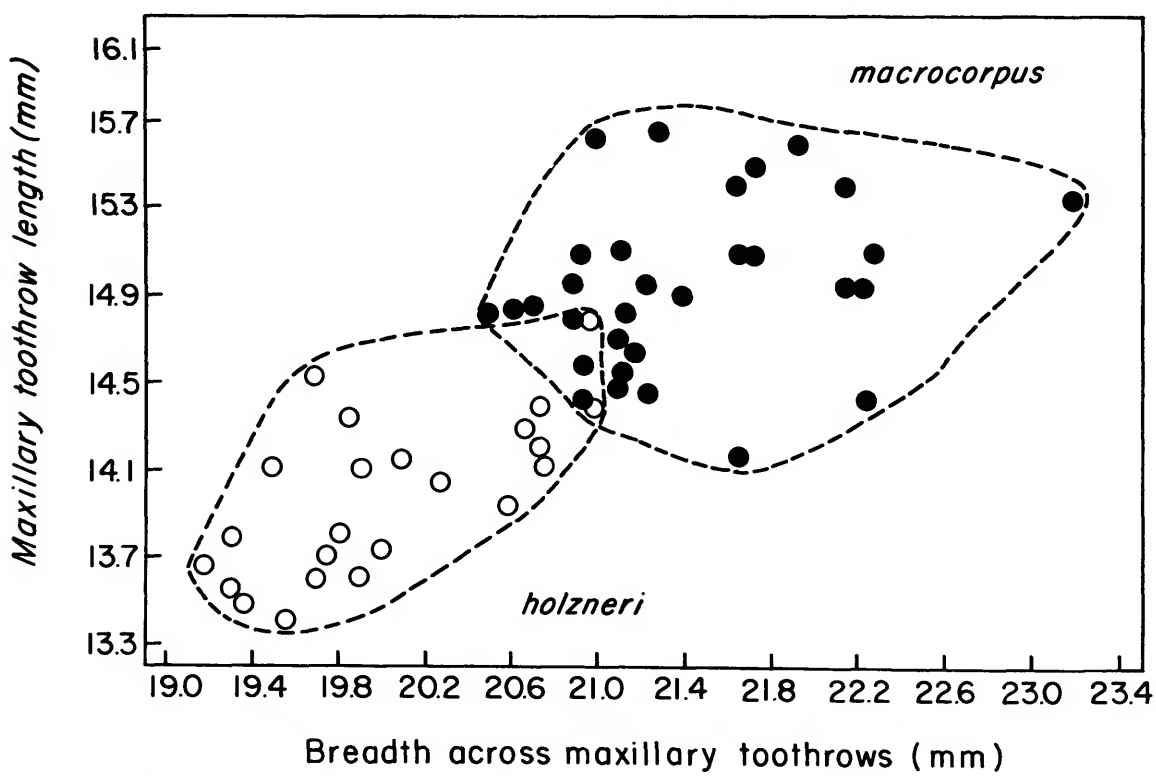

FIGURE 8.—Scattergram analysis of *S. f. macrocorpus* (Figure 4, samples 3, 4) and *S. f. holzneri* (sample 2). (Solid circles = *S. f. macrocorpus*; open circles = *S. f. holzneri*.)

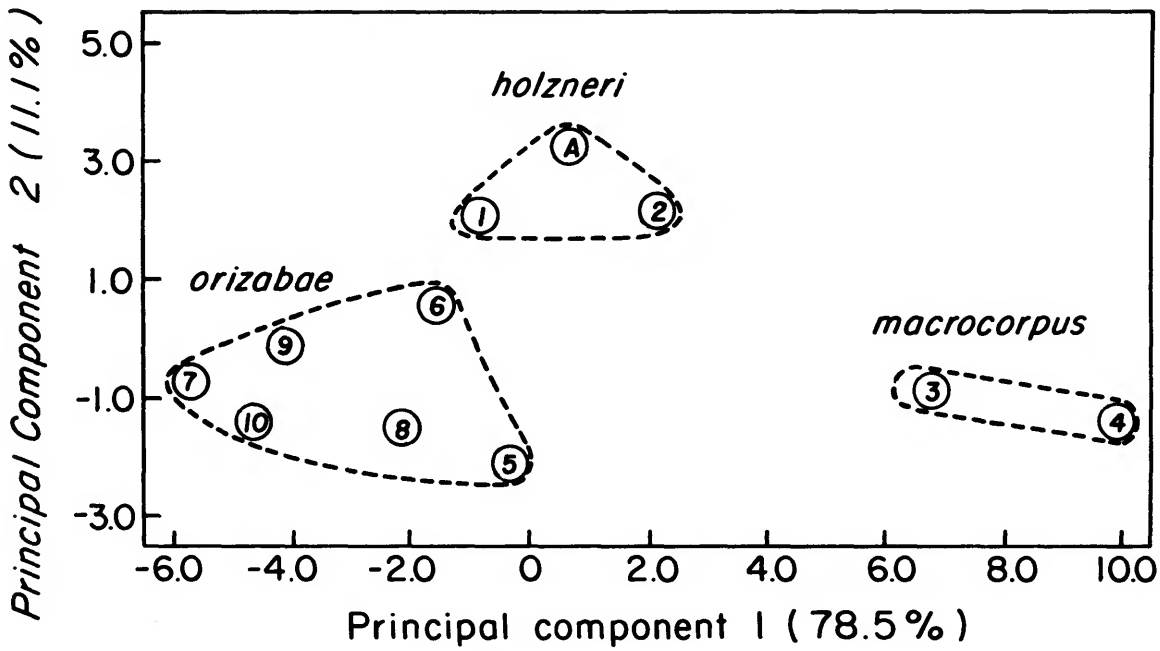

FIGURE 9.—Principal components analysis of *S. f. macrocorpus*, *S. f. holzneri*, and *S. f. orizabae* based upon 26 cranial variables, dry ear length, total length, and hind foot length (sample numbers correspond to those of Figure 4; sample "A" of *S. f. holzneri*, not pictured in Figure 4, is composed of specimens from central Chihuahua, southern Sonora, and northern Sinaloa; see also "Comparisons," page 8).

A principal components analysis also was used to compare *S. f. macrocorpus* with nearby samples of *S. f. orizabae* and *S. f. holzneri* (Figure 9). Sample means of 26 cranial measurements plus dry ear length, total length, and hind foot length were used as data. The samples of *S. f. holzneri* represent central Chihuahua, southern Sonora, and northern Sinaloa (not shown in Figure 8 and indicated as sample "A" in Figure 9); southern Chihuahua and central Sinaloa (sample 1); and southern Sinaloa and Durango (sample 2). The samples of *S. f. orizabae* came from Jalisco, Zacatecas, Michoacan, Aguascalientes, San Luis Potosi, and Guanajuato (samples 5–10). Principal component 1 accounted for 78.5% of the observed variation and separated samples based on overall size. Principal component 2 accounted for an additional 11.1% of the variation and contrasted dry ear and bullar length against length of maxillary toothrow and postdental breadth. This analysis illustrates the large relative size of *S. f. macrocorpus* compared to *S. f. orizabae* or *S. f. holzneri*. *Sylvilagus f. holzneri* is separated from *S. f. orizabae* on the second principal component by its longer ears, larger auditory bullae, relatively shorter maxillary toothrow, and narrower postdental breadth.

REMARKS.—When Nelson (1907) described *S. f. restrictus* he included specimens from north-central Michoacan, west-central Jalisco, and southeastern Nayarit. He distinguished the subspecies from *S. f. orizabae*, the contiguous subspecies in eastern Jalisco, by its heavier rostrum and its reddish, rather than grayish, dorsal color. Later, Nelson (1909:182) mentioned that, "This subspecies is based mainly on color." The type locality of *S. f. restrictus* at Zapotlan, Jalisco, is within the sharp zone of intergradation between the small *S. f. orizabae* of eastern Jalisco and the large *S. f. macrocorpus* of extreme western Jalisco, extreme western Michoacan, and Nayarit. Thus the holotype and topotypes of *S. f. restrictus* are intergrades between these two subspecies and are herein referred to *S. f. orizabae*

because of their small size, especially in alveolar length of the maxillary toothrow, postdental breadth, breadth across the maxillary toothrows, greatest skull length, and alveolar length of the mandibular toothrow. Reddish and grayish specimens are represented among the topotypes of *S. f. restrictus* from Zapotlan, Jalisco.

Nelson had no specimens from extreme western Michoacan, and only a few individuals from north-central Michoacan, extreme western Jalisco, and Nayarit. Specimens are now available from this area where *S. f. macrocorpus* is known to occur. Nelson (1909) had one adult specimen from La Laguna, Sierra de Juanacatlan, 1980 m, Jalisco which he referred to *S. f. restrictus*. He presciently noted (1909:183) that it "differs so much in skull characters and in general appearance from both *restrictus* and *orizabae* that I hesitate to place it with either." Nelson also considered a skull only from Tepic, Nayarit, as representing typical *S. f. restrictus*. This subadult specimen is much larger than other specimens Nelson referred to *S. f. restrictus*. After Nelson had written most of his 1909 account of *S. f. restrictus*, he received specimens of rabbits from several localities in western Jalisco from J. A. Allen. Nelson also identified these morphologically much larger animals as typical *S. f. restrictus*.

The type of *S. f. restrictus* was taken from Zapotlan, Jalisco. Two additional specimens, labelled "Sierra Nevada de Colima," have "Zapotlan" written in pencil on the skull boxes. In addition, one is recorded from an elevation of "about 4500 ft" (1372 m) and the other from "about 5000 ft" (1525 m). Zapotlan (today= Ciudad Guzman) is at the base of the Sierra Nevada de Colima. These two apparent topotypes are slightly smaller than the type, and all three rabbits probably came from a few miles southwest of Zapotlan towards the slope of the Sierra Nevada de Colima (Field notes, E. W. Nelson, 1892). All three are intergrades between *S. f. macrocorpus* and *S. f. orizabae*, but best referred to *S. f. orizabae*.

Three rabbits from Las Canoas, Jalisco (AMNH 26148–50) average larger in all dimensions than do the three specimens from near Zapotlan. Although intermediate in many respects, they are best referred to *S. f. macrocorpus*. The exact location of Las Canoas is unknown, however, Genoways (1973) located it 10 km NW Tuxpan and 10 km SSW Ciudad Guzman (=Zapotlan). Thus, the specimens taken near Zapotlan (type and topotypes of *S. f. restrictus*) may have come from a lower elevation and from only a few miles farther east than the specimens herein referred to *S. f. macrocorpus* from Las Canoas.

In Michoacan and Jalisco *S. f. macrocorpus* is known only from the higher pine-oak forests, where specimens have been recorded from 1980 to 2985 m. However, Nayarit *S. f. macrocorpus* often occur at lower elevations, the lowest at Estanzuela, 1372 m. The specimen from Mesa del Nayar shows morphological intergradation with *S. f. holzneri*, but is here referred to *S. f. macrocorpus*. Two from southern Sinaloa, one taken near San Ignacio, 215 m, and the other near Palmito, overlap with specimens of *S. f. macrocorpus* in Figure 8. These two rabbits are best referred to *S. f. holzneri*.

The eastern limit of *S. f. macrocorpus* in Nayarit, Jalisco, and Michoacan, corresponds closely to the eastern limit of the Pacific Region, as defined by Rzedowski and McVaugh (1966).

Etymology.—The Latin *macrocorpus* ("large body") refers to the large size of this subspecies relative to the smaller contiguous subspecies.

Specimens Examined (32).—JALISCO: Atenguillo (possibly located across the border in Nayarit), 1 (USNM); 32.2 km SE Autlan, 2740 m, 3 (KU); La Cienega, 2 (AMNH); La Laguna, Sierra de Juanacatlan, 1980 m, 1 (USNM); Las Canoas, 3 (AMNH); 24.2 km S, 14.5 km E Talpa de Allende, 2100 m, 4 (KU); 19.3 km S Toliman, 2345 m, 8 (KU); Volcan de Fuego, 2985 m, 1 (KU).

MICHOACAN: 22.4 km W Aquililla, Dos Aguas, 215 m, 1 (UMMZ).

NAYARIT: Estancia (possibly located across the border in Jalisco), 2 (AMNH); Estanzuela, 2 (USNM); Llano y Casco (possibly located across the border in Jalisco), 1 (AMNH); Mesa Del Nayar, 1370 m, 1 (USNM); 3.2 km E San Pedro Lagunillas, E side lake. 1 (USNM); Tepic, 1 (USNM).

Additional Records.—Nelson (1909:183) listed specimens probably referable to this subspecies from the border of western Jalisco and southeastern Nayarit. These localities are Garabatos, Rio Ameca, and Ojo de Agua (near Amatlan). We have examined these specimens and found them to be subadults that we are reluctant to allocate to subspecies, except on geographic grounds.

Sylvilagus floridanus holzneri (Mearns)

Lepus sylvaticus holzneri Mearns, 1896:554.

