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GEOGRAPHIC VARIATION OF *SOREX CINEREUS* IN WEST VIRGINIA

A Thesis
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by
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ABSTRACT

The morphological and geographical diversity of *Sorex cinereus* is evident in West Virginia. In an attempt to identify patterns of morphological variation relative to age, sex, and geographic locality, and to clarify taxonomic status of the West Virginia soricids by defining diagnostic characters applicable to this area, a sample of 288 specimens representing three taxa were analyzed statistically. Standard external measurements were recorded, and a series of 12 cranial and dental characters were measured and recorded for each specimen. Morphological variation due to age was found in *S. c. cinereus*, but not in the smaller reference samples of *S. c. fontinalis* and *S. l. longirostris.* No sexual dimorphism was found in any of the taxa studied. Diagnostic characters found to separate *S. l. longirostris* from *S. c. cinereus* were rostral shape and relative sizes of the third unicuspid. Clear defining characters were not found for *S. c. fontinalis*, although this taxa resembles a smaller version of *S. c. cinereus* with shorter, broader rostra. These data and analyses did not reveal any presence of *S. c. fontinalis* additional to two documented specimens from Hampshire County. Although the presence of *S. l. longirostris* in West Virginia is likely, these analyses were inconclusive.

I would like to dedicate this to my mother, Macel Williams,

who would have been so proud to see me finish.

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Bart Paxton has been a wonderful friend and a tremendous help. Perhaps I could have muddled through all the new computer programs somehow on my own, but I am so glad to have had his help and encouragement. The extraordinary field and museum experiences we've shared have helped me appreciate his knowledge, skill, and wit all the more. Thank you, Barton, I couldn't have done it without you.

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The few words I've written on this page can not begin to express the gratitude I feel for all that has been done along the way to bring this to completion. I have truly been blessed.

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INTRODUCTION

The long-tailed shrews (Insectivora: Soricidae: *Sorex*) are geographically and morphologically diverse. Studying this group of small mammals is difficult due partly to their elusiveness in the field but even more so to their extensive overlap in ranges of standard taxonomic and morphological characters. During early research when identification and taxonomic status were confusing for most mammalian species, the complexities of studying the soricids was appreciated (Rudd,1955). Jackson (1928, pg. 1) wrote,

> "No other group of American mammals having a wide distribution, and in many localities an abundance of individuals, is so little known ... as the long-tailed shrews... And probably no other group of mammals offers so many difficulties and problems in the way of taxonomic study."

Because of the small size of these animals, any slight error in measurements can be significant relative to size. Jackson (1928) also reported that shrews are seemingly more prone to cranial and dental variation and abnormalities than are other small mammals. Bole and Moulthrop (1942) reported a Cleveland Museum of Natural History *S. c. cinereus* specimen, CMNH 16206, having only four unicuspid teeth in an otherwise symmetrical skull. French (1980) also reported tooth anomalies involving the upper unicuspids in several *S. l. longirostris* specimens from Alabama and Indiana.

Members of this group known to occur in West Virginia included in this study are the Masked Shrew, *Sorex cinereus cinereus* Kerr (Hall,1981), the Maryland Shrew, *Sorex cinereus fontinalis* Hollister (two specimens, Kirkland and Levengood, 1987), and the Southeastern Shrew, *Sorex longirostris longirostris*

Bachman (one specimen, French, 1977). The purpose of this study was to evaluate the variation of West Virginia *Sorex c. cinereus* and to more accurately define the status and probable distribution of *S. c. fontinalis* and *S. l. longirostris* in the state.

Taxonomic Review

Sorex cinereus cinereus Kerr

Sorex arcticus cinereus Kerr, 1792:206. Type locality, Fort Severn, Ontario.

Sorex persontus I Geoffroy St-Hilaire,1827:122. Type locality, eastern United States.

Sorex fimbripes Bachman,1837:391. Type locality, Drury Run, Pennsylvania.

Sorex cinereus cinereus Jackson, 1925:56.

(Jackson, 1928 lists 42 synonyms)

Sorex cinereus fontinalis Hollister

Sorex fontinalis Hollister, 1911:378. Type locality, Cold Spring Swamp, Prince Georges Co., Maryland.

Sorex cinereus fontinalis Poole, 1937:96.

(Hall, 1981 lists no other synonyms)

Sorex longirostris longirostris Bachman

Sorex personatus I Geoffroy St-Hilaire, 1827:122. Type locality, eastern United States.

Sorex longirostris Bachman, 1837:370. Type locality, Cat Island, mouth Santee River, South Carolina.

Sorex personatus Baird, 1857:30. Type locality unknown.

(Handley and Varn, 1994, list six synonyms)

Nomenclatorial History

In 1772 J. R. Forster described but did not name several species of shrews from the Fort Severn, Ontario, area of the Hudson Bay region. Robert Kerr reviewed these Hudson Bay shrews in 1792 and described them as *Sorex arcticus* and *Sorex arcticus cinereus* (Jackson, 1925). In 1827 I. Geoffroy St-Hilaire published species descriptions for these specimens, citing the United States as type locality, under the name *Sorex personatus* (Handley and Varn, 1994; Jackson, 1928). In the early 1800s Bachman's work in the southeast resulted in his naming seven new species and redescribing six others (Handley and Varn, 1994). Among these were *Sorex cinereus*, and *Sorex longirostris.*

In the later 1800s G. S. Miller Jr., S. F. Baird and C. H. Merriam also reviewed the specimens from eastern North America. During these reviews *S. personatus* was variously synonymized with *S. l. longirostris* (by Baird), *S. cooperi* (by Merriam), and *S. cinereus* Bachman (= *Cryptotis parva floridana*) (by Miller). In the meantime, Miller redescribed *S. longirostris* Bachman, the first unequivocal use of that name for the long-tailed shrew of the southeastern United States (Handley and Varn, 1994).

Jackson (1925, 1928) revised much of the taxonomy of the genus *Sorex.* Based on early written descriptions, Jackson (1925) determined that *S. richardsonii* Bachman was equivalent to, and therefore a junior synonym of, *S.*

arcticus Kerr. With equal certainty he synonymized *S. personatus* I. Geoffroy St-Hilaire with *S. a. cinereus* Kerr. As a consequence, *S. richardsonii* Bachman became *S. arcticus* Kerr and *S. personatus* I. Geoffroy St-Hilaire became *S. cinereus* Kerr. Note that *S. cinereus* Bachman therefore became a homonym (Jackson, 1925). In his 1928 taxonomic review, Jackson assigned the southeastern *S. cinereus* populations to *S. c. cinereus.*

In reviewing Bachman's original taxonomic work, Handley and Varn (1994) determined that synonymies of Baird, Miller and Merriam for *S. personatus* were unreliable because none had examined the holotype, written descriptions were not definitive, and pertinent comparisons could not have been made. Furthermore, because the location and even existence of the holotype is uncertain, and the absence of a definitive type locality, they concluded that *S. personatus* I. Geoffroy St-Hilaire is unidentifiable. With the binomial *S. personatus* unavailable, *S. longirostris* Bachman took priority as the proper taxonomic designation for long-tailed shrews from the southeast (Handley and Varn, 1994).

In 1911 N. Hollister named the Maryland shrew *Sorex fontinalis*. Jackson, in his 1928 revision of soricid shrews, maintained support for full specific rank for *S. fontinalis*, but stated that availability of specimens from areas where intergradation with *S. c. cinereus* would likely occur might warrant reclassification in the future. Upon review of specimens from the lowlands east of the Appalachians, Poole (1937) found the intergradation predicted by Jackson and thus reduced the taxon to a subspecies of *S. cinereus.* Based on an extensive analysis re-evaluating its taxonomic status, Kirkland (1977) supported Poole's original designation, but declined to offer a formal name change pending further study. In the most comprehensive study to date, van Zyll de Jong and Kirkland (1989) argued against specific status for *S. c. fontinalis*.

General Morphology

Measuring 71 to 111 mm total length and weighing 3.4 to 5.5 g, *Sorex cinereus* is one of the smallest soricid shrews. Length of tail vertebrae measures from 25 to 50 mm. Pelage is brown dorsally with a silvery tint ventrally. Eyes and ears are minute and not easily visible. The snout is long and pointed with many long vibrissae (Hall, 1981).

Though slightly smaller, *S. c. fontinalis* and *S. l. longirostris* are equally difficult to distinguish from *S. c. cinereus*. Pelage color for all taxa is described in varying shades of brown on the dorsum, lighter hairs on sides blending into silver to gray tones ventrally (Jackson, 1928). The type specimen of *S. c. fontinalis* measures 90 mm total length and 31 mm tail vertebrae, well within the range of *S. c. cinereus* (Jackson, 1928). Jackson listed the total and tail lengths for *S. c. fontinalis* as 86 to 98 mm and 33 to 37 mm respectively; pelage is darker brown both dorsally and ventrally, and the tail is distinctly bicolored. Reported external measurements of *Sorex l. longirostris* are total length 68 to 94 mm (French, 1980) and 79 to 108 mm (Hall, 1981), tail length 24 to 37mm (French, 1980) and 27 to 40 mm (Hall, 1981). The tail of *S. l. longirostris* is indistinctly bicolored (Jackson, 1928).

Skull and dental characters are generally used as diagnostic tools.

Though there is overlap in measurement ranges of some characters, cranial and dental morphology can be more accurately assessed than external anatomical characters.

The skull of *S. c. cinereus* has a relatively high and rounded braincase rising above the relatively long and narrow rostrum. The teeth of *S. c. cinereus* are narrow and the third unicuspid is usually larger than the fourth (Hall, 1981). The condylobasal length usually measures between 15.0 and 16.5 mm though extreme measurements of 13.8 to 17.0 mm have been recorded from the periphery of its range (French, 1980; Junge and Hoffmann, 1981).

The skull of *S. c. fontinalis* is smaller than that of *S. c. cinereus*, with a shorter broader rostrum, relatively flatter braincase and shorter unicuspid toothrow. Condylobasal length ranges from 14.6 to 15.2 mm (Junge and Hoffmann, 1981).

Sorex l. longirostris generally measures 13.8 to 15.6 mm in condylobasal length. It also has a flatter and broader braincase than *S. cinereus* and a shorter rostrum with a more crowded unicuspid toothrow. The third unicuspid tooth is smaller than or subequal to the fourth unicuspid (Junge and Hoffmann, 1981).