Sylvilagus (Sylvilagus) floridanus holzneri.—Lyon, 1904:336.
[*Lepus sylvaticus*] subspecies *rigidus* Mearns, 1896:555. [Type from Carrizalillo, Luna Co., New Mexico. Holotype examined.]
Lepus (Sylvilagus) durangae J. A. Allen, 1903:609. [Type from Rancho Bailon, northwestern Durango, Mexico. Holotype examined.]

TYPE.—USNM 58937, adult, female, skin and skull, from the Douglas spruce (=Douglas fir) zone near the summit of the Huachuca Mountains, Cochise County, Arizona. Holotype examined.

RANGE.—Mountains of the southwestern United States southward along the Sierra Madre Occidental of Sonora, Chihuahua, Sinaloa, and Durango. Marginal records in Durango and Sinaloa are: DURANGO: Inde, 1830 m, 6.4 km NW La Pila; 45.1 km S, 27.4 km W Vicente Guerrero, 2545 m. SINALOA: Plomosas, 22 km E Matatan, 760 m; San Ignacio, 215 m; 2.4 km N Badiraguato, 230 m; 16 km NNE Choix, 520 m.

DIAGNOSIS.—Externally: medium-sized to large with long ears. Skull: medium-sized to large in all features except small in rostrum depth, short and narrow maxillary and mandibular toothrows, and shallow mandible, but with large auditory bullae. Color: grayish dorsally, pale ochraceous buff laterally, pale gray rump patch, and creamy white ventrally except for a dusky neck patch.

COMPARISONS.—For comparisons with *S. f. macrocorpus* see that subspecies. *Sylvilagus f. holzneri* differs from *S. f. orizabae:* externally, larger size and longer ear; cranially, larger skull particularly evident in greatest skull length and bullar length; and color, pale grayish dorsally rather than dark grayish.

REMARKS.—Nelson (1909) and Baker and Greer (1962) assigned specimens from Zacatecas to *S. f. holzneri*. Admittedly, intergradation between *S. f. holzneri* and *S. f. orizabae* is gradual in Durango and Zacatecas, and the assignment of intergrades to either subspecies is subjective. However, specimens from Zacatecas (sample 6) are significantly smaller in greatest skull length ($P<.01$) and have smaller auditory bullae than have specimens from Durango and Sinaloa (sample 2). The small skull and small auditory bullae of Zacatecan specimens is characteristic of *S. f. orizabae,* the subspecies to which they are here referred.

SPECIMENS EXAMINED (68).—CHIHUAHUA: 9.7 km N Cerocahui, 1890 m, 1 (KU); 17.7 km S, 12.9 km W Creel, 245 m, 1 (KU); 25.8 km S, 9.7 km E Creel, 2225 m, 1 (KU): 48.3 km SW Gallego, Arroyo del Nido, 2135 m, 1 (MVZ); 64.4 km E Gallego, 1524 m, 1 (ANSP); 5.6 km ESE Los Lamentos, 1 (KU); 3.2 Km W Minaca, 2100 m, 1 (KU); Mojarachic, 2 (USNM); 6.4 km NW San Francisco de Baja, 1735 m, 1 (KU); 25 km NE Santa Clara, W side Sierra del Nido, 2485 m, 1 (MVZ); Sierra del Nido, Arroyo Mesteno, 2315 m, 1 (MVZ); Sierra del Nido, Arroyo Mesteno, 2375 m, 1 (MVZ); Sierra del Nido, Arroyo Mesteno, 2440 m, 1 (MVZ); Sierra del Nido, Canon del Alamo, 2225 m, 3 (MVZ); Sierra Madre, near Guadalupe de Calvo, 2135 m, 1 (USNM); Sierra Tarahumare, "Samachique", 2 (FMNH); 4.8 km NE Temoris, 1705 m, 1 (KU).

DURANGO: 12 km E Cosala, Santa Ana, 395 m, 2 (KU); Coyotes, 1 (FMNH); 38.6 km SSE Durango, 2120 m, 1 (MSU); El Salto, 2315–2560 m, 3 (USNM); 8.1 km NE El Salto, Hacienda Coyotes, 1 (CAS); 9.7 km SW El Salto, 2530–2545 m, 2 (MSU); Guanacevi, 2 (AMNH); mtns, near Guanacevi, 2375 m, 2 (USNM); Inde, 1830 m, 1 (USNM); 6.4 km NW La Pila, 2 (MSU); 2.4 km S Laguna del Progresso, 1 (AMNH); 8.1 km W Las Adjuntas, 3050 m, 1 (KU); 11.3 km SW Las Adjuntas, 2715 m, 1 (KU); Rancho Bailon, 2 (AMNH); 9-7 km NW Rodeo, Rio Nazaz, 1280 m, 1 (KU); Sierra Madre, 2740 m (Cerro Prieto), 1 (USNM); 45.1 km S, 27.4 km W Vicente Guerrero, 2545 m, 2 (MSU).

SINALOA: 2.4 km N Badiraguato, 230 m, 2 (KU); 20.9 km ESE Badiraguato, 245 m, 1 (KU); 20 Km N, 5 km E Badiraguato, 550 m, 2 (KU); 1.6 km S El Cajon, 550 m, 2 (KU); 16 km NNE Choix, 520 m, 2 (KU); 5 km SW Palmito, 1860 m, 5 (KU); Plomosas, 22 km E Matatan, 760 m, 1 (KU); San Ignacio, 215 m, 2 (KU); 10 km S, 38 km E Sinaloa, 245 m, 2 (KU); 15 km N, 65 km E Sinaloa, 1435 m, 1 (KU).

SONORA: 11.3 km WNW Alamos, 1 (UIMNH); 12.9 km WNW Alamos, 1 (UIMNH).

Sylvilagus floridanus orizabae (Merriam)

Lepus orizabae Merriam, 1893:143.
Sylvilagus floridanus orizabae.—Nelson, 1909:183.
Lepus floridanus subcinctus Miller, 1899:386. [Type from Hacienda El Molino, near Negrete, Michoacan, Mexico. Holotype examined.]
Lepus floridanus persultator Elliot, 1903:147. [Type from Puebla. Puebla, Mexico. Holotype examined.]
Sylvilagus floridanus restrictus Nelson, 1907:82. [Type from Zapotlan, Jalisco, Mexico. Holotype examined.]

TYPE.—USNM 53318, adult, female, skin and skull, from Mount Orizaba, Puebla, Mexico. Holotype examined.

RANGE.—Sierra Madre Occidental of the northern panhandle of Jalisco and adjacent southwestern Zacatecas; higher mountains of the Central Mexican Plateau from Aguascalientes, eastern Jalisco, adjacent portions of southwestern San Luis Potosi, and northwestern Guanajuato; Transverse Volcanic Axis from central Jalisco eastward throughout the northern half of Michoacan, ex-

treme southern Guanajuato, Mexico, Distrito Federal, Morelos, Tlaxcala, central third of Puebla, and extreme west-central Veracruz; Sierra Madre Oriental of extreme southeastern Coahuila, southern third of Nuevo Leon, extreme southwestern Tamaulipas, central third of San Luis Potosi, Queretaro, and Hidalgo. Marginal records in west-central Mexico: MICHOACAN: Quiroga, Tacambaro Hwy km 54, 2835 m; San Juan, Cerro Tancitaro, 2300 m. JALISCO: Sierra Nevada de Colima (Zapotlan), 1370–1525 m; 1.6 km SSE Ameca, 1220 m; Etzatlan, 1065 m; 3.2 km E Bolanos, 1080 m. ZACATECAS: Hacienda San Juan Capistrano; Valparaiso Mountains; 6.4 km N Villanueva, 2010 m. AGUASCALIENTES: 4.8 km N Cerro del Jaguez, 2500 m, Sierra Fria. SAN LUIS POTOSI: Cerro Penon Blanco, 2360 m.

DIAGNOSIS.—Externally: small to medium-sized with long ears. Skull: small to medium-sized in greatest length, zygomatic breadth, length of the maxillary and mandibular toothrows, mandibular ramus depth, and rostrum depth; however, with large auditory bullae. Color: variable, usually dark grayish dorsally but reddish gray dorsally in some areas of its range, ochraceous laterally, blackish gray rump patch, and whitish ventrally with a dusky neck patch.

COMPARISONS.—For comparisons of *S. f. orizabae* with *S. f. macrocorpus* and *S. f. holzneri*, see accounts of those subspecies.

REMARKS.—*Sylvilagus f. orizabae* varies in color geographically. Typically the subspecies is grayish dorsally. However, in northwestern Michoacan, many of the specimens are reddish gray, and in some cases (Patzcuaro and Los Reyes in Michoacan), are more reddish than grayish. Likewise, in central Jalisco many individuals intergrading with the reddish *S. f. macrocorpus* are also more reddish than grayish. All specimens within samples 7 and 9 are grayish dorsally.

Topotypical and near topotypical *S. f. orizabae* from Puebla, Tlaxcala, Mexico, and the Distrito Federal were compared to more western samples previously referred to *S. f. orizabae*, *S. f. restrictus*, and *S. f. subcinctus*. Excluding color, the only significant feature noted among these samples was a clinal east to west increase in overall size across the Mexican Plateau and Transverse Volcanic Axis. The largest individuals are within sample 5 and these intergrade with the much larger *S. f. macrocorpus*.

Since geographic variation within all of these samples is largely clinal and color has already been shown to be variable, even within a population, *S. f. subcinctus* and *S. f. restrictus* are both regarded as synonyms of *S. f. orizabae*.

SPECIMENS EXAMINED (81).—AGUASCALIENTES: 4.8 km N Cerro del Jaguez, 2500 m, Sierra Fria, 1 (MVZ); 12.9 km WNW Colonia Presidente Calles, 2285 m, 1 (MVZ); Venaverros, 21 km W Aquascalientes, 2 (MVZ).

JALISCO: 4.8 km N Amatitan, 1235 m, 1 (KU); 1.6 km SSE Ameca, 1220 m, 1 (KU); 3.2 km E Bolanos, 1080 m, 1 (KU); 9.7 km ENE Bolanos, 1630 m, 2 (KU); Top of Cerro Viejo de Curjuflam, 2955 m, 30.6 km S, 14.5 km W Guadalajara, 1 (KU); 7.2 km NE Comanja de Corona, 2440 m, 2 (KU); Etzatlan, 1065 m, 9 (USNM); 6.4 km W, 3.2 km S Guadalajara, 1555 m, 1 (KU); 25.8 km S Guadalajara, 1 (KU); 8.1 km NE Huejuquilla, 1890 m, 1 (KU); 1.6 km S Jalostotitlan, 1735 m, 1 (KU); La Barca, 1 (USNM); La Mesa Maria de Leon, 2255 m, 2 (KU); Lagos, 1875 m, 2 (USNM); 22.5 km SE Lagos de Moreno, 2040 m, 1 (KU); 16.1 km NW Matanzas, 2440 m, 2 (KU); Ocotlan, 3 (2 FMNH, 1 USNM); Sierra Nevada de Colima, (Zapotlan) 1370–1525 m, 3 (USNM); 4 km E Tuxcueca, S side Lago de Chapala, 1525 m, 1 (KU); 6.4 km W Villa Guerrero, 1675 m, 2 (KU); 3.2 km S, 14.5 km W Yahualica, 2135 m, 1 (KU); 1.6 km SW Zapotlanejo, 1 (KU); 3.2 km E Zapotlanejo, 1 (KU).

MICHOACAN: Barranca Seca, 1 (UMMZ); Hacienda El Molino, near Negrete, 2 (USNM); 17.7 km W Jiquilpan, 2040 m, 1 (KU); 3.2 km E Los Reyes, 2 (UMMZ); Mt. Tancitaro, 2745–?660 m, 1 (USNM); Nuevo San Juan (Los Conejos), 8.1 km SW Uruapan, 1 (UMMZ); Patzcuaro, 2135 m, 9 (USNM); 9 km S Patzcuaro, on Hwy to Tacambaro, 2440 m, 1 (UMMZ); Puerto Murillos, 59.6 km E Morelia, 1 (MVZ); Quiroga, Tacambaro Hwy, km 54, 2835 m, 1 (UMMZ); 6 km NW Quiroga, Lake Patzcuaro, 2745 m, 1 (MVZ); San Juan, Cerro Tancitaro, 2300 m, 1 (UMMZ); 7.2 km NE Tarecuato, 1 (KU); 4.8 km N Volcan Paricutin, San Juan, 7200 ft, 1 (UMMZ).

ZACATECAS: Hacienda San Juan Capistrano, 2 (USNM); Monte Escobedo, 2285 m, 1 (KU); Plateado, 1 (USNM); Valparaiso Mtns, 1 (USNM); 6.4 km N Villanueva, 2010 m, 1 (CAS).

Sylvilagus graysoni graysoni (J. A. Allen)

Lepus graysoni J. A. Allen, 1877:347.
Sylvilagus (Sylvilagus) graysoni.—Lyon, 1904:336.

TYPE.—USNM 8318, adult, female, skin with skull inside, "undoubtedly from Maria Madre," according to Nelson (1899:16), Tres Marias Islands, Nayarit, Mexico. Holotype examined.

RANGE.—The southern three islands of the Tres

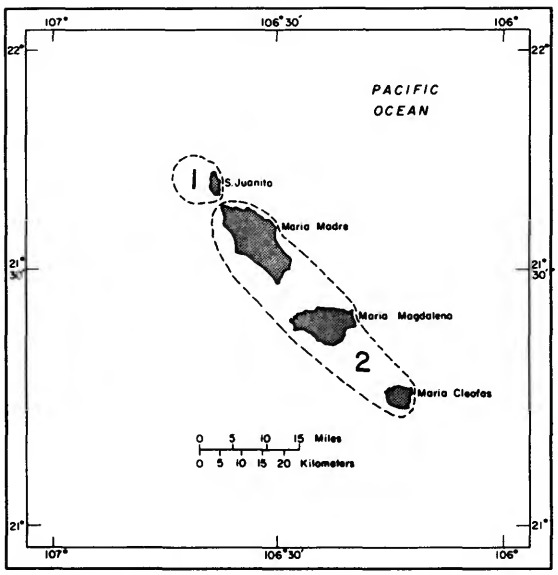

FIGURE 10.—Geographic distribution of *S. graysoni* on the Tres Marias Islands and San Juanito Island (individuals were grouped into two pooled samples and compared in Figure 11).

Marias (Maria Madre, Maria Magdalena, and Maria Cleofas), Nayarit, Mexico (Figure 10).

DIAGNOSIS.—Externally: Medium-sized to large except with short ears. Skull: medium-sized to large with long rostrum (reflected in long diastema and incisive foramina), short maxillary toothrow, and narrow basioccipital. Color: reddish dorsally with the nape and rump brightest, body sides a paler reddish, venter whitish except for the brownish throat patch.

COMPARISONS.—For comparisons with *S. graysoni* from San Juanito Island, see below.

REMARKS.—Only two adults are available from Maria Magdalena and one from Maria Cleofas. All three compare with topotypical specimens from Maria Madre and all are referable to *S. g. graysoni*. Specimens from Maria Magdalena are the darkest in color.

Short-term morphological evolution of insular faunas is often assumed. To test the possibility of rapid change in the Tres Marias rabbits, 15 specimens collected from Maria Madre in 1897 were compared to five collected in 1960 and 1976 (2 from Maria Madre, 2 from Maria Magdalena, and 1 from Maria Cleofas). There were no significant differences between the two samples (univariate Student's *t*-tests, $P>0.05$).

SPECIMENS EXAMINED (28).—NAYARIT: Tres Marias Islands: Maria Madre, 22 (20 USNM, 2 CAS); Maria Magdalena, 4 (3 USNM, 1 UBC); Maria Cleofas, 1 (USNM); and unidentified island, 1 (FMNH).

Sylvilagus graysoni badistes, new subspecies

TYPE.—USNM 512550, adult, male, skin and skull, from San Juanito Island of the Tres Marias Islands, Nayarit, Mexico, collected 24 March 1976 by Don E. Wilson, original no. 3730.

RANGE.—Occurs only on San Juanito Island, Nayarit, Mexico (Figure 10).

DIAGNOSIS.—Externally: medium-sized except with short ears. Skull: medium-sized with short rostrum (reflected in short diastema and short incisive foramina), long maxillary toothrows, and wide basioccipital. Color: variable, from reddish to brownish dorsally, pale reddish to brownish on the sides; venter whitish except for a brown throat patch.

COMPARISONS.—*Sylvilagus g. badistes* differs significantly from *S. g. graysoni* in having a smaller skull as measured by greatest skull length ($P<0.05$), wider basioccipital ($P<0.01$), longer maxillary toothrow ($P<0.001$), shorter incisive foramina ($P<0.001$), and shorter diastema ($P<0.001$).

A scattergram analysis (Figure 11) of maxillary toothrow length against length of the incisive foramen, separates all individuals of the two subspecies. Table 3 details the morphological differences between *S. g. badistes* and *S. g. graysoni*.

ETYMOLOGY.—The name *badistes*, from the Greek stem badio ("to advance slowly, step by step") refers to the unusual lack of escape behavior in these rabbits.

SPECIMENS EXAMINED (11).—NAYARIT: Tres Marias Islands, San Juanito Island, 11 (USNM).

Sylvilagus audubonii parvulus (J. A. Allen)

Lepus (Sylvilagus) parvulus J. A. Allen 1904:34.
Sylvilagus audubonii parvulus.—Nelson, 1909:236.

TYPE.—AMNH 12578/10888, adult, sex unknown, skin and skull, from Apam, Hidalgo, Mexico, approximately 2440 m. Holotype examined.

RANGE.—Arid deserts of the Mexican Plateau. Marginal records in west-central Mexico are:

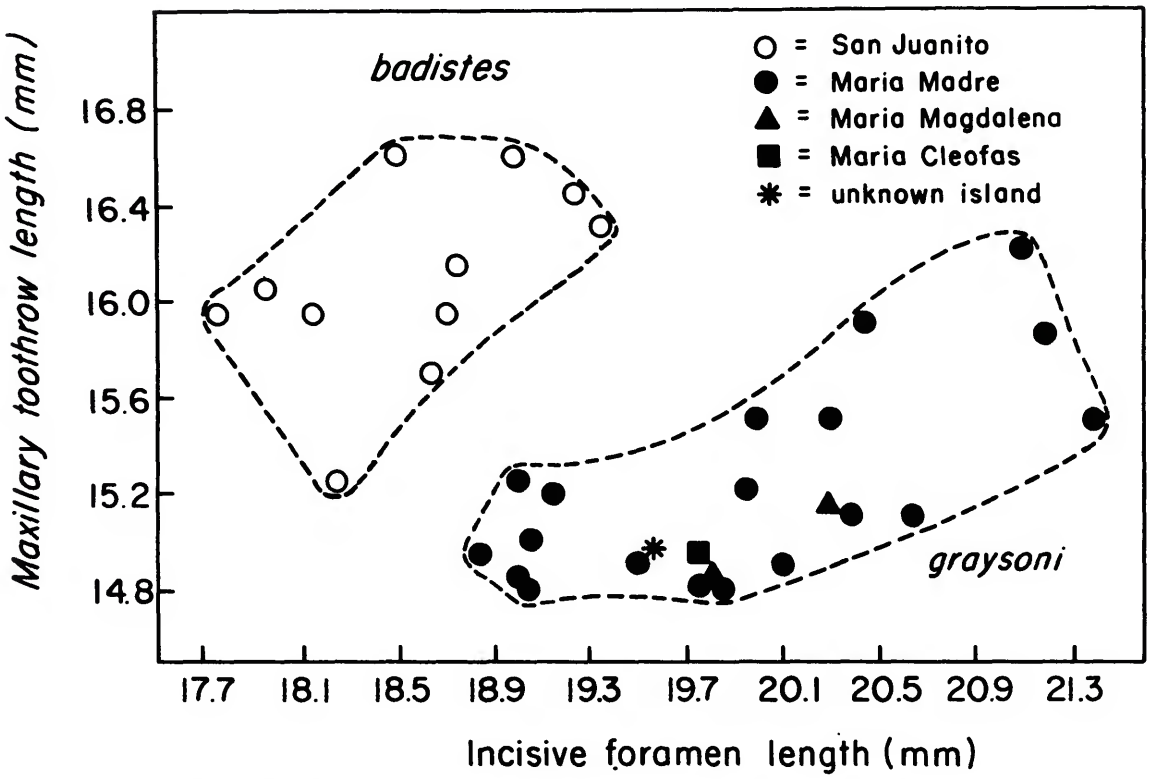

FIGURE 11.—Scattergram analysis comparing *S. g. badistes* from San Juanito Island (Figure 10, sample 1) with *S. g. graysoni* from the Tres Marias Islands (sample 2).

DURANGO: 6.4 km NNE Boquilla, 1920 m; Durango City. ZACATECAS: 4.8 km SW Sombrerete, 2345 m. JALISCO: 4.8 km S Huejucar, 1800 m; 4.8 km S Yahualica, 1800 m; 4.8 km SW Teatitlan. GUANAJUATO: 4.8 km E Tepezala, 2345 m. QUERETARO: Caderata [= Cadereyta], 2100 m.

DIAGNOSIS.—Externally: size small except with large ears. Skull: small size especially evident in greatest skull length, nasal length, and palate length, however, with large auditory bullae and medium depth mandibular ramus. Color: dorsum gray and tail gray middorsally broadly margined by white.

COMPARISONS.—*Sylvilagus a. parvulus* differs from Sinaloan *S. a. goldmani* (sample 3 of Figure 12) in smaller size overall, particularly in palate length, nasal length, and breadth across the carotid foramina. *Sylvilagus a. parvulus* does have markedly larger auditory bullae.

These characters distinguish all individuals of the two subspecies. Refer to Table 1 for quantitative data.

REMARKS.—The two samples (1 and 2 of Figure 12) of *S. a. parvulus* differ significantly only in length of the auditory bullae ($P<0.05$). Topotypical and near topotypical specimens of *S. a. minor* from near El Paso, Texas were compared with *S. a. parvulus* and found to average smaller in size and paler gray in color. Nevertheless, differences between samples from Texas and Durango are slight.

SPECIMENS EXAMINED (44).—AGUASCALIENTES: Chichalote, 3 (USNM); 4.8 km E Tepezala, 2345 m, 1 (MVZ).

DURANGO: 2 km E Atotonilco, 2035 m, 2 (MSU); 3.1 km SE Atotonilco, 2035 m, 1 (MSU); 4.8 km SE Atotonilco, 2035 m, 1 (MSU); 15 km NW Atotonilco, 1980 m, 1 (MSU); 6.4 km NNE Boquilla, 1920 m, 1 (MSU); 9.7 km N Chocolate,

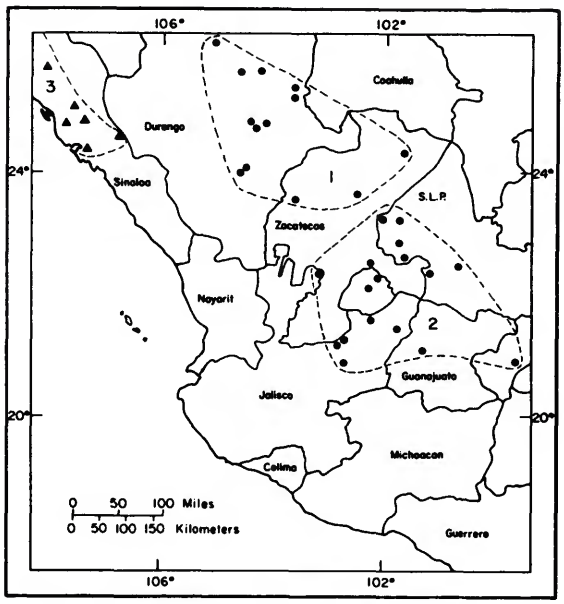

FIGURE 12—Geographic distribution of *S. audubonii* (circles = individual localities of *S. a. parvulus;* triangles = *S. a. goldmani;* each pooled sample was treated statistically in Table A).

1250 m, 1 (MSU); Durango City, 2 (USNM); 12 km NE Durango, 1860 m, 1 (MVZ); 6.4 km NW La Pila, 1 (MSU); 11.3 km NNW La Zarca, 185 m, 2 (MSU); 56 km W Mapimi, 1675 m, 1 (MSU); San Juan, 19.3 km W Lerdo, 1160 m, 2 (UMMZ); San Juan, 20 km W Ciudad Lerdo, 1160 m, 1 (MVZ).

GUANAJUATO: Silao, 1 (USNM).

JALISCO: 12.9 km W Encarnacion de Diaz, 1 (KU); 4.8 km S Huejucar, 1800 m, 3 (KU); Lagos de Moreno, 1 (USNM); 4.8 km SW Tepatitlan, 4.8 km S Yahualica, 1800 m, 1 (KU); 8.1 km S, 1.6 km E Yahualica, 1 (KU); 16.1 km NE Yahualica, 1 (KU).

QUERETARO: Caderata [=Cadereyta], 2100 m, 1 (UMMZ).

SAN LUIS POTOSI: 1.6 km W Hacienda la Parada, 32.2 km NW San Luis Potosi, 1 (MVZ); 2 km E Illescas, 2 (LSUMZ); Leoncito, 1 (LSUMZ); 7 km NW Palma, 2380 m, 1 (LSUMZ); Salinas, 1 (LSUMZ); 3 km S Santo Domingo, 1 (LSUMZ).

ZACATECAS: Berriozabal, 2 (USNM); Canitas, 1 (USNM); 32.2 KM S Concepcion del Oro, 1830 m, 1 (CAS); 35.4 km SW Concepcion del Oro, 1 (CAS); 4.8 km SW Sombrerete, 2345 m, 1 (CAS).

Sylvilagus audubonii goldmani (Nelson)

Lepus arizonae goldmani Nelson, 1904:107.
Sylvilagus audubonii goldmani.—Nelson, 1909:225.

TYPE.—USNM 96812, adult, female, skin and skull, from Culiacan, Sinaloa, Mexico. Holotype examined.