Range and Distribution

Figure 1, based on an adaptation from Hall (1980), illustrates the geographic ranges of the *S. c. cinereus*, *S. c. fontinalis*, and *S. l. longirostris*. As indicated, *Sorex c. cinereus* is among the most widespread of all small mammals. Its range extends over all of Canada and Alaska and south throughout northern forests with extensions reaching southward into the Rockies and Appalachian Mountains (Hall, 1981). Distributed throughout much of West Virginia (Fig. 2), *S. cinereus* has been found in a variety of habitats and from elevations of approximately 600 to above 4000 feet.

The range of *S. c. fontinalis* is limited to the Delmarva Peninsula and southeastern Pennsylvania (Hall. 1981). The only documented occurrence of *S. c. fontinalis* in West Virginia is two specimens from Romney, Hampshire County (Kirkland and Levengood, 1987).

Sorex longirostris is found throughout a large portion of the southeastern United States, as far west as Missouri and northward up the Mississippi River to northern Illinois, southeastward through Indiana, into Kentucky and east to Virginia (Hall, 1981). In West Virginia *S. l. longirostris* has been documented by a single specimen from near Walton, Roane County (French, 1977).

Objectives

As a result of the West Virginia Mammal Survey and other projects seeking to catalog mammalian and other vertebrate fauna in the state, a large number of presumed *S. c. cinereus* have recently been collected over a wide

Figure 1. Ranges of *S. c. cinereus*, *S. c. fontinalis*, and *S. l. longirostris*.

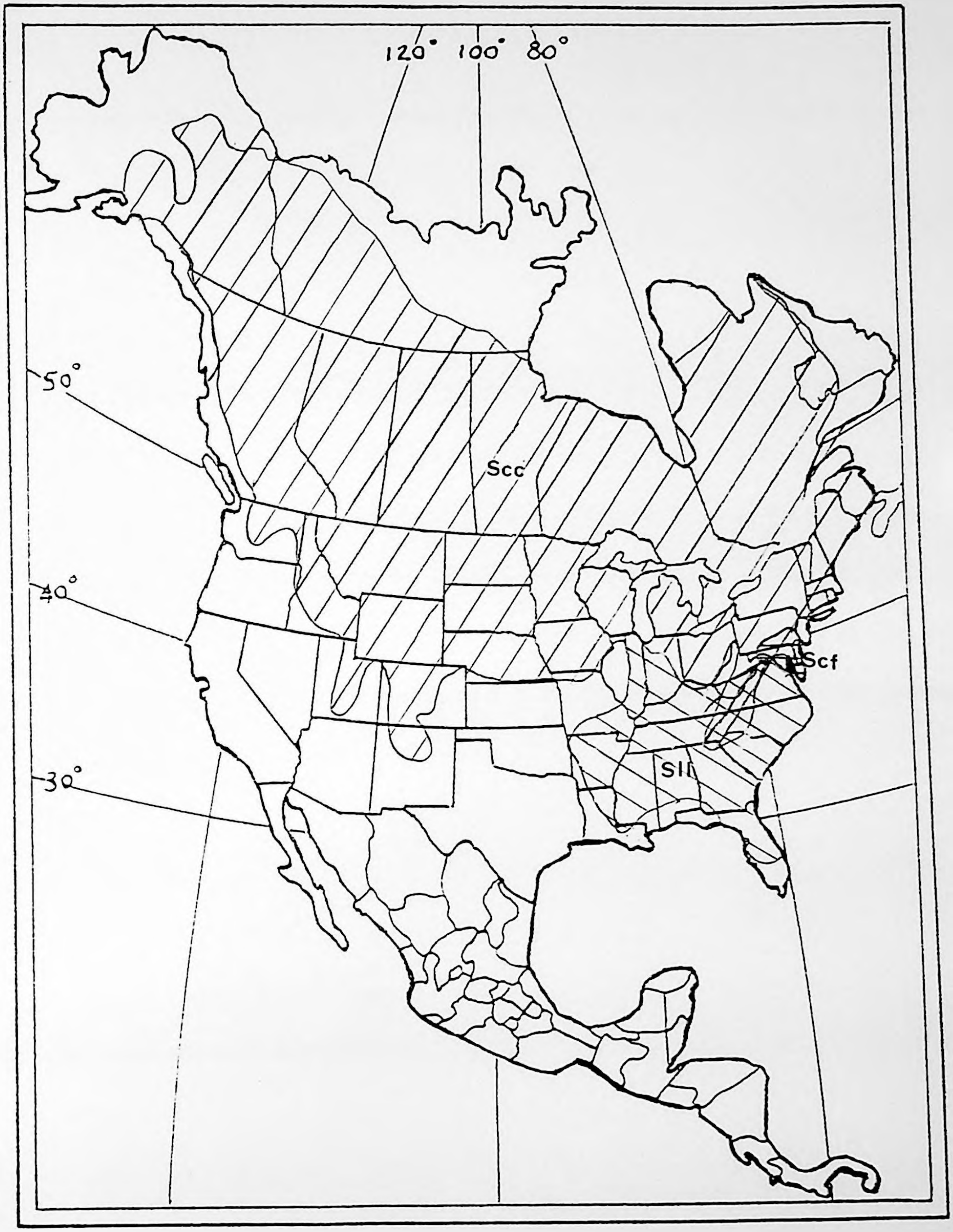
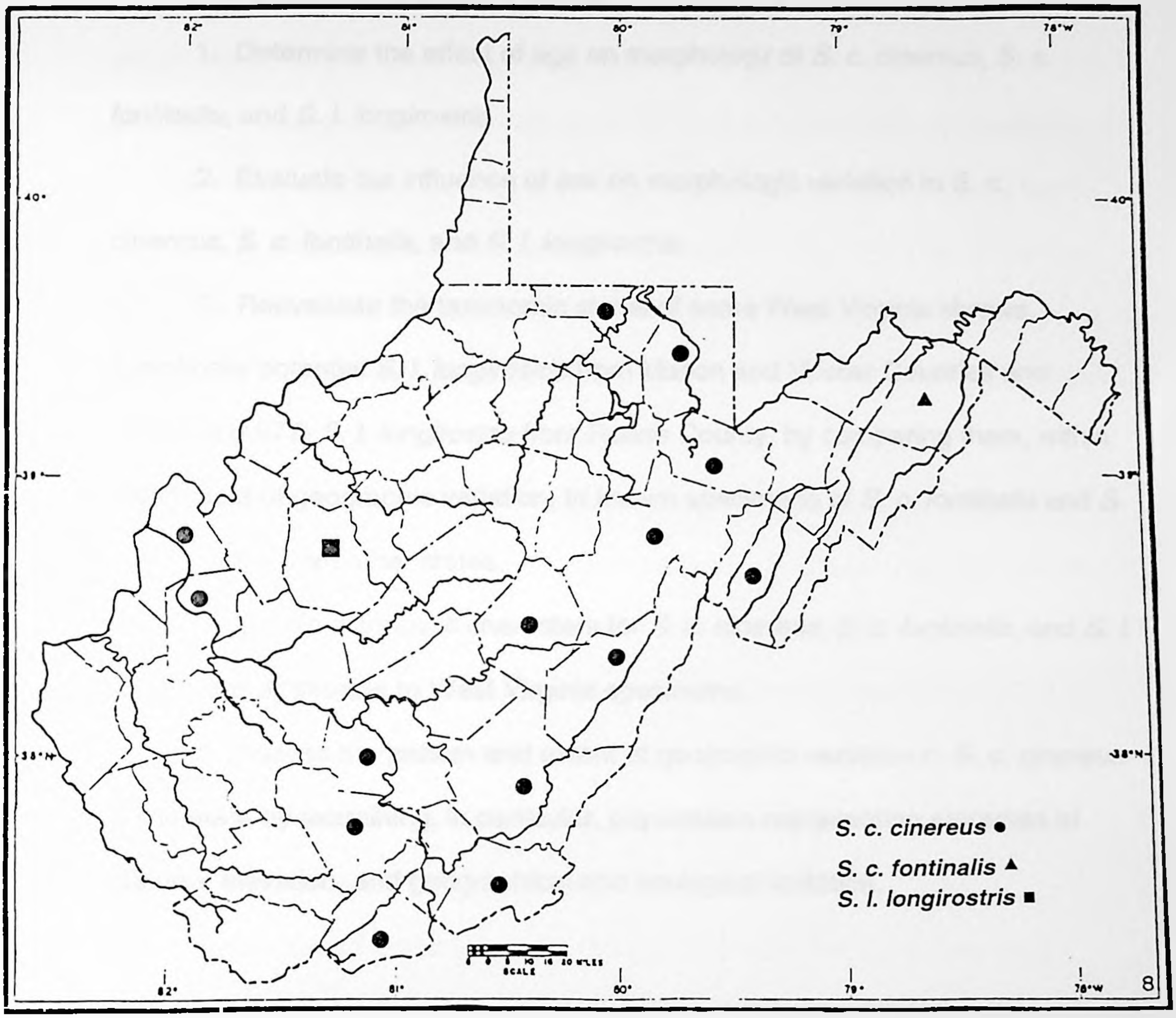

120° 100° 80°
50°
40°
30°
Scc
Scf
Sll

Figure 2. Counties in West Virginia from which *S. c. cinereus* specimens were measured are Monongalia, Preston, Tucker, Pendleton, Randolph, Pocahontas, Webster, Greenbrier, Monroe, Mercer, Fayette, Raleigh, Putnam, and Mason. The only *S. c. fontinalis* recorded from West Virginia are from Hampshire County. The West Virginia record for *S. l. longirostris* is Roane County.


82°
81°
80°
79°
78°W
40°
39°
38°N
S. c. cinereus ●
S. c. fontinalis ▲
S. l. longirostris ■
SCALE
0 5 10 15 20 MILES

area of the state. Most of these are cataloged in the Marshall University Mammal Collection. Others are housed at the Carnegie Museum of Natural History.

The purpose of this study was to:

1. Determine the effect of age on morphology of *S. c. cinereus*, *S. c. fontinalis*, and *S. l. longirostris*.

2. Evaluate the influence of sex on morphologic variation in *S. c. cinereus*, *S. c. fontinalis*, and *S. l. longirostris*.

3. Reevaluate the taxonomic status of some West Virginia shrews, specifically potential *S. l. longirostris* from Mason and Mercer Counties and French's (1977) *S. l. longirostris* from Roane County, by comparing them, within the context of geographic variation, to known specimens of *S. c. fontinalis* and *S. l. longirostris* from other states.