RANGE.—Arid coastal plains of the northern half of Sinaloa. Marginal records: SINALOA: 19.3 km SW El Fuerte; Sinaloa; 1.6 km S Pericos; 3.2 km E Aguacaliente, 245 m; 9.7 km N El Dorado; Isla de Tachichilte, 6 km E Isla de Altamura; 17.7 km N Ahome, 45 m.

DIAGNOSIS.—Externally: medium-sized. Skull: medium-sized in greatest skull length, nasal length, maxillary toothrow length, and zygomatic breadth, but with small auditory bullae and narrow mandible. Color: dorsum gray and tail gray middorsally and narrowly margined by white.

COMPARISONS.—For comparisons with *S. a. parvulus* see that subspecies.

REMARKS.—In Sinaloa the ranges of *S. audubonii* and *S. floridanus* are complementary. The range of *S. audubonii* may also be complementary with *S. cunicularius,* although specimens of either are not available from the coastal region of central Sinaloa.

SPECIMENS EXAMINED (30).—SINALOA: 3.2 km E Aguacaliente, 245 m, 2 (KU); 17.7 km N Ahome, 45 m, 1 (MVZ); Bacubirito, 1 (USNM); Culiacan, 2 (USNM); 9.7 km NW Culiacan, 1 (MVZ); 19.3 km N Culiacan, 2 (KU); 12.9 km WNW El Carrizo, 3 m, 1 (KU); 9.7 km N El Dorado, 1 (KU); 9.7 km N, 2.4 km E El Dorado, 3 (KU); 11.3 km NE El Fuerte, 2 (KU); 19.3 km SW El Fuerte, 1 (UIMNH); Isla de Tachichilte, 6 km E Isla de Altamura, 7 (KU); 4 km SW Navolato, 6 m, 2 (KU); S side Rio Sinaloa, 1.6 km SW Sinaloa, 35 m, 2 (MVZ); Sinaloa, 1 (USNM); 16 km SE Topolobampo, 6 m. 1 (KU).

Summary

The geographic distribution of populations of *Sylvilagus* in west-central Mexico may be summarized as follows: The northern part of the coastal plain in Sinaloa is inhabited by *S. audubonii goldmani.* This area is characterized by arid climate and thorn scrub vegetation. The coastal plain from southern Sinaloa through Nayarit, Jalisco, and Colima is more humid and contains subtropical deciduous forest. This region is inhabited by *S. cunicularius insolitus. Sylvilagus cunicularius cunicularius* extends eastward across the Transverse Volcanic Axis from montane Jalisco into eastern Mexico. The southern extension of the Sierra Madre Occidental in eastern Nayarit, Jalisco, and western Michoacan is inhabited by *S. floridanus*

macrocorpus. These animals are primarly restricted to the pine-oak woodlands of intermediate to higher elevations on the western flanks of the Sierra Madre Occidental. They intergrade in the north with *S. f. holzneri,* the form inhabiting the Sierra Madre Occidental northwards into the United States. To the east, they intergrade with *s. f. orizabae,* which extends westward from the Mexican Plateau along the eastern edges of the Sierra Madre Occidental. The more arid northern parts of the Mexican Plateau are inhabited by *S. audubonii parvulus.* The insular species, *Sylvilagus graysoni,* has two subspecies, the nominate form of the three major islands of the Tres Marias, and *S. g. badistes* on San Juanito Island.

Reasons for the subspeciation of *Sylvilagus graysoni* on the Tres Marias Islands are not readily apparent. However, the taxonomic conclusions (endemic species with insular subspecies) support the hypothesis that these rabbits are not adept at crossing water barriers. Such an hypothesis is in line with our view that the species *S. graysoni* shared a common mainland ancestor with *S. cunicularius,* and was separated from it at a time when the Islands were closer to, or attached to the mainland. More recently, the Islands were probably closer together or possibly united. It is possible that the rabbits on San Juanito were separated from the nearest populations on Maria Madre at a time when rising sea levels created the situation we see today. Although the water gap between the two islands is narrow (3 kms), there is a strong current between the islands which makes passage by boat hazardous. Perhaps this current adds to the effect of distance to preclude interchange between the populations.

Finally, it should be noted that most of the geographic variation found in these rabbits is due to size. Since many, if not all, of the mensural characters are correlated with size, this is not surprizing. However, some populations do show allometric relationships that result in the separation seen on the second discriminant function of those analyses. The most notable general pattern is the north-to-south size increase demonstrated by almost all taxa. In some forms, especially *S. floridanus,* a similar trend occurs from east-to-west. The ecological reasons for such size differences are beyond the scope of this study, but should provide a fruitful field of inquiry for future research.

Appendix: Measurements and Discriminant Multipliers

TABLE A.—External and cranial measurements of *Sylvilagus*

Character	*Sample number*	*Sample size*	*Mean*	*Range*	*Standard deviation*	*Coefficient of variation*
			Sylvilagus cunicularius insolitus			
Total length	1	16	473.50	438.00–516.00	22.41	4.73
	2	22	473.32	441.00–522.00	20.63	4.36
	3	13	480.85	426.00–525.00	34.11	7.09
Tail length	1	16	49.38	30.00– 62.00	10.17	20.60
	2	22	47.23	30.00– 65.00	10.11	21.41
	3	13	47.85	25.00– 70.00	12.97	27.10
Body Length	1	16	424.13	394.00–471.00	22.44	5.29
	2	22	426.14	401.00–471.00	20.34	4.77
	3	13	433.00	384.00–475.00	26.39	6.10
Hind foot length	1	16	94.31	85.00–103.00	6.34	6.73
	2	22	98.00	90.00–104.00	4.42	4.51
	3	13	106.00	96.00–119.00	6.62	6.25
Ear length (wet)	1	12	75.75	70.00– 90.00	5.69	7.51
	2	9	74.78	69.00– 99.00	9.40	12.58
	3	4	79.00	74.00– 84.00	4.08	5.17
Ear length (dry)	1	20	67.82	61.40– 74.40	3.82	5.63
	2	20	64.35	59.80– 71.40	2.85	4.43
	3	14	70.33	64.80– 72.60	2.02	2.87
First upper incisor length	1	27	8.44	7.35– 9.25	0.55	6.47
	2	22	8.42	6.70– 9.45	0.56	6.64
	3	14	8.29	7.65– 9.35	0.48	5.74
Palate length	1	27	7.66	6.85– 8.90	0.57	7.44
	2	22	7.66	6.60– 9.10	0.60	7.84
	3	14	7.57	6.55– 8.15	0.46	6.02
Greatest skull length	1	27	81.10	76.30– 84.20	2.20	2.71
	2	22	82.63	79.50– 86.00	1.87	2.26
	3	14	82.54	77.60– 86.80	2.54	3.08
Basal length	1	27	65.71	61.10– 69.60	2.10	3.19
	2	22	66.70	64.25– 69.25	1.52	2.28
	3	14	66.53	62.20– 79.35	4.04	6.08
Zygomatic breadth	1	27	37.33	35.35– 39.60	0.94	2.51
	2	20	37.68	35.95– 38.80	0.72	1.92
	3	14	38.71	37.35– 40.15	0.85	2.19
Braincase breadth	1	27	27.42	26.00– 29.80	0.79	2.88
	2	21	27.42	25.60– 28.60	0.73	2.66
	3	14	27.83	26.55– 29.00	0.75	2.71
Nasal length	1	27	36.86	34.25– 40.10	1.52	4.12
	2	22	37.96	35.70– 40.80	1.42	3.73
	3	14	36.46	32.60– 39.80	1.74	4.77
Nasal breadth	1	27	15.95	14.10– 17.75	0.88	5.53
	2	22	16.77	15.10– 18.30	0.93	5.56
	3	14	17.04	14.85– 18.85	1.22	7.16
Maxillary toothrow length (alveolar)	1	26	15.82	14.90– 17.15	0.51	3.25
	2	22	15.94	15.20– 16.95	0.42	2.61
	3	14	15.79	14.95– 16.60	0.39	2.47
Maxillary toothrows breadth (alveolar)	1	27	22.17	21.15– 23.60	0.70	3.15
	2	22	22.45	21.35– 23.65	0.61	2.70
	3	14	22.83	20.65– 23.65	0.74	3.24
Postdental breadth	1	25	9.92	9.25– 10.65	0.38	3.85
	2	21	9.99	9.35– 10.50	0.29	2.92
	3	14	10.18	9.10– 10.90	0.48	4.74

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	*Sample number*	*Sample size*	*Mean*	*Range*	*Standard deviation*	*Coefficient of variation*
			Sylvilagus cunicularius insolitus—continued			
Incisive foramen length	1	27	19.93	17.60– 21.80	0.92	4.61
	2	22	20.23	18.80– 21.65	0.88	4.33
	3	14	20.70	20.10– 22.20	0.55	2.68
Basioccipital length	1	27	10.59	8.95– 11.60	0.56	5.32
	2	22	10.56	9.50– 11.35	0.53	4.99
	3	14	9.85	9.10– 10.55	0.39	3.94
Basioccipital breadth	1	27	10.06	9.25– 10.85	0.42	4.15
	2	22	10.03	9.30– 10.65	0.39	3.85
	3	14	10.05	9.25– 11.35	0.54	5.34
Diastema length	1	27	22.03	19.75– 23.95	1.10	5.01
	2	22	22.50	20.75– 24.05	0.90	4.00
	3	14	22.47	21.15– 24.30	0.83	3.71
Rostrum depth	1	27	16.99	15.75– 18.20	0.74	4.34
	2	22	17.06	15.85– 18.35	0.70	4.11
	3	14	16.64	15.50– 17.80	0.63	3.78
Bulla length	1	27	11.85	11.25– 12.60	0.34	2.91
	2	22	12.14	11.35– 12.75	0.42	3.47
	3	14	11.53	10.90– 12.10	0.36	3.09
Bullae breadth	1	27	28.05	26.90– 29.70	0.82	2.93
	2	21	28.00	25.90– 28.90	0.84	3.00
	3	14	27.61	26.00– 28.70	0.86	3.12
Shield-bullae depth	1	27	23.89	21.90– 25.00	0.62	2.60
	2	22	24.32	22.85– 25.60	0.80	3.29
	3	14	23.67	21.60– 24.65	0.94	3.95
Skull depth	1	27	34.03	31.90– 35.50	1.01	2.96
	2	22	34.42	31.95– 36.00	1.13	3.28
	3	14	34.25	33.00– 36.15	0.93	2.71
Carotid foramina breadth	1	27	12.39	11.00– 14.30	0.77	6.22
	2	22	12.28	11.45– 13.00	0.47	3.82
	3	14	20.78	18.75– 22.20	0.83	4.01
Infraorbital canals breadth	1	26	19.98	18.20– 21.40	0.89	4.47
	2	22	19.69	18.20– 21.05	0.78	3.95
	3	14	20.78	18.75– 22.20	0.83	4.01
Mandible height	1	26	39.48	37.15– 42.90	1.33	3.38
	2	19	39.93	38.40– 42.85	1.20	3.00
	3	14	39.96	37.35– 42.10	1.25	3.12
Mandible length	1	24	40.97	38.20– 43.45	1.20	2.92
	2	21	41.55	39.80– 42.80	0.94	2.27
	3	13	40.51	38.30– 41.90	1.00	2.47
Mandible ramus depth	1	27	12.49	11.60– 13.70	0.48	3.83
	2	22	12.64	11.40– 13.65	0.55	4.35
	3	14	12.68	11.15– 13.80	0.62	4.91
Mandibular toothrow length (alveolar)	1	27	16.09	15.00– 17.65	0.56	3.50
	2	22	16.29	15.70– 17.00	0.33	2.03
	3	14	16.38	15.30– 17.00	0.50	3.03
			Sylvilagus cunicularius cunicularius			
Total length	4	13	509.69	490.00–525.00	12.43	2.44
Tail length	4	13	62.69	28.00– 78.00	12.68	20.14
Body length	4	13	447.00	422.00–467.00	13.98	3.13
Hind foot length	4	13	109.00	102.00–118.00	4.18	3.84
Ear length (wet)	4	4	81.25	78.00– 83.00	2.36	2.91
Ear length (dry)	4	12	75.29	70.00– 78.80	2.79	3.71

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus cunicularius cunicularius—continued			
First upper incisor length	4	14	9.28	8.10– 9.99	0.57	6.09
Palate length	4	14	8.25	7.40- 9.35	0.55	6.71
Greatest skull length	4	14	86.18	82.30– 88.90	1.69	1.96
Basal length	4	14	69.26	66.40– 70.95	1.37	1.98
Zygomatic breadth	4	14	39.72	38.05– 41.45	0.85	2.14
Braincase breadth	4	14	29.87	28.80– 30.50	0.53	1.78
Nasal length	4	14	37.35	34.75– 39.20	1.41	3.78
Nasal breadth	4	14	16.82	15.50– 18.05	0.69	4.13
Maxillary toothrow length (alveolar)	4	14	16.41	15.70– 17.25	0.40	2.41
Maxillary toothrows breadth (alveolar)	4	13	23.44	21.95– 25.10	0.93	3.99
Postdental breadth	4	14	9.96	9.40– 10.35	0.32	3.20
Incisive foramen length	4	14	20.18	19.25– 20.95	0.50	2.47
Basioccipital length	4	14	10.11	9.25– 10.70	0.38	3.74
Basioccipital breadth	4	14	10.68	10.00– 11.70	0.56	5.29
Diastema length	4	14	23.43	22.00– 24.10	0.71	3.05
Rostrum depth	4	14	17.22	16.20– 18.15	0.61	3.53
Bulla length	4	14	12.06	11.20– 12.70	0.42	3.52
Bullae breadth	4	14	28.92	27.90– 30.80	0.83	2.86
Shield-bullae depth	4	14	25.29	24.35– 26.50	0.57	2.25
Skull depth	4	14	36.22	34.65– 37.75	0.81	2.23
Carotid foramina breadth	4	14	12.08	11.35– 13.15	0.55	4.58
Infraorbital canals breadth	4	14	21.46	20.45– 23.45	0.85	3.96
Mandible height	4	14	42.16	40.65– 43.60	0.88	2.09
Mandible length	4	14	43.98	42.45– 45.10	0.85	1.94
Mandible ramus depth	4	14	13.43	12.75– 14.50	0.47	3.53
Mandibular toothrow length (alveolar)	4	14	16.90	16.20– 17.70	0.52	3.07
			Sylvilagus floridanus macrocorpus			
Total length	3	9	437.78	369.00–464.00	28.23	6.45
	4	12	443.08	400.00–485.00	25.27	5.70
Tail length	3	9	45.22	38.00– 55.00	6.59	14.58
	4	12	37.00	21.00– 50.00	8.02	21.68
Body length	3	9	392.56	331.00–424.00	27.47	7.00
	4	12	405.25	370.00–440.00	19.96	4.92
Hind foot length	3	9	96.22	83.00–105.00	6.34	6.59
	4	12	94.17	91.00– 99.00	3.13	3.32
Ear length (wet)	3	8	65.38	61.00– 71.00	3.42	5.23
	4	12	63.08	58.00– 69.00	2.94	4.66
Ear length (dry)	3	10	57.33	50.10– 64.80	4.94	8.61
	4	9	57.44	53.50– 60.60	2.49	4.33
First upper incisor length	3	15	7.59	6.60– 8.45	0.59	7.75
	4	16	7.68	6.55– 8.80	0.70	9.10
Palate length	3	15	6.58	5.80– 7.30	0.45	6.86
	4	16	6.90	5.10– 7.85	0.76	11.00
Greatest skull length	3	15	76.04	73.70– 78.30	1.56	2.06
	4	16	76.82	71.05– 80.35	2.77	3.60

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus floridanus macrocorpus—continued			
Basal length	3	15	61.99	59.80– 63.90	1.39	2.23
	4	16	62.99	57.20– 65.85	2.61	4.14
Zygomatic breadth	3	15	36.17	34.65– 37.80	0.95	2.62
	4	16	36.62	34.25– 39.25	1.31	3.57
Braincase breadth	3	15	26.51	24.65– 27.60	0.90	3.40
	4	16	27.21	25.60– 28.85	1.04	3.83
Nasal length	3	15	34.81	31.00– 37.70	1.96	5.62
	4	16	34.67	30.30– 37.40	2.23	6.43
Nasal breadth	3	15	15.78	13.55– 17.85	1.30	8.21
	4	16	15.92	13.75– 17.80	1.09	6.85
Maxillary toothrow length (alveolar)	3	15	14.72	14.15– 15.10	0.28	1.88
	4	16	15.16	14.40– 15.65	0.36	2.39
Maxillary toothrows breadth (alveolar)	3	15	21.20	20.65– 22.25	0.42	1.98
	4	16	21.63	20.50– 23.20	0.69	3.18
Postdental breadth	3	15	9.40	8.15– 10.60	0.63	6.67
	4	16	10.02	9.40– 11.00	0.48	4.82
Incisive foramen length	3	15	18.91	17.95– 20.00	0.71	3.76
	4	16	19.20	16.55– 21.20	1.11	5.79
Basioccipital length	3	15	9.33	7.85– 10.45	0.67	7.16
	4	16	9.63	8.50– 10.75	0.63	6.57
Basioccipital breadth	3	15	9.61	8.60– 10.40	0.54	5.65
	4	16	10.13	9.00– 11.70	0.64	6.33
Diastema length	3	15	21.02	19.45– 22.35	0.86	4.08
	4	16	21.20	18.25– 22.65	1.27	6.01
Rostrum depth	3	15	15.38	14.60– 16.55	0.67	4.33
	4	16	15.72	13.75– 17.80	1.23	7.86
Bulla length	3	15	10.97	10.50– 11.60	0.33	2.98
	4	16	11.08	10.20– 12.10	0.46	4.17
Bullae breadth	3	15	25.74	24.50– 27.80	1.09	4.23
	4	16	26.29	23.95– 28.05	1.13	4.31
Shield-bullae depth	3	15	22.19	21.05– 23.15	0.60	2.71
	4	16	22.31	20.70– 23.80	0.74	3.31
Skull depth	3	15	32.02	30.45– 33.20	0.83	2.59
	4	16	32.45	30.50– 33.60	0.84	2.59
Carotid foramina breadth	3	15	10.55	9.75– 11.65	0.58	5.51
	4	16	10.95	9.75– 12.40	0.80	7.30
Infraorbital canals breadth	3	15	18.72	17.15– 20.20	0.87	4.65
	4	16	19.48	18.00– 20.75	0.75	3.84
Mandible height	3	15	36.17	34.20– 38.25	1.13	3.12
	4	16	37.22	33.50– 40.10	1.87	5.01
Mandible length	3	15	38.32	36.95– 39.95	0.87	2.26
	4	16	39.36	34.95– 42.50	2.06	5.24
Mandible ramus depth	3	14	11.17	10.20– 11.95	0.56	4.98
	4	16	11.34	10.10– 11.95	0.56	4.93
Mandibular toothrow length (alveolar)	3	14	15.05	14.30– 15.90	0.45	3.00
	4	16	15.35	13.75– 16.25	0.61	4.00
			Sylvilagus floridanus holzneri			
Total length	1	14	416.43	371.00–448.00	21.59	5.19
	2	21	423.52	398.00–461.00	18.65	4.40
Tail length	1	14	50.21	35.00– 62.00	8.00	15.94
	2	20	49.50	33.00– 73.00	11.61	23.46
Body length	1	14	366.50	336.00–397.00	18.90	5.16
	2	20	375.20	345.00–409.00	18.43	4.91

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	*Sample number*	*Sample size*	*Mean*	*Range*	*Standard deviation*	*Coefficient of variation*
			Sylvilagus floridanus holzneri—continued			
Hind foot length	1	14	92.86	85.00–100.00	5.43	5.85
	2	21	94.29	86.00–110.00	5.25	5.57
Ear length (wet)	1	9	67.11	61.00– 76.00	5.33	7.94
	2	17	69.76	59.00– 86.00	7.16	10.27
Ear length (dry)	1	15	61.79	53.80– 68.40	4.29	6.94
	2	17	62.70	54.70– 68.70	4.40	7.02
First upper incisor length	1	19	7.27	6.40– 8.60	0.51	7.05
	2	23	7.25	6.10– 8.55	0.55	7.59
Palate length	1	20	5.89	4.95– 6.95	0.54	9.09
	2	23	5.91	4.95– 6.80	0.49	8.27
Greatest skull length	1	20	71.95	66.90– 77.15	2.32	3.23
	2	23	73.58	70.55– 78.20	1.84	2.51
Basal length	1	20	58.20	53.30– 63.10	2.25	3.86
	2	23	59.51	56.85– 64.20	1.75	2.94
Zygomatic breadth	1	20	34.86	33.05– 37.15	1.29	3.71
	2	23	35.57	33.35– 37.00	0.96	2.69
Braincase breadth	1	20	26.26	24.80– 28.30	1.05	4.01
	2	23	26.36	23.90– 27.75	1.01	3.83
Nasal length	1	18	31.45	27.60– 34.90	1.77	5.63
	2	23	32.61	30.30– 35.65	1.37	4.21
Nasal breadth	1	20	15.16	14.10– 16.40	0.70	4.64
	2	23	15.83	14.60– 18.00	0.94	5.96
Maxillary toothrow length (alveolar)	1	20	13.64	12.80– 14.30	0.42	3.10
	2	23	13.99	13.40– 14.80	0.37	2.67
Maxillary toothrows breadth (alveolar)	1	20	19.65	18.50– 20.90	0.60	3.07
	2	23	20.03	19.15– 21.00	0.59	2.94
Postdental breadth	1	20	8.50	7.80– 9.15	0.38	4.52
	2	23	8.98	7.75– 10.05	0.49	5.43
Incisive foramen length	1	20	18.35	16.55– 20.10	0.91	4.97
	2	23	18.62	17.05– 21.20	1.00	5.39
Basioccipital length	1	20	8.85	8.25– 10.00	0.43	4.82
	2	23	9.08	8.10– 10.35	0.54	5.91
Basioccipital breadth	1	20	9.00	8.30– 9.65	0.46	5.08
	2	23	9.20	8.30– 10.35	0.53	5.81
Diastema length	1	20	20.06	17.80– 21.75	1.00	4.96
	2	23	20.65	19.15– 23.30	0.94	4.55
Rostrum depth	1	19	13.81	12.55– 15.50	0.70	5.10
	2	23	14.33	13.60– 15.40	0.46	3.23
Bulla length	1	20	11.23	10.05– 12.35	0.51	4.58
	2	23	11.21	10.55– 12.30	0.49	4.41
Bullae breadth	1	18	25.92	24.35– 27.30	1.01	3.89
	2	22	25.75	23.80– 27.20	0.78	3.05
Shield-bullae depth	1	20	21.68	20.80– 22.80	0.65	2.99
	2	23	21.92	20.30– 22.60	0.64	2.94
Skull depth	1	19	31.18	29.45– 33.20	0.98	3.15
	2	23	32.15	30.65– 33.85	0.80	2.49
Carotid foramina breadth	1	20	10.06	9.20– 10.90	0.44	4.41
	2	22	10.25	9.25– 11.80	0.64	6.19
Infraorbital canals breadth	1	20	17.89	15.95– 19.10	0.88	4.92
	2	23	18.13	16.95– 19.20	0.61	3.36
Mandible height	1	18	34.41	31.45– 36.75	1.60	4.66
	2	22	35.08	33.10– 37.05	1.02	2.92

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	*Sample number*	*Sample size*	*Mean*	*Range*	*Standard deviation*	*Coefficient of variation*
			Sylvilagus floridanus holzneri—continued			
Mandible length	1	17	35.25	31.80– 37.40	1.58	4.48
	2	21	36.28	34.40– 38.00	1.13	3.12
Mandible ramus depth	1	19	10.78	9.85– 12.30	0.61	5.70
	2	20	10.71	9.95– 11.60	0.47	4.37
Mandibular toothrow length (alveolar)	1	19	13.89	13.10– 14.60	0.50	3.59
	2	21	14.15	13.50– 15.00	0.45	3.20
			Sylvilagus floridanus orizabae			
Total length	5	12	425.17	402.00–450.00	14.78	3.48
	6	14	406.00	345.00–435.00	22.58	5.56
	7	11	397.55	375.00–446.00	19.85	4.99
	8	15	398.00	367.00–434.00	22.72	5.71
	9	11	397.45	378.00–436.00	20.04	5.04
	10	14	409.43	335.00–445.00	28.88	7.05
Tail length	5	12	55.17	43.00– 65.00	6.58	11.92
	6	14	49.29	37.00– 68.00	9.43	19.12
	7	11	42.91	32.00– 61.00	8.94	20.83
	8	15	44.47	26.00– 67.00	10.16	22.85
	9	11	42.55	32.00– 58.00	8.18	19.22
	10	14	49.64	40.00– 57.00	5.60	11.27
Body length	5	12	370.00	352.00–390.00	10.57	2.86
	6	14	356.71	290.00–391.00	23.06	6.46
	7	11	354.64	343.00–385.00	12.32	3.47
	8	15	355.80	300.00–392.00	26.31	7.40
	9	11	354.91	329.00–393.00	19.61	5.52
	10	14	359.79	285.00–392.00	26.60	7.39
Hind foot length	5	12	92.25	88.00– 98.00	2.83	3.07
	6	14	91.07	85.00– 96.00	3.43	3.77
	7	11	86.91	81.00– 92.00	3.56	4.10
	8	15	88.87	83.00– 95.00	3.62	4.08
	9	11	88.55	77.00– 97.00	5.35	6.05
	10	14	91.07	85.00–102.00	4.63	5.09
Ear length (wet)	5	1	68.00	68.00– 68.00	0.00	0.00
	6	10	72.10	68.00– 89.00	6.19	8.59
	7	11	67.09	60.00– 72.00	3.91	5.83
	8	10	66.30	59.00– 85.00	7.15	10.78
	9	7	67.57	66.00– 71.00	1.72	2.54
	10	4	65.50	59.00– 78.00	8.74	13.34
Ear length (dry)	5	11	55.33	51.80– 60.50	2.99	5.40
	6	7	61.04	55.10– 66.90	3.80	6.22
	7	10	59.51	52.60– 66.30	4.24	7.12
	8	15	57.05	54.20– 58.90	1.65	2.89
	9	9	60.08	57.00– 62.10	1.80	3.00
	10	14	57.76	51.20– 66.70	4.08	7.06
First upper incisor length	5	13	7.49	6.50– 8.40	0.61	8.17
	6	13	7.44	6.85– 8.15	0.41	5.55
	7	12	7.07	6.40– 7.80	0.41	5.80
	8	16	7.44	6.40– 8.10	0.50	6.76
	9	12	7.31	6.45– 8.25	0.54	7.38
	10	14	6.96	5.30– 8.10	0.71	10.21
Palate length	5	13	6.23	5.30– 6.80	0.43	6.93
	6	14	5.86	4.85– 7.00	0.66	11.21
	7	12	5.75	5.15– 6.20	0.34	5.84