4. Define diagnostic characters for *S. c. cinereus*, *S. c. fontinalis*, and *S. l. longirostris* applicable to West Virginia specimens.

5. Assess the pattern and extent of geographic variation in *S. c. cinereus* in the state by examining, in particular, populations representing extremes of latitude, elevation, and geographical and ecological isolation.

MATERIALS AND METHODS

Specimens Examined

More than 400 specimens representing localities from West Virginia (including definitive and putative *S. c. cinereus*, *S. c. fontinalis*, and *S. longirostris)*; Pennsylvania, Maryland, Virginia (definitive *S. c. fontinalis* and one putative *S. l. longirostris*); and Virginia, South Carolina, and Georgia (definitive *S. l. longirostris*) were examined. Specimens from outside of West Virginia were included as regionally relevant reference specimens. Definitive identifications are those of the curators at the museums from which specimens were obtained. Those individuals based their identifications on a combination of morphological characters and geographic distribution.

Specimens on which few measurements could be made or specimens lacking pertinent catalog data were not included for analysis. Two anomalous specimens, MUMC 5390 and 5834, totally lacking the fifth unicuspid, were also omitted from analysis. A series of sixteen measurements from 288 (223 *S. c. cinereus*, 25 *S. c. fontinalis*, and 40 *S. l. longirostris*) of the most complete specimens were recorded for analysis. Note that sample sizes vary among statistical analyses due to the software's handling of missing values.

Most specimens observed for this study are housed in the mammal collection in the vertebrate museum at Marshall University (MUMC). The collection, subsequent processing, and age and sex determinations of some of the MUMC specimens were conducted personally. Data were also collected on

Table 1. Description of characters used for analysis. The abbreviations shown will be used to refer to these characters throughout this paper.

Skull length	SL	One caliper point was placed at anterior medial point of premaxillaries between first incisors, and the other at posterior most point at midline of occipital.
Cranial width	CW	Caliper arms were positioned on either side of cranium at broadest point of brain case.
Cranial height	CH	Ventral or palatal surface of cranium was placed on microscope slide. The measurement was made with one caliper arm on the bottom of the slide and the other on highest point of brain case. The recorded measurement was minus thickness of the slide.
Interorbital constriction	IC	Viewing the skull dorsally the micrometer lines were positioned at smallest distance across rostrum at location of orbits.
Length of maxillary plate	MP	Line of ocular micrometer dissected toothrow between third incisor and canine, at alveolar dip. Reading was made parallel to toothrow, not axis of skull, at posterior border of palate.
Width across second molars	M2-M2	Lines of ocular micrometer were positioned at broadest points on labial side of second molars.
Width across first incisors	I1-I1	Lines of ocular micrometer were positioned at widest point on labial side of first incisors.
Unicuspid toothrow	UT	Line of ocular micrometer intersected toothrow just posterior to first incisor. Reading was made parallel to axis of skull at posterior most point of fifth unicuspid.
Length of molariform toothrow	P4-M3	Line of ocular micrometer intersected toothrow anterior to first molariform tooth. Reading was made parallel to axis of skull at posterior most point of last molar.
Width of third unicuspid	U3	Lines of ocular micrometer were projected on either side of third unicuspid at alveolar dip. Measurement was made along axis of tooth, not necessarily toothrow or axis of skull.
Width of fourth unicuspid	U4	Lines of ocular micrometer were projected on either side of fourth unicuspid at alveolar dip. Measurement was made along axis of tooth, not necessarily toothrow or axis of skull.
Width of fifth unicuspid	U5	Lines of ocular micrometer were projected on either side of fifth unicuspid at alveolar dip. Measurement was made along axis of tooth, not necessarily toothrow or axis of skull.
Shape of rostrum	RO	Calculated measurement: ratio of UT+(P4-M3)/M2-M2.

specimens from Carnegie Museum of Natural History (CMNH), Smithsonian Institution National Museum of Natural History (USNM), and Cornell University (CU). A complete list of specimens used is in Appendix I.

Morphological characters

The standard external measurements of total length (TotL), tail length (TalL), length of hind foot (HF) and weight (Hall, 1981) were taken from skin tags or catalog data. The first three cranial measurements were made with Helios dial calipers and recorded to nearest 0.1 mm. The other nine cranial and dental measurements were made with the aid of an ocular micrometer in a Cambridge Instruments Stereozoom 4 dissecting microscope at 0.7 power and recorded to 0.1 micrometer. These measurements were then converted to the nearest 0.01 mm. The final measurement (RO) is a ratio created from three of the other measurements. Table 1 and Figure 3 describe and illustrate the measurements used.

Age Classes

Each specimen was assigned to one of three age classes based on a modification of Pruitt's (1954) and Diersing's (1980) aging techniques. Due to the lack of complete reproductive data, age classes were based solely on dental conditions. For this reason subadults may have been included in class 1 because of difficulty in distinguishing them from new adults. The difficulty in distinguishing subadults is noted by Jones et al (1991) who also included them in their data set. Although obviously immature specimens were not included in this study, Levengood (1987) found few statistically significant differences between subadults and young adults and combined the two for analysis. The age classes are defined in Table 2 and illustrated in Figure 4.

Table 2. Definition of age classes used in this study.

Age Class	Description
1 New adult	Teeth unworn, all cutting edges sharp, cingulum of first incisor appressed against alveolus.
2 Adult	Teeth showing wear, cutting edges blunted, first incisor beginning to curve down exposing root.
3 Old adult	Teeth extremely worn, cutting edges reduced to base, first incisor greatly dropped exposing considerable root.

Sex

In soricids, determination of sex based solely on external morphology is extremely difficult (Rudd,1955). It is also hindered by rapid deterioration of dead shrews; sex, therefore, is often missing from specimen data. Accurate sexual identification of one relatively large series of West Virginia *S. c. cinereus* (Populations H and I), was obtained through direct examination of internal morphology of fresh specimens. For the other specimens included, sex was recorded from skin tags or catalog data when available.

Statistical Analysis

Sexual dimorphism. Because determining sex based on external anatomy is difficult, the subset of *S. c. cinereus* specimens known to have been sexed by internal examination of fresh specimens was used. On this subset of 25 females and 34 males, a t-test was used to assess differences between sexes for all characters. A Bonferroni adjustment was used to control for the effects of multiple comparisons by setting the significance level to p=0.05/17=0.003. No statistically significant differences were found; sexes were therefore combined for all analyses.

Age variation. To assess morphometric variation among age classes within taxa, a three-way multiple analysis of variance (MANOVA) was performed for each taxon. Student-Newman-Keuls multiple comparison test (SNK) was used to identify groups for which significant differences were found. Although some statistically significant differences were found among age classes for all taxa (see Results), age classes were grouped for the among-taxon comparisons to increase sample size. Note that each taxon includes representatives of all age classes.

Morphometric variation among *S. c. cinereus*, *S. c. fontinalis* and *S. l. longirostris.* Three complementary techniques were used. Principal components analysis (PCA) was used to visualize morphometric relationships and detect any linear relationships among individuals. The results of this analysis were plotted along three axes with principal component I (PCI) represented by the X axis, PCII the Y axis, and PCIII the Z axis. The usefulness of this test lies in its ability to derive the linear combinations, or principal components, of the set of variables while retaining most of the original information in the variables. The assumption is that individuals from the same taxon, because they are more similar

Figure 3. Dorsal, lateral and palatal views of *S. c. cinereus* skulls showing where measurements were made. The measurements are: 1 SL, 2 CW, 3 CH, 4 IC, 5 MP, 6 M2-M2, 7 I1-I1, 8 UT, 9 P4-M3, 10 U3, 11 U4, and 12 U5. The widths across U3, U4, and U5 were measured on the same side of the skull as UT, P4-M3, and MP but are shown on the opposite side for clarity. The regions of the skull are: 1 anterior rostral, 2 posterior rostral, 3 precranial, and 4 cranial; as indicated by the numbered sections at the bottom of the diagram.