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus floridanus orizabae—continued			
	8	16	6.03	4.40– 7.10	0.74	12.25
	9	12	5.94	5.40– 6.40	0.38	6.34
	10	13	5.76	5.05– 6.70	0.52	9.05
Greatest skull	5	13	72.54	70.30– 75.80	1.77	2.44
	6	14	72.06	69.40– 74.05	1.47	2.04
	7	12	70.16	67.30– 73.30	2.15	3.06
	8	16	71.39	67.70– 75.45	2.29	3.21
	9	12	71.19	68.80– 76.80	2.17	3.05
	10	13	70.40	68.15– 75.85	1.92	2.73
Basal length	5	13	58.54	56.10– 62.05	1.59	2.72
	6	14	57.90	55.05– 60.95	1.77	3.06
	7	12	56.51	52.55– 60.00	2.08	3.68
	8	16	57.23	53.45– 60.70	2.91	3.52
	9	12	57.35	55.10– 61.70	1.75	3.05
	10	11	56.45	53.50– 57.75	1.14	2.01
Zygomatic breadth	5	13	35.21	33.95– 37.00	0.84	2.38
	6	14	34.74	33.20– 37.00	0.98	2.82
	7	12	33.79	32.40– 35.90	1.07	3.17
	8	16	34.69	32.85– 36.35	1.08	3.10
	9	12	34.21	33.35– 35.80	0.80	2.35
	10	11	33.53	31.25– 35.05	0.99	2.97
Braincase breadth	5	13	26.58	25.35– 28.20	0.86	3.23
	6	13	26.09	25.25– 27.30	0.58	2.22
	7	12	25.42	23.80– 26.95	0.90	3.53
	8	16	26.40	24.50– 27.70	0.98	3.72
	9	12	26.04	24.90– 27.10	0.68	2.63
	10	13	25.69	23.70– 26.75	0.83	3.24
Nasal length	5	13	31.98	30.15– 35.30	1.60	4.99
	6	14	31.33	29.55– 32.95	1.06	3.40
	7	12	30.58	27.05– 33.70	2.01	6.58
	8	16	32.24	29.60– 36.15	1.73	5.35
	9	12	31.07	28.90– 33.50	1.48	4.76
	10	13	31.19	28.40– 35.00	1.55	4.95
Nasal breadth	5	13	14.93	13.80– 16.75	0.82	5.52
	6	14	15.03	13.80– 16.95	0.97	6.47
	7	12	14.73	13.45– 17.00	1.24	8.42
	8	16	15.21	13.30– 17.45	1.09	7.18
	9	12	14.68	13.50– 16.15	0.93	6.32
	10	13	14.91	12.65– 17.00	1.18	7.91
Maxillary toothrow length (alveolar)	5	13	14.23	13.55– 14.75	0.33	2.34
	6	14	13.81	13.05– 14.35	0.46	3.31
	7	12	13.69	13.05– 14.30	0.38	2.79
	8	16	13.87	13.05– 14.85	0.54	3.90
	9	12	13.67	13.00– 14.60	0.39	2.84
	10	13	13.58	13.00– 14.45	0.43	3.13
Maxillary toothrows breadth (alveolar)	5	13	19.97	18.35– 20.95	0.66	3.28
	6	14	19.68	18.80– 21.55	0.70	3.58
	7	12	19.29	18.40– 20.65	0.76	3.94
	8	16	19.56	18.40– 20.85	0.67	3.44
	9	12	19.20	18.35– 20.95	0.67	3.47
	10	13	19.24	18.20– 20.50	0.77	4.01
Postdental breadth	5	13	8.91	8.25– 9.70	0.41	4.63
	6	14	8.55	7.85– 8.95	0.32	3.73

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus floridanus orizabae—continued			
	7	12	8.41	7.50– 8.90	0.47	5.57
	8	15	8.68	7.70– 9.60	0.50	5.76
	9	12	8.36	7.70– 9.00	0.35	4.21
	10	11	8.62	7.90– 9.25	0.38	4.43
Incisive foramen length	5	13	17.99	17.10– 18.95	0.49	2.73
	6	14	18.40	17.20– 19.00	0.51	2.77
	7	12	17.72	16.15– 19.30	0.94	5.31
	8	16	17.95	16.50– 19.65	0.85	4.71
	9	12	18.23	16.90– 20.65	0.98	5.37
	10	12	18.19	17.60– 19.55	0.54	2.97
Basioccipital length	5	13	8.96	8.60– 9.60	0.29	3.19
	6	14	8.77	8.25– 9.50	0.32	3.67
	7	12	8.67	7.90– 9.15	0.32	3.74
	8	16	8.66	7.75– 9.60	0.61	7.08
	9	12	8.69	8.30– 9.30	0.31	3.57
	10	13	8.80	7.65– 9.60	0.52	5.88
Basioccipital breadth	5	13	9.13	8.60– 9.75	0.33	3.60
	6	14	8.96	8.45– 10.60	0.60	6.71
	7	12	8.65	7.55– 9.55	0.69	7.94
	8	16	9.12	8.25– 9.80	0.49	5.40
	9	12	8.75	8.05– 9.80	0.58	6.68
	10	13	9.27	8.50– 10.10	0.60	6.47
Diastema length	5	13	19.65	18.70– 21.30	0.64	3.26
	6	14	19.91	18.75– 20.70	0.48	2.43
	7	12	19.22	17.55– 21.60	1.22	6.36
	8	16	19.60	18.20– 21.45	0.78	4.98
	9	12	19.66	18.45– 21.90	0.98	4.99
	10	12	19.65	18.80– 21.25	0.80	4.09
Rostrum depth	5	13	14.08	12.70– 15.00	0.59	4.19
	6	14	13.93	12.85– 14.70	0.60	4.34
	7	12	13.76	13.00– 14.90	0.55	3.98
	8	16	14.01	13.40– 14.85	0.43	3.10
	9	12	13.31	12.10– 14.15	0.59	4.46
	10	13	13.57	13.15– 14.90	0.41	3.27
Bulla length	5	13	10.60	10.00– 11.40	0.42	4.00
	6	14	10.91	10.40– 11.75	0.40	3.69
	7	12	10.72	10.05– 11.80	0.49	4.61
	8	16	10.56	10.15– 11.30	0.36	3.41
	9	12	10.68	9.95– 11.65	0.48	4.48
	10	14	10.50	9.85– 11.45	0.41	3.91
Bullea breadth	5	13	24.81	23.65– 26.50	0.80	3.23
	6	14	25.24	23.80– 27.55	0.95	3.76
	7	12	24.35	22.80– 26.00	1.07	4.39
	8	15	24.98	23.15– 26.80	1.09	4.36
	9	12	24.73	22.80– 25.70	0.81	3.26
	10	10	24.43	22.85– 25.50	0.84	3.44
Shield-bullae depth	5	13	21.24	20.45– 22.40	0.59	2.76
	6	14	21.61	21.00– 22.65	0.54	2.51
	7	12	21.09	19.85– 22.40	0.70	3.32
	8	16	21.54	20.70– 22.80	0.56	2.58
	9	12	21.38	20.20– 22.45	0.56	2.60
	10	12	21.18	20.80– 21.55	0.27	1.25

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus floridanus orizabae—continued			
Skull depth	5	13	31.11	29.70– 32.50	0.71	2.28
	6	14	30.94	30.20– 31.80	0.46	1.48
	7	12	30.48	28.80– 33.10	1.11	3.65
	8	16	31.24	29.20– 33.75	1.05	3.37
	9	12	31.02	30.05– 32.00	0.65	2.10
	10	11	30.48	29.40– 31.50	0.61	1.99
Carotid foramina breadth	5	13	10.21	9.35– 11.15	0.50	4.91
	6	14	10.07	9.05– 11.35	0.59	5.88
	7	12	9.70	8.50– 10.75	0.63	6.49
	8	16	10.06	8.90– 11.40	0.63	6.25
	9	12	9.87	9.30– 10.95	0.51	5.14
	10	11	10.41	9.95– 10.90	0.44	4.19
Infraorbital canals breadth	5	13	17.89	17.25– 19.60	0.62	3.46
	6	14	17.66	16.35– 18.80	0.60	3.38
	7	12	17.33	15.55– 18.95	0.99	5.70
	8	16	17.45	16.30– 18.95	0.80	4.56
	9	12	17.16	16.30– 18.50	0.63	3.66
	10	13	16.92	15.35– 18.60	0.95	5.62
Mandible height	5	13	34.06	32.30– 35.85	1.10	3.24
	6	13	33.98	32.65– 36.10	0.91	2.69
	7	12	32.92	31.25– 35.70	1.31	3.99
	8	15	33.21	30.75– 36.50	1.64	4.94
	9	12	33.17	30.85– 36.05	1.69	5.11
	10	13	32.66	30.40– 34.75	1.52	4.65
Mandible length	5	13	35.77	33.40– 37.70	1.45	4.06
	6	12	35.33	33.00– 36.85	1.06	3.00
	7	12	34.22	32.75– 35.70	0.84	2.44
	8	14	35.10	31.80– 38.35	1.91	5.43
	9	12	34.33	32.50– 37.40	1.38	4.01
	10	13	34.07	32.40– 35.70	0.98	2.87
Mandible Ramus depth	5	13	10.26	9.50– 11.15	0.49	4.76
	6	14	10.50	9.60– 11.40	0.50	4.76
	7	12	10.17	9.60– 11.35	0.50	4.88
	8	15	10.35	9.30– 11.10	0.52	5.01
	9	9	10.15	9.20– 11.45	0.67	6.59
	10	4	9.46	9.25– 9.80	0.24	2.53
Mandibular toothrow length (alveolar)	5	13	14.32	13.00– 15.15	0.62	4.35
	6	14	14.14	13.40– 14.90	0.42	2.94
	7	12	13.75	13.10– 14.80	0.47	3.44
	8	15	14.07	13.10– 15.45	0.61	4.35
	9	9	13.70	12.75– 14.45	0.48	3.48
	10	4	13.25	13.00– 13.55	0.23	1.77
			Sylvilagus graysoni graysoni			
Total length	2a	19	466.11	400.00–490.00	23.24	4.99
	2b	2	502.00	470.00–534.00		
	2c	1	480.00			
Tail length	2a	19	50.21	28.00– 65.00	9.94	19.79
	2b	2	43.00	30.00– 56.00		
	2c	1	36.00			
Body length	2a	19	415.89	371.00–438.00	17.27	4.15
	2b	2	459.00	440.00–478.00		
	2c	1	444.00			