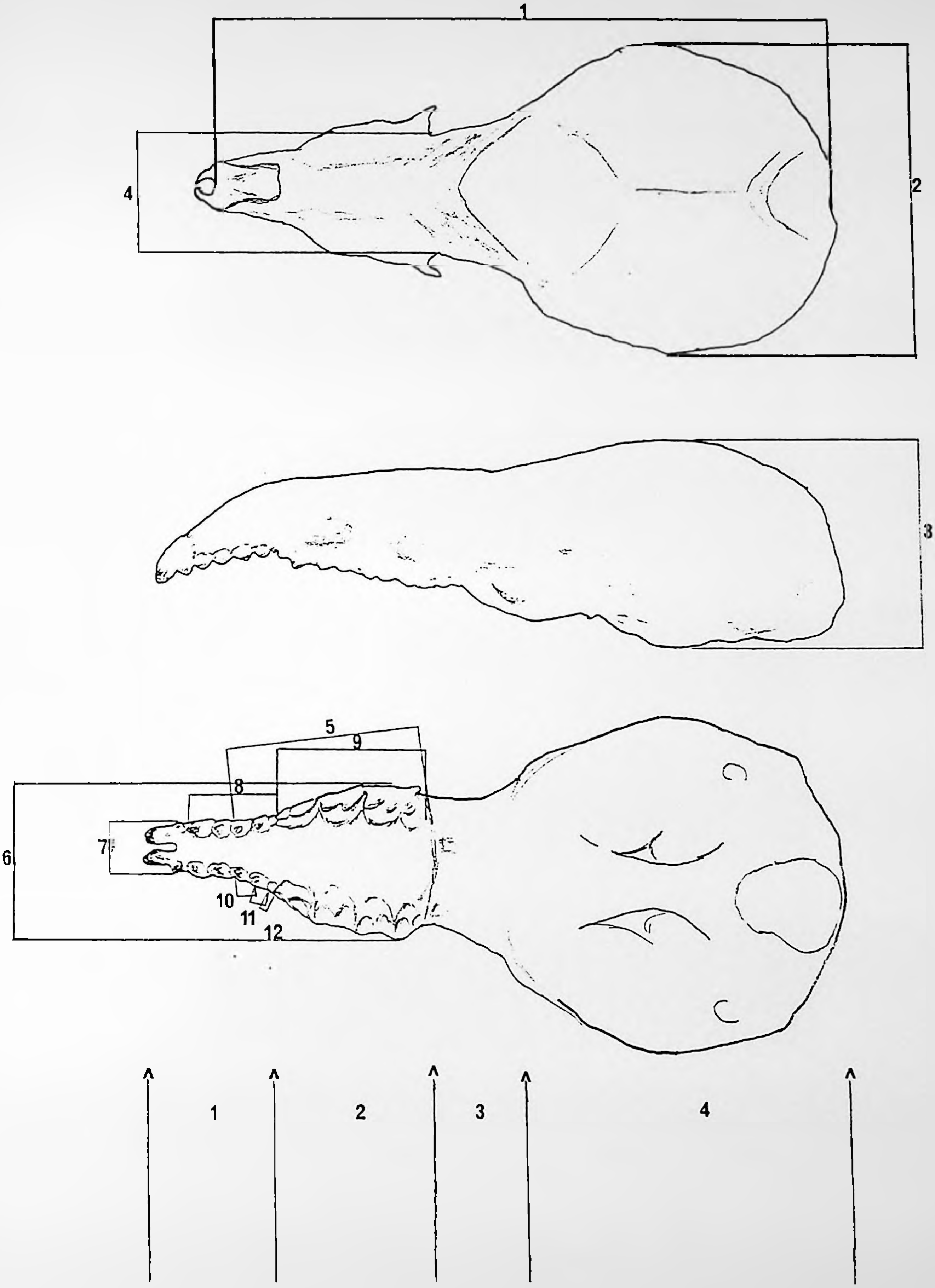

1
4
2
3
5
9
8
6
7
10
11
12
1
2
3
4

Figure 4. Age classes as recognized in this study are: 1 new adult, 2 adult, and 3 old adult.


MUMC 44418
1
MDMC 44428
2
2844
3

morphologically, will cluster together. Although PCA accurately represents morphological distances among groups (operational taxonomic units or OTUs), it may fail to elucidate subtle differences between individuals in adjacent clusters (Sneath and Sokal, 1973). Therefore, canonical discriminant analysis (CDA) was also used. The results were also plotted along three dimensional axes, CANI, CANII, and CANIII. Characters are weighted in this type of analysis such that differences among pre-defined OTU centroids are maximized. This intrinsic bias is useful for detecting the morphometric differences that may be obscured by the PCA (Jones et al, 1991; Sneath and Sokal, 1973). Because neither PCA nor CDA permits it, a three-way MANOVA was performed to identify those characters that differed significantly among OTUs.

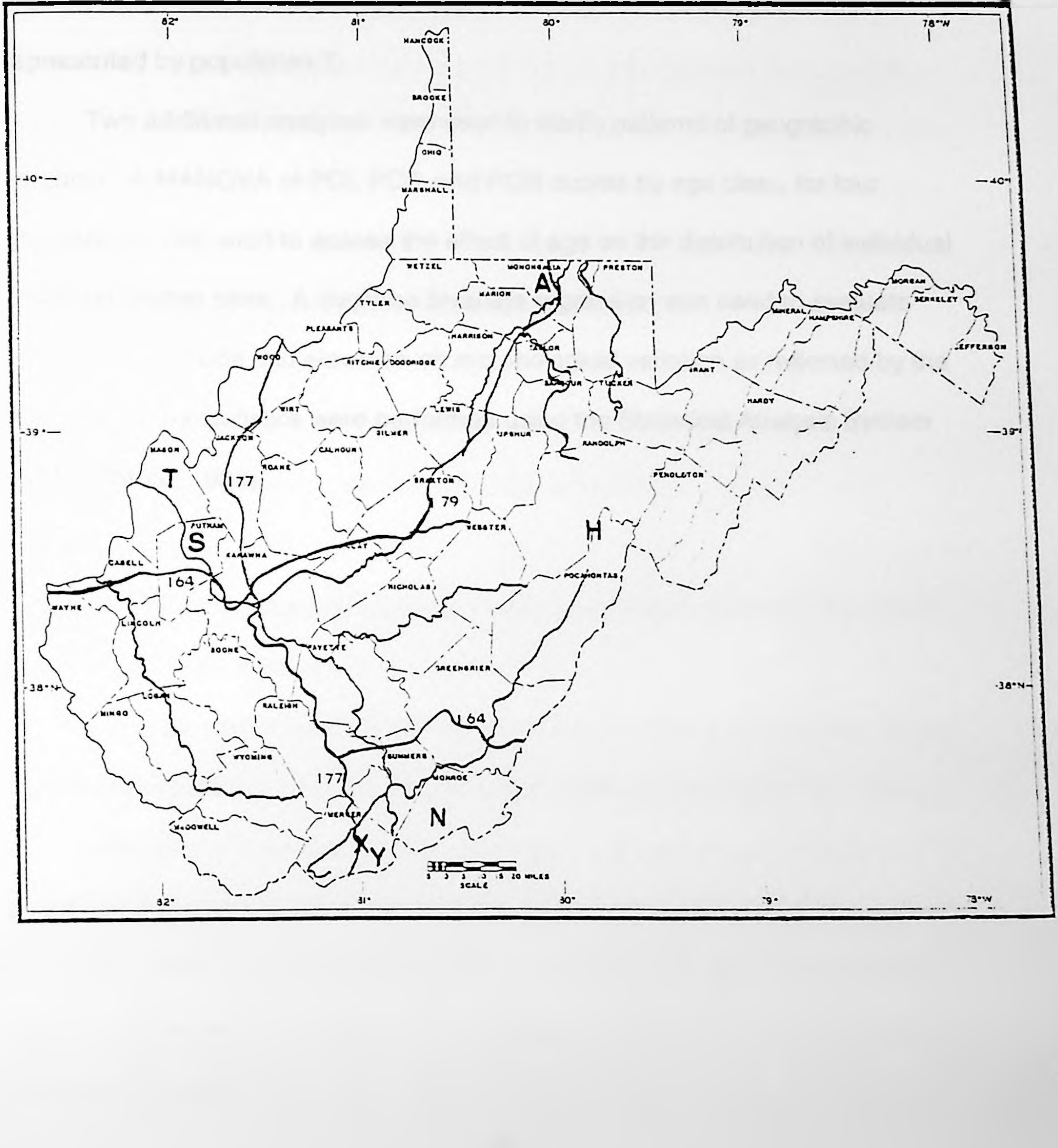
Geographic variation within *S. c. cinereus* in West Virginia. Specimens of *S. c. cinereus* from Monongalia, Preston, Tucker, Pendleton, Randolph, Pocahontas, Webster, Greenbrier, Monroe, Mercer, Summers, Raleigh, Fayette, Putnam, and Mason counties and possible *S. l. longirostris* from Mason and Mercer counties were used in this analysis. Specimens from within small geographic areas and elevational ranges of 500' were grouped into a total of 23 OTUs and analyzed using the same procedures as described above. Three OTUs were not included in the PCA and CDA due to missing values.

Figure 5 illustrates the position of the geographically extreme populations and their proximity to the nearest populations relative to important geographic features. Population A in Monongalia County represents the northern most

Table 3. Description of OTUs including their letter identifications, county location, elevation, and number of specimens represented in analysis.

OTU	Locality	Elevation (ft)	N
A	Monongalia	2100	20
B	Preston	1500	2
C	Preston	2540	3
D	Randolph	2320	8
E	Tucker	3100	8
G	Pendleton	4862	1
H	Randolph/Pocahontas	3860-4300	58
I	Randolph/Pocahontas	3650-3850	3
J	Pendleton	3840	2
L	Webster	2400	1
M	Greenbrier	2200	7
N	Monroe	2400-2500	13
O	Fayette	1840	7
P	Raleigh	2360-2600	16
Q	Fayette	1240	4
R	Fayette/Raleigh	1600-1840	4
S	Putnam	700	6
T	Mason	620	13
X	Mercer	2550-2980	11
Y	Mercer	3050-3450	8

Figure 5. Elevational and latitudinal extreme populations of *S. c. cinereus* in West Virginia relative to important geographic features. Populations H and T represent the highest and lowest elevations, respectively, and populations A, X, and Y the northern and southern most latitudes.


82°
81°
80°
79°
78°W
40°
39°
38°N
HANCOCK
BROOKE
OHIO
MARSHALL
WETZEL
MONONGALIA
PRESTON
TYLER
MARION
PLEASANTS
HARRISON
TAYLOR
WOOD
RITCHIE
DODDRIDGE
BARBOUR
TUCKER
WIRT
LEWIS
JACKSON
GILMER
UPSHUR
RANDOLPH
MASON
CALHOUN
ROANE
BRAXTON
PUTNAM
CLAY
WEBSTER
KANAWHA
CABELL
NICHOLAS
POCAHONTAS
WAYNE
LINCOLN
BOONE
FAYETTE
GREENBRIER
LOGAN
MINGO
RALEIGH
WYOMING
SUMMERS
MONROE
MERCER
McDOWELL
MINERAL
HAMPSHIRE
MORGAN
BERKELEY
JEFFERSON
GRANT
HARDY
PENDLETON
T
S
A
H
N
X
Y
I77
I79
I64
SCALE
20 MILES

population, populations X and Y in Mercer County the southern most. Population G in Pendleton County was from the highest elevation in West Virginia. However, because this population was represented by a single specimen, population H in Pocahontas and Randolph Counties was chosen to represent the high elevation extreme in analysis. Mason County had the lowest elevation represented by population T.

Two additional analyses were used to clarify patterns of geographic variation. A MANOVA of PCI, PCII, and PCIII scores by age class, for four populations, was used to assess the effect of age on the distribution of individual points on scatter plots. A stepwise bivariate regression was used to evaluate the effect of latitude and elevation on morphological variation as reflected by the PCI scores. All statistics were performed using the Statistical Analysis System (SAS Institute, 1988).

RESULTS

Age Variation Within Taxa

In *S. c. cinereus* four of the sixteen variables differed significantly among the age classes at the level of $p<0.0001$. Adults and old adults, age classes 2 and 3, differed from young adults, age class 1, for total length. Significant variation was found for cranial height and rostral shape between young adults and the other two age classes. Adults and young adults varied significantly from old adults for unicuspid toothrow. *S. c. fontinalis* showed a significant difference among age classes for only two characters. As with *S. c. cinereus*, young adults showed significant difference from adults and old adults for cranial height ($p<0.0073$). Young adults varied from old adults and adults for length of skull ($p<0.0194$). *Sorex l. longirostris* showed no significant difference for any characters. Table 4 shows the results of this analysis.

Variation Among Taxa

Principal components analysis. Table 5 and Figure 6 contain the results of the PCA of 248 specimens.

Principal component I (PCI) explained 40.4% of the total variation among individuals. Because 14 of the 16 characters loaded positively on PCI, this axis was a reflection of overall size. The characters that loaded most heavily on PCI, in descending order, were: length of skull, tail length, rostral shape, U3, and unicuspid toothrow. Individuals with high PCI scores, therefore, are generally large with long skulls and relatively long, narrow rostra, have a relatively wide U3, and are long-tailed.

The amount of total variation accounted for by PCII is 12.1%. Half of the characters loaded positively on PCII making it as much a representation of shape as of size. Characters that loaded most heavily on PCII are interorbital constriction, width across second molars, length of molariform toothrow, U5, and U3. Of these U3 had a negative loading. Individuals with high PCII scores have a relatively long and wide molariform region, and a small U3.

Only 9.3% of the variation was explained by PCIII. This axis described variation in shape, with 8 of the 16 characters loading negatively. The most heavily loading characters on PCIII were unicuspid toothrow, U5, rostral shape, cranial width, and hind foot. Individuals with high PCIII scores have a long narrow rostrum, particularly anteriorly, a relatively narrow cranium, and small feet. Because no significant differences were found among taxa for U5 (see Table 7), any influence of this character on the positioning of points on the scatter plots along axes PCII and PCIII was not considered.

Principal component I largely separated *S. l. longirostris* from *S. c. cinereus* and *S. c. fontinalis*. *Sorex longirostris* clustered at the low end of this axis indicating an overall smaller size than the other two taxa. Along PCI *S. c. cinereus* clustered highest , completely encompassing *S. c. fontinalis*. One individual *S. c. fontinalis* from Maryland (USNM 76587) scored lower on PCI than any other of this taxon. Because of their generally small body size and

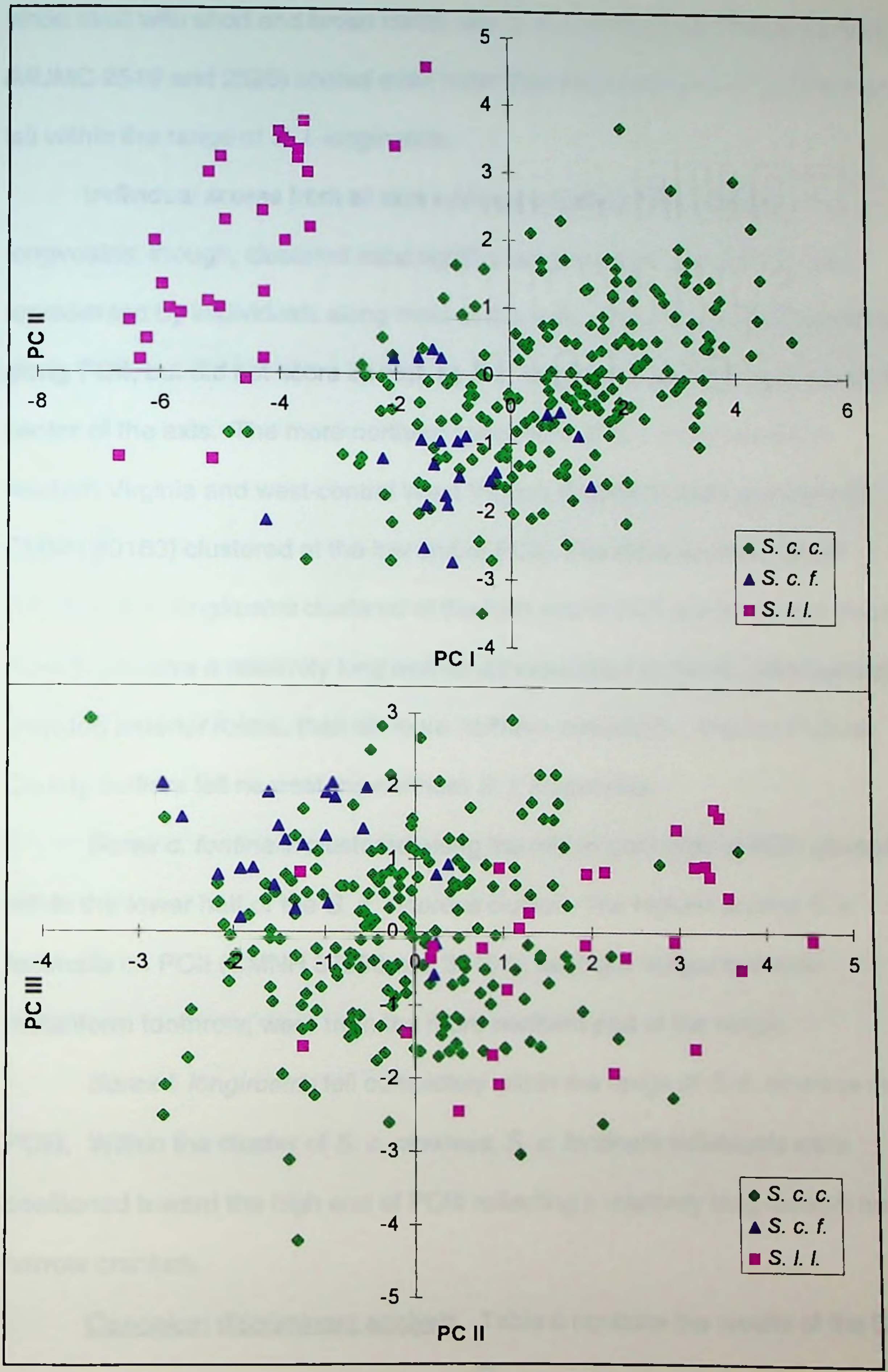
Table 4. Results of the MANOVA for morphological differences in age classes of *S. c. cinereus* and *S. c. fontinalis*. The characters shown are the ones for which significant differences were found. Age classes with the same superscript for the same character are not signifcantly different.

S. c. cinereus					
age	mean(±SD)	N	age	mean(±SD)	N
TotL (p<0.0011)			CH (p<0.0001)		
2^a	94.88(4.13)	46	1^a	5.01(0.24)	90
3^a	94.81(3.08)	83	2^b	4.74(0.33)	48
1^b	90.93(3.02)	86	3^b	4.67(0.25)	86
UT (p<0.0001)			RO (p<0.0001)		
2^a	2.02(0.10)	48	1^a	3.02(0.07)	90
1^a	2.02(0.07)	90	2^a	3.02(0.10)	48
3^b	1.93(0.07)	86	3^b	2.92(0.07)	86
S. c. fontinalis					
SL (p<0.0194)			CH (p<0.0073)		
1^a	15.28(0.45)	6	1^a	4.62(0.29)	6
3^b	14.87(0.39)	8	2^b	4.31(0.19)	15
2^b	14.76(0.27)	16	3^b	4.26(0.25)	8

Table 5. Eigenvalues of the correlation matrix from the principal components analysis for among taxa variation, and eigenvectors of PCI, PCII, and PCIII.

	PRINI	PRINII	PRINIII
Eigenvalue	6.46665	1.94278	1.49083
Difference	4.52388	0.45195	.
Proportion	0.404166	0.121424	0.093177
Cumulative	0.404166	0.525589	0.618766
Variables	Eigenvectors		
TotL	0.283463	-0.052341	-0.227658
TalL	0.328138	-0.030085	-0.227658
HF	0.216194	-0.184688	-0.278665
SL	0.353018	0.112189	-0.144246
CW	0.287177	0.199779	-0.337292
CH	0.217343	0.207644	-0.276567
IC	-0.064605	0.545916	-0.138112
MP	0.284660	0.181967	0.108684
M2-M2	-0.115860	0.537256	0.118972
I1-I1	0.168146	-0.103286	-0.050578
UT	0.294862	-0.054841	0.419273
P4-M3	0.206520	0.363783	0.142471
U3	0.307350	-0.211546	0.086428
U4	0.215994	-0.033292	0.237368
U5	0.113625	0.219549	0.388202
RO	0.316828	-0.082318	0.377545

Figure 6. Plots of first three principal components from the PCA for among taxa variation for *S. c. cinereus, S. c. fontinalis*, and *S. l. longirostris*.


PC II
PC I
-8
-6
-4
-2
0
2
4
6
5
4
3
2
1
-2
-3
-4
S. c. c.
S. c. f.
S. l. l.
PC III
PC II
-4
-3
-2
-1
0
1
2
3
4
5
3
2
1
-2
-3
-4
-5
S. c. c.
S. c. f.
S. l. l.

short skull with short and broad rostra, two *S. c. cinereus* from Putnam County (MUMC 2519 and 2520) scored even lower than this outlying *S. c. fontinalis* and fell within the range of *S. l. longirostris.*

Individual scores from all taxa overlapped along PCII. *Sorex l. longirostris*, though, clustered most tightly toward the high end of PCII, was represented by inidividuals along most of this axis. *Sorex c. cinereus* spread out along PCII, but did not score as high as *S. l. longirostris* and clustered toward the center of the axis. The more northern specimens of *S. l. longirostris* from western Virginia and west-central West Virginia (USNM 283624 and 290472, CMNH 80163) clustered at the low end of PCII. The more southern South Carolina *S. l. longirostris* clustered at the high end of PCII indicating that these individuals have a relatively long and broad molariform toothrow, yet short and crowded anterior rostra, than do more northern individuals. The two Putnam County outliers fell nearest the northern *S. l. longirostris.*

Sorex c. fontinalis clustered along the mid to low range of PCII, generally within the lower half of the *S. c. cinereus* cluster. The highest scoring *S. c. fontinalis* on PCII (CMNH 37296 and 39154), having a longer and wider molariform toothrow, were from the more northern part of the range.

Sorex l. longirostris fell completely within the range of *S. c. cinereus* along PCIII. Within the cluster of *S. c. cinereus*, *S. c. fontinalis* individuals were positioned toward the high end of PCIII reflecting a relatively long rostrum and narrow cranium.

Canonical discriminant analysis. Table 6 contains the results of the CDA of 248 specimens. Because 100% of the variation was described by the first two canonical variates, figure 7 displays the two dimensional plot of these results.