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	*Sample number*	*Sample size*	*Mean*	*Range*	*Standard deviation*	*Coefficient of variation*
			Sylvilagus graysoni graysoni—continued			
Hind foot length	2a	19	95.42	90.00–102.00	3.17	3.32
	2b	2	97.50	95.00–100.00		
	2c	1	95.00			
Ear length (wet)	2a	4	63.75	63.00– 65.00	0.96	1.50
	2b	1	66.00			
	2c	1	63.00			
Ear length (dry)	2a	19	56.83	53.00– 60.40	1.94	3.41
	2b	2	58.25	54.90– 60.00		
	2c	1	57.50			
First upper incisor length	2a	19	8.93	7.75– 9.95	0.52	6.18
	2b	2	8.00	7.60– 8.40		
	2c	1	7.50			
Palate length	2a	19	8.04	7.00– 9.30	0.61	7.60
	2b	2	8.73	8.40– 9.05		
	2c	1	8.15			
Greatest skull length	2a	19	79.92	76.00– 84.20	2.21	2.76
	2b	2	83.38	83.05– 83.70		
	2c	1	81.55			
Basal length	2a	19	64.83	61.25– 68.30	1.88	2.90
	2b	2	67.20	66.50– 67.90		
	2c	1	66.00			
Zygomatic breadth	2a	19	37.00	35.50– 38.95	0.95	2.56
	2b	2	37.90	37.60– 38.20		
	2c	1	36.90			
Braincase breadth	2a	19	27.33	26.50– 28.05	0.49	1.78
	2b	2	27.85	27.55– 28.15		
	2c	1	27.35			
Nasal length	2a	19	34.31	32.00– 36.85	1.50	4.38
	2b	2	35.03	34.85– 35.20		
	2c	1	36.75			
Nasal breadth	2a	19	14.90	13.65– 16.70	0.86	5.77
	2b	2	16.33	16.05– 16.60		
	2c	1	14.85			
Maxillary toothrow length (alveolar)	2a	19	15.23	14.80– 16.30	0.43	2.80
	2b	2	14.98	14.80– 15.15		
	2c	1	14.95			
Maxillary toothrows breadth (alveolar)	2a	19	22.60	21.70– 23.70	0.53	2.33
	2b	2	23.10	22.85– 23.35		
	2c	1	23.00			
Postdental breadth	2a	19	10.15	9.65– 10.95	0.37	3.64
	2b	2	10.00	9.90– 10.10		
	2c	1	10.55			
Incisive foramen length	2a	19	19.93	18.85– 21.40	0.79	3.99
	2b	2	20.05	19.80– 20.30		
	2c	1	19.75			
Basioccipital length	2a	19	10.09	9.30– 10.80	0.45	4.50
	2b	2	10.90	10.80– 11.00		
	2c	1	9.75			
Basioccipital breadth	2a	19	9.73	9.25– 10.70	0.32	3.32
	2b	2	9.80	9.20– 10.40		
	2c	1	9.50			
Diastema length	2a	19	22.05	20.55– 23.60	0.88	3.99
	2b	2	22.70	22.60– 22.80		
	2c	1	22.80			

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus graysoni graysoni—continued			
Rostrum depth	2a	19	16.47	15.50– 17.80	0.59	3.61
	2b	2	17.05	16.10– 18.00		
	2c	1	17.30			
Bulla length	2a	19	11.31	10.60– 12.30	0.54	4.78
	2b	2	11.23	11.05– 11.40		
	2c	1	10.65			
Bullae breadth	2a	19	27.48	26.50– 28.80	0.73	2.64
	2b	2	27.58	27.40– 27.75		
	2c	1	27.00			
Shield-bullae depth	2a	19	23.03	21.70– 24.40	0.73	3.18
	2b	2	23.95	23.60– 24.30		
	2c	1	22.70			
Skull depth	2a	19	33.31	31.80– 34.80	0.85	2.55
	2b	2	33.83	33.80– 33.85		
	2c	1	33.55			
Carotid foramina breadth	2a	19	11.99	11.10– 12.95	0.52	4.32
	2b	2	12.15	11.95– 12.35		
	2c	1	11.55			
Infraorbital canals breadth	2a	19	19.71	17.95– 20.70	0.72	3.67
	2b	2	20.33	19.95– 20.70		
	2c	1	19.15			
Mandible height	2a	19	38.84	36.30– 42.60	1.50	3.87
	2b	2	40.65	40.55– 40.75		
	2c	1	40.70			
Mandible length	2a	19	41.15	39.30– 45.10	1.44	3.50
	2b	2	42.53	41.90– 43.15		
	2c	1	41.80			
Mandible ramus depth	2a	19	12.73	11.80– 13.95	0.62	4.85
	2b	2	12.93	12.75– 13.10		
	2c	1	12.60			
Mandibular toothrow length (alveolar)	2a	19	15.71	15.10– 16.30	0.37	2.35
	2b	2	15.78	15.65– 15.90		
	2c	1	15.00			
			Sylvilagus graysoni badistes			
Total length	1	11	436.91	412.00–472.00	17.00	3.89
Tail length	1	11	32.55	26.00– 45.00	5.94	18.25
Body length	1	11	404.36	373.00–427.00	17.13	4.24
Hind foot length	1	11	90.73	86.00– 95.00	2.69	2.96
Ear length (wet)	1	11	62.18	55.00– 65.00	2.60	4.18
Ear length (dry)	1	11	57.11	50.80– 59.70	2.43	4.25
First upper incisor length	1	11	9.14	8.20– 9.95	0.60	6.52
Palate length	1	11	7.84	7.15– 9.10	0.52	6.66
Greatest skull length	1	11	78.22	75.90– 79.95	1.36	1.74
Basal length	1	11	63.95	61.55– 65.60	1.47	2.29
Zygomatic breadth	1	11	37.27	36.15– 38.75	0.94	2.51
Braincase breadth	1	11	27.57	26.65– 28.70	0.70	2.52
Nasal length	1	11	34.42	32.45– 36.00	0.99	2.88
Nasal breadth	1	11	14.97	14.15– 15.80	0.49	3.28
Maxillary toothrow length (alveolar)	1	11	16.09	15.25– 16.60	0.40	2.50
Maxillary toothrows breadth (alveolar)	1	11	22.49	21.85– 23.35	0.44	1.96

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus graysoni badistes—continued			
Postdental breadth	1	11	10.23	9.60– 10.60	0.30	2.90
Incisive foramen length	1	11	18.57	17.75– 19.35	0.52	2.77
Basioccipital length	1	11	9.99	9.10– 10.60	0.45	4.53
Basioccipital breadth	1	11	10.07	9.65– 10.65	0.32	3.15
Diastema length	1	11	20.19	18.90– 21.20	0.66	3.27
Rostrum depth	1	11	16.15	15.35– 16.85	0.47	2.94
Bulla length	1	11	11.48	10.75– 11.80	0.30	2.59
Bullae breadth	1	11	27.04	26.35– 28.20	0.52	1.92
Shield-bullae depth	1	11	23.19	22.70– 23.75	0.30	1.30
Skull depth	1	11	33.20	32.25– 33.90	0.58	1.74
Carotid foramina breadth	1	11	11.97	11.30– 12.80	0.43	3.57
Infraorbital canals breadth	1	11	20.11	19.20– 21.15	0.61	3.06
Mandible height	1	11	38.40	37.40– 40.25	0.96	2.50
Mandible length	1	11	40.64	39.75– 41.70	0.64	1.58
Mandible ramus depth	1	11	12.66	12.00– 13.35	0.41	3.23
Mandibular toothrow length (alveolar)	1	11	15.89	15.40– 16.80	0.47	2.98
			Sylvilagus audubonii parvulus			
Total length	1	11	351.64	302.00–410.00	31.42	8.94
	2	7	339.71	320.00–360.00	14.97	4.41
Tail length	1	10	43.40	21.00– 64.00	10.99	25.34
	2	7	38.29	28.00– 52.00	8.75	22.86
Body length	1	10	321.20	281.00–386.00	35.81	11.15
	2	7	301.43	280.00–315.00	12.55	4.17
Hind foot length	1	11	77.55	67.00– 95.00	7.48	9.64
	2	7	75.29	71.00– 78.00	2.36	3.14
Ear length (wet)	1	11	75.00	65.00– 91.00	8.96	11.94
	2	7	67.00	64.00– 70.00	2.31	3.45
Ear length (dry)	1	9	62.08	57.90– 65.80	2.56	4.12
	2	7	60.94	58.10– 63.50	1.84	3.02
First upper incisor length	1	17	6.94	6.15– 7.70	0.49	7.11
	2	10	6.86	5.25– 8.25	0.87	12.75
Palate length	1	17	4.95	4.10– 5.65	0.37	7.55
	2	10	4.97	4.35– 5.40	0.31	6.15
Greatest skull length	1	17	64.57	59.20– 68.30	2.34	3.62
	2	11	64.27	62.00– 67.35	1.69	2.63
Basal length	1	17	51.51	46.55– 54.50	2.00	3.86
	2	10	51.41	48.95– 53.45	1.42	2.75
Zygomatic breadth	1	16	32.27	29.75– 33.90	1.11	3.43
	2	10	32.22	30.70– 33.00	0.86	2.65
Braincase breadth	1	16	24.69	23.10– 26.40	0.80	3.23
	2	10	24.96	23.95– 25.75	0.57	2.29
Nasal length	1	17	26.64	24.45– 28.85	1.35	5.08
	2	10	27.00	24.90– 29.05	1.35	4.99
Nasal breadth	1	17	12.85	11.50– 13.75	0.76	5.90
	2	10	12.94	11.90– 13.70	0.63	4.89
Maxillary toothrow length (alveolar)	1	17	12.07	11.35– 12.60	0.36	2.97
	2	10	12.04	11.25– 12.60	0.47	3.94
Maxillary toothrows breadth (alveolar)	1	17	17.27	16.10– 18.60	0.74	4.27
	2	10	16.95	15.80– 17.80	0.65	3.83
Postdental breadth	1	15	7.27	6.20– 8.30	0.46	6.37
	2	10	7.09	6.75– 7.60	0.26	3.64

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	Sample number	Sample size	Mean	Range	Standard deviation	Coefficient of variation
			Sylvilagus audubonii parvulus—continued			
Incisive foramen length	1	17	15.56	14.15– 16.40	0.66	4.25
	2	10	15.90	14.85– 17.15	0.75	4.72
Basioccipital length	1	17	8.27	7.65– 9.00	0.39	4.77
	2	10	8.31	7.60– 9.00	0.37	4.49
Basioccipital breadth	1	17	7.69	7.05– 9.00	0.40	5.27
	2	10	7.59	6.95– 8.75	0.54	7.07
Diastema length	1	17	16.87	15.25– 18.30	0.87	5.13
	2	10	17.06	15.40– 18.40	0.87	5.10
Rostrum depth	1	17	12.07	11.05– 12.60	0.41	3.44
	2	10	12.11	11.45– 13.70	0.66	5.45
Bulla length	1	17	12.85	12.00– 13.95	0.55	4.26
	2	11	12.39	11.75– 13.15	0.41	3.30
Bullae breadth	1	14	26.63	24.50– 29.25	1.32	4.97
	2	9	25.78	24.50– 26.90	0.87	3.37
Shield-bullae depth	1	17	21.76	20.55– 23.15	0.64	2.96
	2	9	21.66	20.85– 22.90	0.64	2.94
Skull-depth	1	14	29.30	28.30– 30.85	0.64	2.19
	2	9	29.67	28.00– 30.45	0.77	2.60
Carotid foramina breadth	1	16	8.38	7.40– 9.15	0.52	6.17
	2	10	8.16	7.10– 9.25	0.58	7.06
Infraorbital canals breadth	1	17	15.80	14.75– 17.10	0.68	4.28
	2	10	15.78	15.00– 16.55	0.50	3.15
Mandible height	1	15	31.61	27.25– 34.10	1.90	6.00
	2	10	31.36	29.95– 33.00	1.01	3.23
Mandible length	1	13	31.95	27.80– 33.55	1.52	4.76
	2	9	31.39	29.60– 34.90	1.55	4.95
Mandible ramus depth	1	15	10.24	9.35– 10.85	0.57	5.52
	2	10	10.33	8.95– 11.30	0.65	6.26
Mandibular toothrow length (alveolar)	1	15	12.27	11.70– 12.65	0.28	2.32
	2	9	12.41	11.50– 12.95	0.48	3.90
			Sylvilagus audubonii goldmani			
Total length	3	6	369.25	363.00–380.00	7.46	2.02
Tail length	3	6	44.00	43.00– 46.00	1.41	3.21
Body length	3	6	325.25	320.00–334.00	6.08	1.87
Hind foot length	3	6	75.50	72.00– 78.00	2.65	3.50
Ear length (wet)	3	6	68.50	60.00– 80.00	8.39	12.24
Ear length (dry)	3	10	60.08	56.50– 62.20	2.60	4.34
First upper incisor length	3	10	7.34	6.70– 7.70	0.42	5.69
Palate length	3	10	5.82	5.50– 6.30	0.33	5.59
Greatest skull length	3	10	66.78	64.15– 69.60	2.23	3.34
Basal length	3	10	53.61	52.00– 56.35	1.93	3.59
Zygomatic breadth	3	10	33.34	31.35– 34.40	1.19	3.56
Braincase breadth	3	10	24.96	23.75– 25.95	0.91	3.66
Nasal length	3	10	28.54	27.25– 29.90	1.24	4.34
Nasal breadth	3	10	13.96	13.00– 14.65	0.65	4.68
Maxillary toothrow length (alveolar)	3	10	12.96	12.45– 13.35	0.39	2.99
Maxillary toothrows breadth (alveolar)	3	10	18.21	17.65– 18.95	0.48	2.65
Postdental breadth	3	10	8.05	7.30– 8.80	0.55	6.89
Incisive foramen length	3	10	16.73	15.65– 17.15	0.63	3.76

TABLE A.—External and cranial measurements of *Sylvilagus*—continued

Character	*Sample number*	*Sample size*	*Mean*	*Range*	*Standard deviation*	*Coefficient of variation*
			Sylvilagus audubonii goldmani—continued			
Basioccipital length	3	10	8.96	8.75– 9.15	0.19	2.15
Basioccipital breadth	3	10	8.39	7.95– 8.75	0.35	4.12
Diastema length	3	10	18.09	17.15– 19.15	0.82	4.55
Rostrum depth	3	10	13.09	12.60– 13.60	0.36	2.73
Bulla length	3	9	11.38	8.95– 12.40	1.00	8.81
Bullae breadth	3	9	24.51	23.45– 25.55	0.84	3.42
Shield-bullae depth	3	10	21.31	20.65– 22.30	0.63	2.97
Skull depth	3	10	29.29	28.05– 30.15	0.81	2.75
Carotid foramina breadth	3	10	9.87	9.35– 10.35	0.36	3.63
Infraorbital canals breadth	3	10	16.94	16.25– 17.75	0.54	3.17
Mandible height	3	10	32.16	29.90– 33.70	1.35	4.20
Mandible length	3	10	33.01	31.95– 34.85	0.88	2.67
Mandible ramus depth	3	10	10.32	9.50– 10.85	0.48	4.70
Mandibular toothrow length (alveolar)	3	10	13.34	12.60– 14.00	0.45	3.35

TABLE B.—List of 26 cranial characters and their discriminant multipliers used in a discriminant function analysis comparing individuals of *S. floridanus, S. cunicularius,* and *S. graysoni* from western Mexico

Character	First discriminant multiplier	Second discriminant multiplier
Upper incisor length	.128990	–.203200
Least palatal length	.298270	–.311270
Greatest skull length	.126300	.020535
Basal length	–.028489	–.018176
Greatest zygomatic breadth	–.012512	.063484
Braincase breadth	–.252760	–.010618
Greatest nasal length	–.114320	.152860
Greatest nasal breadth	.052802	.086462
Maxillary toothrow length	.050421	.050469
Maxillary toothrows breadth	.049597	–.258320
Postdental breadth	.167790	–.095209
Incisive foramen length	.209620	–.022496
Basioccipital length	.158450	–.077523
Basioccipital breadth	–.425280	–.214120
Diastema length	–.351690	.044509
Rostrum depth	–.061170	.063670
Bulla length	.175600	.333940
Bullae breadth	.070920	–.005489
Shield-bullae depth	–.033701	.117760
Skull depth	.102300	.018456
Carotid foramina breadth	.455340	.154000
Infraorbital canals breadth	–.084252	.040451
Mandible height	.049897	.161480
Mandible length	–.056153	–.224970
Mandible ramus height	.334970	–.461430
Mandibular toothrow length	.086564	.498630

TABLE C.—List of 26 characters and their discriminant multipliers used in a discriminant function analysis comparing individuals of *S. f. macrocorpus* and *S. f. orizabae* from western Mexico (see "Comparisons" under *S. f. macrocorpus* for discussion)

Character	Discriminant multiplier	Character	Discriminant multiplier
Upper incisor length	.013404	Basioccipital breadth	.071662
Least palatal length	.126090	Diastema length	−.349320
Greatest skull length	−.150300	Rostrum depth	.338130
Basal length	.343930	Bulla length	.288650
Greatest zygomatic breadth	−.086063	Bullae breadth	.066839
Braincase breadth	−.159110	Shield-bullae depth	.127060
Greatest nasal length	.128430	Skull depth	.022495
Greatest nasal breadth	−.143300	Carotid foramina breadth	−.198880
Maxillary toothrow length	−.025437	Infraorbital canals breadth	.086752
Maxillary toothrows breadth	.398370	Mandible height	−.012280
Postdental breadth	.241650	Mandible length	−.083788
Incisive foramen length	−.034595	Mandible ramus height	−.269720
Basioccipital length	−.280460	Mandibular toothrow length	−.052596

Literature Cited

Allen, J. A.

1877. Leporidae. *In* E. Coues and J. A. Allen, *Monographs of North American Rodentia,* pages 265–378. Washington, D.C.: United States Geological Survey of the Territories.

1890. Notes on Collections of Mammals made in Central and Southern Mexico, by Dr. Audley C. Buller, with Descriptions of New Species of the Genera *Vespertilio, Sciurus,* and *Lepus. Bulletin of the American Museum of Natural History,* 3:175–194.

1903. List of Mammals Collected by Mr. J. H. Batty in New Mexico and Durango, with Descriptions of New Species and Subspecies. *Bulletin of the American Museum of Natural History,* 19:587–612.

1904. Mammals from Southern Mexico and Central and South America. *Bulletin of the American Museum of Natural History,* 20:29–80.

1906. Mammals from the States of Sinaloa and Jalisco, Mexico, Collected by J. H. Batty during 1904 and 1905. *Bulletin of the American Museum of Natural History,* 22:191–262.

Armstrong, D. M., and J. K. Jones, Jr.

1971. Mammals from the Mexican State of Sinaloa, I: Marsupialia, Insectivora, Edentata, Lagomorpha. *Journal of Mammalogy,* 52:747–757.

Baird, S. F.

1857. *North American Mammals.* xxxiv + 757 pages, 60 plates. Philadelphia: J. B. Lippincott & Co.

Baker, R. H., and J. K. Greer

1962. Mammals of the Mexican State of Durango. *Publications of the Museum, Michigan State University, Biological Series,* 2:25–154.

Coues, E., and J. A. Allen

1877. *Monographs of North American Rodentia.* x + 1091 pages. Washington, D.C.: United States Geological Survey of the Territories.

Diersing, V. E.

1978. *A Systematic Revision of Several Species of Cottontails (Genus Sylvilagus) from North and South America.* 872 pages. Doctoral dissertation, University of Illinois, Urbana.

Elliot, D. G.

1903. A List of a Collection of Mexican Mammals with Descriptions of Some Apparently New Forms. *Field Columbian Museum Publication,* 71, Zoological Series, 3:141–149.

Findley, J. S., A. H. Harris, D. E. Wilson, and C. Jones

1975. *Mammals of New Mexico.* 360 pages. Albuquerque: University of New Mexico Press.

Genoways, H. H.

1973. Systematics and Evolutionary Relationships of the Spiny Pocket Mice of the Genus Liomys. *Special Publications of the Museum, Texas Tech University,* 5:1–368.

Genoways, H. H., and J. K. Jones, Jr.

1973. Notes on Some Mammals from Jalisco, Mexico. *Occasional Papers of the Museum, Texas Tech University,* 9:1–22.

Hoffmeister, D. F., and E. G. Zimmerman

1967. Growth of the Skull in the Cottontail *(Sylvilagus floridanus)* and Its Application to Age-Determination. *The American Midland Naturalist,* 78:198-206.

Hsu, T. C., and K. Benirschke

1971. *An Atlas of Mammalian Chromosomes.* Volume 5, folio 212. New York: Springer-Verlag.

Lyon, M. W., Jr.

1904. Classification of the Hares and Their Allies. *Smithsonian Miscellaneous Collections,* 45:321–447.

Mearns, E. A.

1896. Preliminary Description of a New Subgenus and Six New Species and Subspecies of Hares, from the Mexican Border of the United States. *Proceedings of the United States National Museum,* 18:551–565.

Merriam, C. H.

1893. Preliminary Descriptions of Four New Mammals from Southern Mexico, Collected by E. W. Nelson. *Proceedings of the Biological Society of Washington,* 8:143–146.

Miller, G. S., Jr.

1899. Descriptions of Six New American Rabbits. *Proceedings of the Academy of Natural Sciences of Philadelphia,* 51:380–390.

Nelson, E. W.

1899. General Account of the [Tres Marias] Islands, with Reports on Mammals and Birds. *In* E. W. Nelson, L. Stejneger, M. J. Rathbun, and J. M. Rose, Natural History of the Tres Marias Islands, Mexico. *North American Fauna,* 14:1–97.

1904. Descriptions of Seven New Rabbits from Mexico. *Proceedings of the Biological Society of Washington,* 17:103–110.

1907. Descriptions of New American Rabbits. *Proceedings of the Biological Society of Washington,* 20:81–84.

1909. The Rabbits of North America. *North American Fauna,* 29:1–314.

Rzedowski, J., and R. McVaugh

1966. La vegetacion de Nueva Galicia. *Contributions of the Herbarium, University of Michigan,* 9:1–123.

Thomas, O.

1890. On a Collection of Mammals from Central Vera Cruz, Mexico. *Proceedings of the Zoological Society of London,* 4 Feb:71–76.

Waterhouse, G. R.

1848. *A Natural History of the Mammalia.* Volume II, 500 pages. London: Hippolyte Bailliere.

Zweifel, R. G.

1960. Results of the Puritan-American Museum of Natural History Expedition to Western Mexico, 9: Herpetology of the Tres Marias Islands. *Bulletin of the American Museum of Natural History,* 119:81–128.

REQUIREMENTS FOR SMITHSONIAN SERIES PUBLICATION

Manuscripts intended for series publication receive substantive review within their originating Smithsonian museums or offices and are submitted to the Smithsonian Institution Press with approval of the appropriate museum authority on Form SI–36. Requests for special treatment—use of color, foldouts, casebound covers, etc.—require, on the same form, the added approval of designated committees or museum directors.

Review of manuscripts and art by the Press for requirements of series format and style, completeness and clarity of copy, and arrangement of all material, as outlined below, will govern, within the judgment of the Press, acceptance or rejection of the manuscripts and art.

Copy must be typewritten, double-spaced, on one side of standard white bond paper, with 1¼" margins, submitted as ribbon copy (not carbon or xerox), in loose sheets (not stapled or bound), and accompanied by original art. Minimum acceptable length is 30 pages.

Front matter (preceding the text) should include: **title page** with only title and author and no other information, **abstract page** with author/title/series/etc., following the established format, **table of contents** with indents reflecting the heads and structure of the paper.

First page of text should carry the title and author at the top of the page and an unnumbered footnote at the bottom consisting of author's name and professional mailing address.

Center heads of whatever level should be typed with initial caps of major words, with extra space above and below the head, but with no other preparation (such as all caps or underline). Run-in paragraph heads should use period/dashes or colons as necessary.

Tabulations within text (lists of data, often in parallel columns) can be typed on the text page where they occur, but they should not contain rules or formal, numbered table heads.

Formal tables (numbered, with table heads, boxheads, stubs, rules) should be submitted as camera copy, but the author must contact the series section of the Press for editorial attention and preparation assistance before final typing of this matter.

Taxonomic keys in natural history papers should use the alined-couplet form in the zoology and paleobiology series and the multi-level indent form in the botany series. If cross-referencing is required between key and text, do not include page references within the key, but number the keyed-out taxa with their corresponding heads in the text.

Synonymy in the zoology and paleobiology series must use the short form (taxon, author, year:page), with a full reference at the end of the paper under "Literature Cited." For the botany series, the long form (taxon, author, abbreviated journal or book title, volume, page, year, with no reference in the "Literature Cited") is optional.

Footnotes, when few in number, whether annotative or bibliographic, should be typed at the bottom of the text page on which the reference occurs. Extensive notes must appear at the end of the text in a notes section. If bibliographic footnotes are required, use the short form (author/brief title/page) with the full reference in the bibliography.

Text-reference system (author/year/page within the text, with the full reference in a "Literature Cited" at the end of the text) must be used in place of bibliographic footnotes in all scientific series and is strongly recommended in the history and technology series: "(Jones, 1910:122)" or ". . . Jones (1910:122)."

Bibliography, depending upon use, is termed "References," "Selected References," or "Literature Cited." Spell out book, journal, and article titles, using initial caps in all major words. For capitalization of titles in foreign languages, follow the national practice of each language. Underline (for italics) book and journal titles. Use the colon-parentheses system for volume/number/page citations: "10(2):5–9." For alinement and arrangement of elements, follow the format of the series for which the manuscript is intended.

Legends for illustrations must not be attached to the art nor included within the text but must be submitted at the end of the manuscript—with as many legends typed, double-spaced, to a page as convenient.

Illustrations must not be included within the manuscript but must be submitted separately as original art (not copies). All illustrations (photographs, line drawings, maps, etc.) can be intermixed throughout the printed text. They should be termed **Figures** and should be numbered consecutively. If several "figures" are treated as components of a single larger figure, they should be designated by lowercase italic letters (underlined in copy) on the illustration, in the legend, and in text references: "Figure 9b." If illustrations are intended to be printed separately on coated stock following the text, they should be termed **Plates** and any components should be lettered as in figures: "Plate 9b." Keys to any symbols within an illustration should appear on the art and not in the legend.

A few points of style: (1) Do not use periods after such abbreviations as "mm, ft, yds, USNM, NNE, AM, BC." (2) Use hyphens in spelled-out fractions: "two-thirds." (3) Spell out numbers "one" through "nine" in expository text, but use numerals in all other cases if possible. (4) Use the metric system of measurement, where possible, instead of the English system. (5) Use the decimal system, where possible, in place of fractions. (6) Use day/month/year sequence for dates: "9 April 1976." (7) For months in tabular listings or data sections, use three-letter abbreviations with no periods: "Jan, Mar, Jun," etc.

Arrange and paginate sequentially EVERY sheet of manuscript—including ALL front matter and ALL legends, etc., at the back of the text—in the following order: (1) title page, (2) abstract, (3) table of contents, (4) foreword and/or preface, (5) text, (6) appendixes, (7) notes, (8) glossary, (9) bibliography, (10) index, (11) legends.