Canonical axis I (CANI) explained 93% of the total variation. As with PCA, 14 of the 16 characters loaded positively on this axis making it a general size axis. The characters that loaded most heavily, in descending order, are U3, rostral shape, width across second molars, unicuspid toothrow, and length of skull. Individuals with high CANI scores have generally large skulls that are long, have a long narrow rostrum and a wide U3.

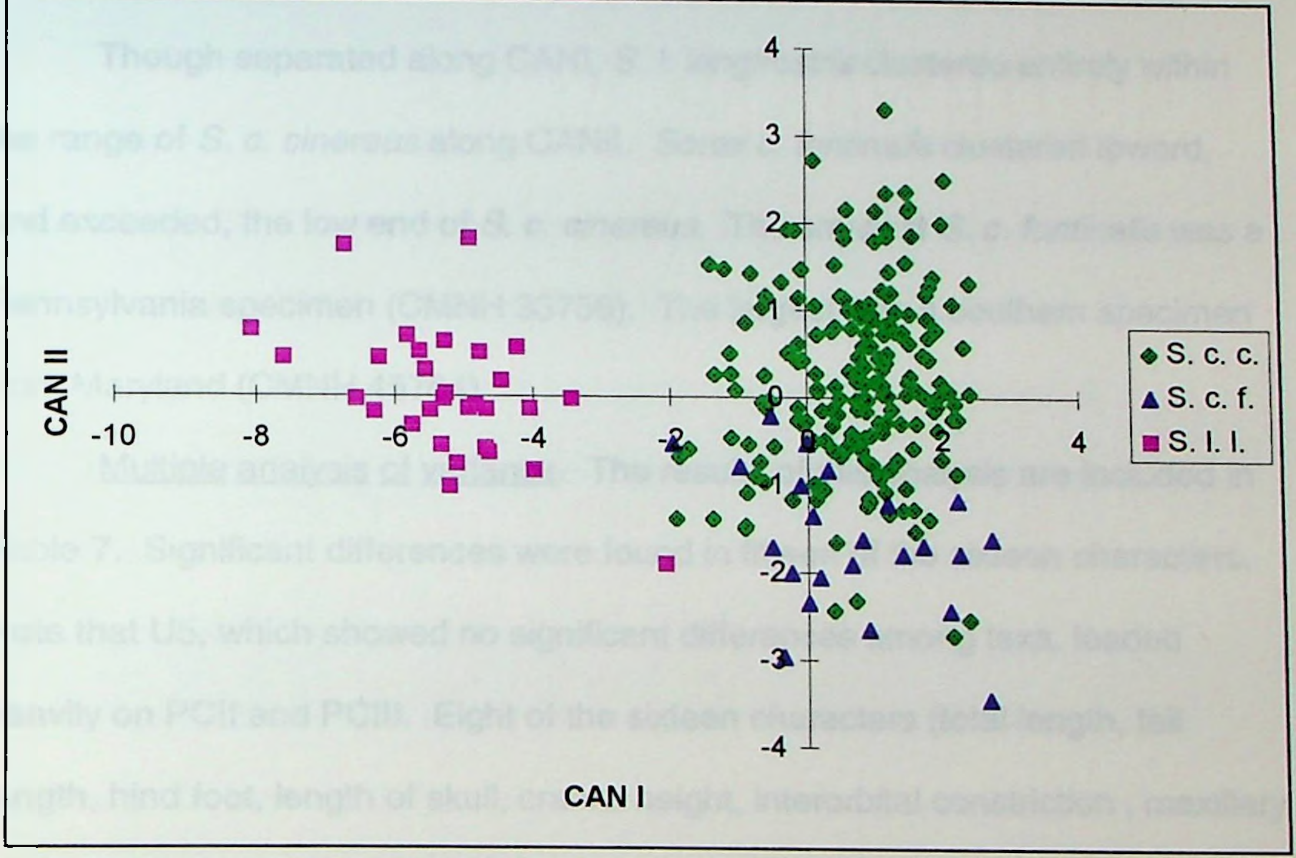
The remainder of total variation, 7%, is accounted for by CANII. This axis also represented size as all characters loaded positively. The characters that loaded most heavily were: cranial height, cranial width, length of skull, tail length, and interorbital constriction . Individuals with high CANII scores have large skulls with wide rounded crania, relatively wide rostra, and a long tail.

As with PCI, *S. l. longirostris* was segregated from *S. c. cinereus* and *S. c.fontinalis* along CANI. The only individual separated from the otherwise tight cluster was French's (1977) Roane County specimen (CMNH 80163) which was larger than the *S. l. longirostris* specimens from out of state. *Sorex c. fontinalis* clustered within the range of *S. c. cinereus* on this axis. The two Putnam County specimens (MUMC 2519 and 2520) again clustered along the small end of the

Table 6. Canonical correlation and eigenvalues from the canonical discriminant analysis for among taxa, and total canonical structure of canonical correlates CANI, and CANII.

	CANI	CANII
Eigenvalue	3.8069	0.2845
Proportion	0.9305	0.0695
Cumulative	0.9305	1.0000
Characters	Total Canonical Structure	
TotL	0.499154	0.358040
TalL	0.601306	0.510652
HF	0.465885	0.276084
SL	0.622432	0.600302
CW	0.460730	0.741032
CH	0.245646	0.796627
IC	-0.514772	0.384660
MP	0.428046	0.230545
M2-M2	-0.657111	0.053478
I1-I1	0.577938	0.007399
UT	0.623024	0.033688
P4-M3	0.233549	0.117466
U3	0.836909	0.030318
U4	0.505594	0.070449
U5	0.029392	0.185312
RO	0.705281	0.037090

Figure 7. Plot of first two canonical variates from the CDA for among taxa variation for *S. c. cinereus*, *S. c. fontinalis*, and *S. l. longirostris*.



4
3
2
1
0
-1
-2
-3
-4
-10
-8
-6
-4
-2
0
2
4
CAN II
CAN I
◆ S. c. c.
▲ S. c. f.
■ S. l. l.

scatter plot near the Roane County *S. l. longirostris* and with small *S. c. fontinalis.* The more northern specimens of *S. c. fontinalis* clustered on the high end of CANI (CMNH 33756, 37258). From the more southern end of the geographical range Maryland specimens (CMNH 45704 and 45705) clustered high on CANI. The Hampshire County *S. c. fontinalis* specimens (CU 11965 and 11966) clustered near the middle of the CDA plot, within the upper end of the *S. c. fontinalis* cluster.

Though separated along CANI, *S. l. longirostris* clustered entirely within the range of *S. c. cinereus* along CANII. *Sorex c. fontinalis* clustered toward, and exceeded, the low end of *S. c. cinereus.* The smallest *S. c. fontinalis* was a Pennsylvania specimen (CMNH 33756). The largest was a southern specimen from Maryland (CMNH 45704) .

Multiple analysis of variance. The results of this analysis are included in Table 7. Significant differences were found in fifteen of the sixteen characters. Note that U5, which showed no significant differences among taxa, loaded heavily on PCII and PCIII. Eight of the sixteen characters (total length, tail length, hind foot, length of skull, cranial height, interorbital constriction , maxillary plate, and rostral shape) were found to be significantly different among all taxa. Only for cranial width did *S. c. cinereus* differ significantly from *S. c. fontinalis* and *S. l. longirostris.* For the remaining six characters (width across M2, width across I1, unicuspid toothrow, molariform toothrow, U3, and U4). *Sorex c. cinereus* and *S. c. fontinalis* did not differ significantly from each other; however, both differed significantly from *S. l. longirostris.*

For thirteen of the fifteen characters showing significant differences, *S. c. fontinalis* was intermediate between *S. c. cinereus* and *S. l. longirostris*. *Sorex c. cinereus* had the largest mean cranial height, followed by *S. l. longirostris* then *S. c. fontinalis*. For interorbital constriction *S. c. cinereus* was the intermediate between *S. l. longirostris* and *S. c. fontinalis*. Table 8 shows the minimum, mean, and maximum values for each character measured for all taxa.

Diagnostic characters

The most obvious clusters on the PCA and CDA are a result of the segregation of *S. l. longirostris* from *S. c. cinereus* along PCI and CANI respectively. That the third unicuspid (U3), rostral shape (RO), width across second molars (M2-M2), unicuspid toothrow length (UT), skull length (SL) and tail length (TalL) were all found to be significantly different between *S. l. longirostris* and *S. c. cinereus* by the MANOVA for among taxa comparisons, indicates that these are good diagnostic characters and further explains the patterns on the PCA and CDA.

The PCA and CDA reflect and support the subspecific status of *S. c. fontinalis*. On both scatterplots *S. c. fontinalis* clustered toward the low end of *S. c. cinereus* along the second axes. The CDA revealed tighter clustering of *S. c. fontinalis* but not significant segregation from *S. c. cinereus* along the second axis.

Table 7. MANOVA results for differences among taxa for the characters that loaded most heavily on PCI, PCII, PCIII, CANI, and CANII.

Taxon	Mean(±SD)	N	Taxon	Mean(±SD)	N	Taxon	Mean(±SD)	N	Taxon	Mean(±SD)	N
TalL$_{(p<0.0001)}$			HF$_{(p<0.0001)}$			SL$_{(p<0.0001)}$			CW$_{(p<0.0001)}$		
S. c. c.	38.16^{a}(2.77)	220	*S. c. c.*	11.70^{a}(0.49)	221	*S. c. c.*	15.44^{a}(0.42)	220	*S. c. c.*	7.66^{a}(0.19)	223
S. c. f.	34.32^{b}(8.23)	25	*S. c. f.*	11.24^{b}(1.47)	25	*S. c. f.*	14.89^{b}(1.14)	30	*S. c. f.*	7.29^{b}(0.53)	28
S. l. l.	30.92^{c}(7.16)	33	*S. l. l.*	10.35^{c}(1.28)	33	*S. l. l.*	14.35^{c}(1.07)	34	*S. l. l.*	7.25^{b}(0.45)	38
CH$_{(p<0.0001)}$			IC$_{(p<0.0001)}$			M2-M2$_{(p<0.0001)}$			UT$_{(p<0.0001)}$		
S. c. c.	4.82^{a}(0.18)	224	S. l. l.	2.85^{a}(0.17)	40	*S. l. l.*	3.84^{a}(0.17)	39	*S. c. c.*	1.98^{a}(0.10)	224
S. l. l.	4.55^{b}(0.43)	38	*S. c. c.*	2.71^{b}(0.07)	224	*S. c. f.*	3.66^{b}(0.20)	30	*S. c. f.*	1.96^{a}(0.29)	29
S. c. f.	4.36^{c}(0.49)	29	*S. c. f.*	2.61^{c}(0.19)	30	*S. c. c.*	3.65^{b}(0.07)	224	*S. l. l.*	1.71^{b}().25)	39
P4-M3$_{(p<0.0001)}$			U3$_{(p<0.0001)}$			U5$_{(p<0.0648)}$			RO$_{(p,0.0001)}$		
S. c. c.	3.64^{a}(0.03)	224	*S. c. c.*	0.42^{a}(0.04)	211	*S. c. c.*	0.28^{a}(0.01)	211	*S. c. c.*	2.98^{a}(0.15)	224
S. c. f.	3.62^{a}(0.09)	30	*S. c. f.*	0.42^{a}(0.12)	30	*S. l. l.*	0.27^{a}(0.01)	40	*S. c. f.*	2.89^{b}(0.40)	30
S. l. l.	3.56^{b}(0.07)	40	*S. l. l.*	0.31^{b}(0.10)	39	*S. c. f.*	0.27^{a}(0.01)	30	*S. l. l.*	2.60^{c}(0.35)	39

Table 8. Measurement ranges of sixteen character of *S. c. cinereus*, *S. c. fontinalis*, and *S. longirostris*.

	S. c. cinereus (n=294)			*S. c. fontinalis* (n=30)			*S. longirostris* (n=40)		
characters	mean(±SD)	max	min	mean(±SD)	max	min	mean(±SD)	max	min
TotL	93.35(7.68)	113	74	89.5(4.49)	98	81	82.61(4.49)	90	74
TailL	38.21(3.75)	45	28	34.18(2.11)	38	30	30.92(2.17)	34	25
HF	11.71(0.92)	14	6	11.21(0.50)	12	10	10.35(0.63)	12	9
SL	15.45(0.48)	16.7	14.1	14.88(0.39)	15.5	14	14.35(0.37)	15.2	13.4
CW	7.66(0.24)	8.4	7	7.3(0.18)	7.6	6.9	7.25(0.21)	7.8	6.7
CH	4.82(0.17)	5.8	4	4.37(0.24)	4.9	3.9	4.55(0.23)	5.1	3.9
IC	2.71(0.13)	3.17	1.8	2.61(0.10)	2.87	2.36	2.85(0.26)	3.19	1.43
MP	4.73(0.17)	5.09	3.51	4.65(0.11)	4.94	4.4	4.49(0.20)	4.86	3.64
M2-M2	3.65(0.09)	3.9	3.41	3.66(0.14)	4.29	3.4	3.84(0.13)	4.04	3.54
I1-I1	1.23(0.06)	1.43	0.91	1.22(0.05)	1.34	1.1	1.13(0.07)	1.43	0.91
UT	1.98(0.13)	2.29	1.57	1.93(0.12)	2.14	1.57	1.71(0.12)	1.9	1.43
P4-M3	3.65(0.10)	3.93	3.43	3.62(0.06)	3.73	3.49	3.56(0.11)	3.77	3.31
U3	0.43(0.03)	0.51	0.29	0.42(0.04)	0.56	0.38	0.31(0.03)	0.37	0.26
U4	0.39(0.03)	0.46	0.29	0.38(0.03)	0.46	0.31	0.34(0.03)	0.4	0.29
U5	0.28(0.03)	0.37	0.14	0.26(0.03)	0.3	0.17	0.27(0.04)	0.36	0.2
RO	2.98(0.13)	3.29	2.58	2.87(0.36)	3.15	0.93	2.60(0.30)	2.82	0.93

Variation within *Sorex c. cinereus*

Principal components analysis. The results of this analysis are shown in Table 9 and Figure 8.

Principal component I (PCI) explained 31.4% of the total variation. This axis is a representation of overall size. All characters loaded positively. The characters that loaded most heavily on PCI were length of skull, tail length, maxillary plate, cranial width, and rostral shape. Individuals with high PCI scores are generally large, have long, wide skulls and long tails. As shown above significant age variation was found for rostral shape within *S. c. cinereus.*

The amount of variation explained by PCII was 12.2%. Half of the sixteen characters loaded negatively on PCII. Principal component II was, therefore, as much a reflection of shape as of size. The characters that loaded most heavily on PCII were unicuspid toothrow, rostral shape, hind foot, tail length, and total length. Individuals scoring high on PCII are relatively small and have a long narrow rostrum. Three of the characters that loaded heavily on this axis (unicuspid toothrow, rostral shape, and total length) were found to differ significantly among age classes within *S. c. cinereus.*

Principal component III explained 10.6% of the variation. Seven of the sixteen characters loaded negatively on this axis, resulting in PCIII representing size more so than shape. The highest loading characters on PCIII are width across I1, width across M2, molariform toothrow, U3, and unicuspid toothrow. Two of the highest loading characters (U3 and unicuspid toothrow) loaded negatively on this axis. High PCIII scores reflect individuals with wide, anteriorly short but posteriorly long rostra, with small U3. Significant age variation was found within *S. c. cinereus* for unicuspid toothrow.

Though none segregate without any overlap, Putnam (S) and Mason (T) County OTUs cluster toward the low end of PCI. Along the low to mid range of the axis, Mercer County OTUs (X, Y) clustered with considerable overlap. Clustering near the center of PCI, the Monroe County OTU (N) was completely contained within the clusters of Monongalia (A) and Pocahontas/Randolph Counties (H). Spreading from the low-mid range to the highest along PCI, OTU H represented the widest spread, but also the largest individuals. Other OTUs represented in the upper range of PCI are Preston (C and B), Randolph/Pocahontas (I), Pendleton (J), Greenbrier (M), Monroe (N), Raleigh (P), and Fayette (Q) Counties.

Showing even more overlap than along PCI, OTUs were not clearly segregated along PCII. Representing small individuals, OTUs T and S clustered furthest from the origin of the axis reflecting high PCII scores. Clustering along the center toward the high range of PCII were OTUs X, Y and N. The other OTUs did not cluster along this axis.

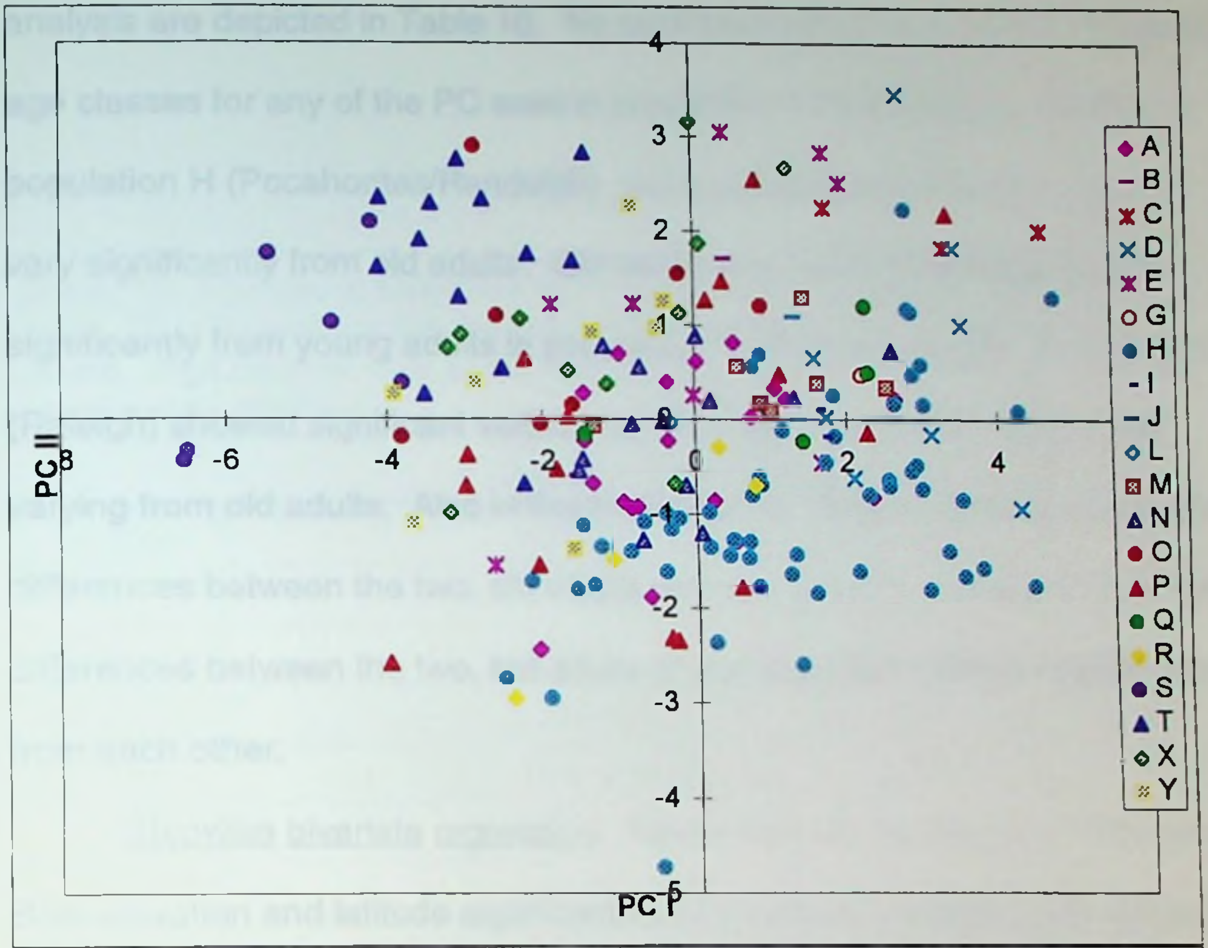
Only OTUs represented by small numbers, C (Preston) and J (Pendleton), seemed to cluster on PCIII. No segregation was noticeable along this axis.

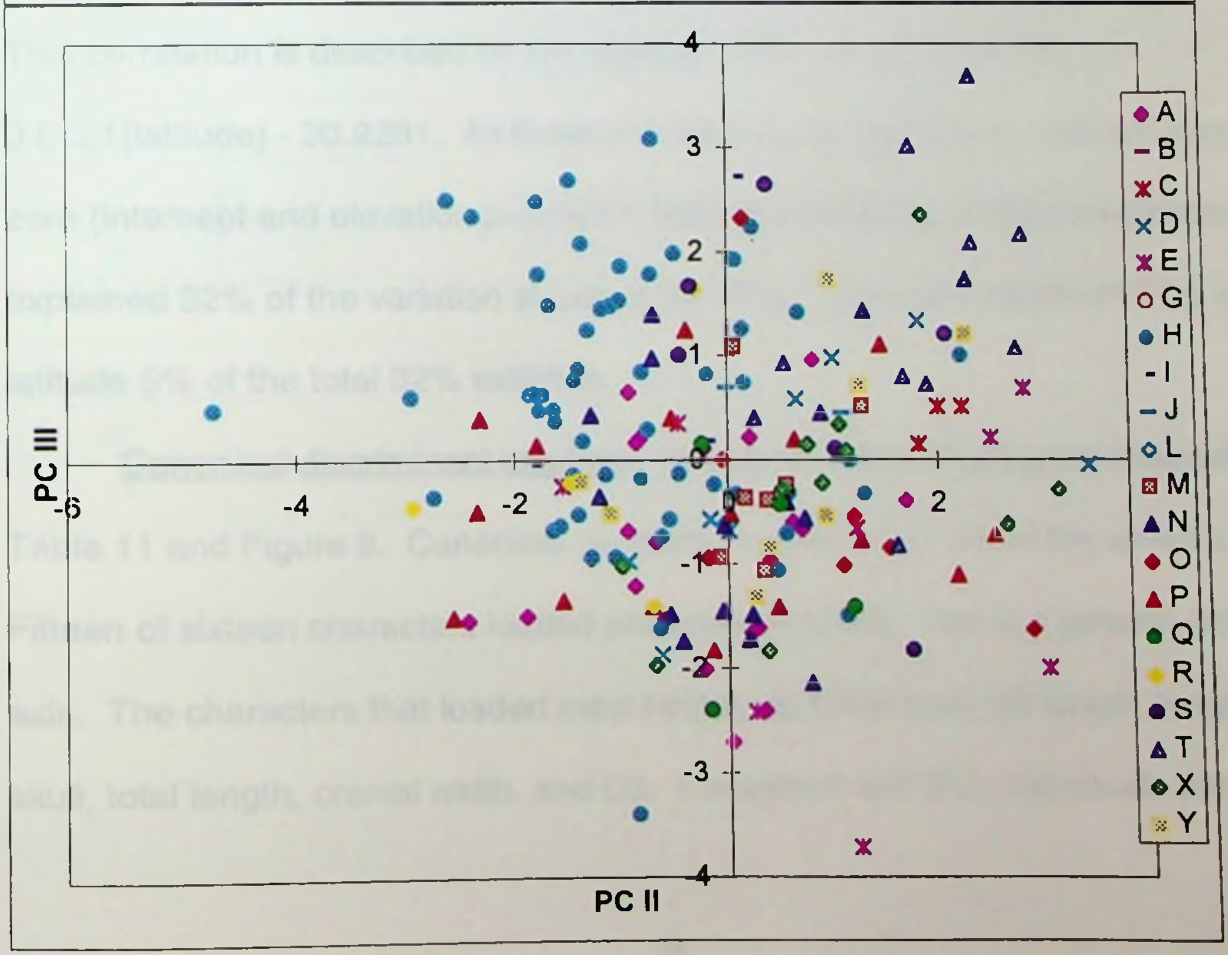
Multiple analysis of variance among populations. The results of this

Table 9. Eigenvalues of the correlation matrix from the principal components analysis for within West Virginia *S. c. cinereus*, and eigenvectors of PCI, PCII, and PCIII.

	PCI	PCII	PCIII
Eigenvalue	5.02690	1.95946	1.69881
Difference	3.06744	0.26065	.
Proportion	0.314181	0.122466	0.106176
Cumulative	0.314181	0.436648	0.542823
Characters	Eigenvectors		
TotL	0.274958	-0.294772	-0.102116
TalL	0.330753	-0.323908	-0.124478
HF	0.148453	-0.330211	-0.02992
SL	0.385079	-0.155004	0.047326
CW	0.305222	-0.270514	0.169588
CH	0.241779	-0.162496	0.021849
IC	0.119880	-0.036301	0.278170
MP	0.322008	0.090862	0.088927
M2-M2	0.124890	0.282434	0.460464
I1-I1	0.051655	0.013033	0.499409
UT	0.271597	0.413028	-0.292260
P4-M3	0.265842	0.198211	0.374761
U3	0.261969	-0.019456	-0.295817
U4	0.169861	0.218812	-0.056011
U5	0.170190	0.279699	0.011218
RO	0.293004	0.386864	-0.279911

Figure 8. Plots of the first three principal components from the PCA for variation within West Virginia *S. c. cinereus*. The symbols represent the populations with coordinating letter designations. A=Monongalia, B=Preston, C=Preston, D=Randolph, E=Tucker, G=Pendleton, H=Randolph/Pocahontas, I=Randolph/Pocahontas, J=Pendleton, L=Webster, M=Greenbrier, N=Monroe, O=Fayette, P=Raleigh,Q=Fayette, R=Fayette/Raleigh, S=Putnam, T=Mason, X=Mercer, Y=Mercer.


PC II
PC I
4
3
2
1
0
-1
-2
-3
-4
-5
-8
-6
-4
-2
0
2
4
◆ A
– B
✖ C
× D
✖ E
○ G
● H
- I
– J
◇ L
▣ M
▲ N
● O
▲ P
● Q
● R
● S
▲ T
◈ X
▨ Y


PC III
PC II
4
3
2
1
0
-1
-2
-3
-4
-6
-4
-2
0
2
◆ A
– B
✖ C
× D
✖ E
○ G
● H
- I
– J
◇ L
▣ M
▲ N
◆ O
▲ P
● Q
● R
● S
▲ T
◈ X
▨ Y

analysis are depicted in Table 10. No significant differences were found among age classes for any of the PC axes in population A (Monongalia). On PCI in population H (Pocahontas/Randolph), young adults and adults were found to vary significantly from old adults. Old adults and adults were found to differ significantly from young adults in population N (Monroe) on PCII. Population P (Raleigh) showed significant variation on PCII with adults and young adults varying from old adults. Also in this population adults and old adults showed no differences between the two, old adults and young adults showed no significant differences between the two, but adults and young adults differed significantly from each other.

Stepwise bivariate regression. Figure 8 shows the results of this analysis. Both elevation and latitude significantly and positively correlated with PCI scores. This correlation is described by the equation: PCI = 0.0011(elevation) + 0.0121(latitude) - 30.9281. All three intercepts were significantly different from zero (intercept and elevation $p<0.0001$, latitude $p<0.0003$). These two factors explained 32% of the variation shown in the PCA. Elevation explained 27% and latitude 5% of the total 32% variation.

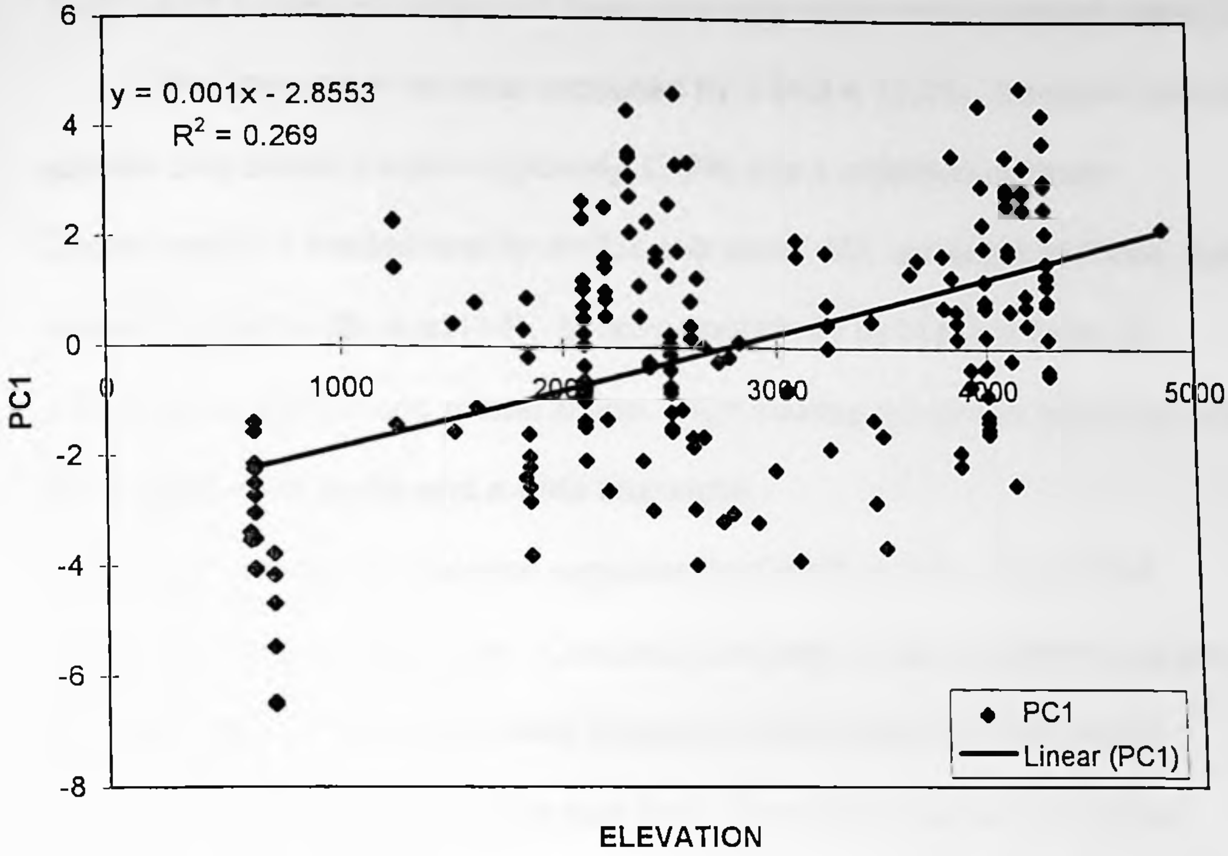
Canonical discriminant analysis. Results of this analysis are contained in Table 11 and Figure 9. Canonical correlate I explained 47.0% of the variation. Fifteen of sixteen characters loaded positively on CANI. This is a general size axis. The characters that loaded most heavily on CANI were tail length, length of skull, total length, cranial width, and U3. Consistent with PCI, individuals with

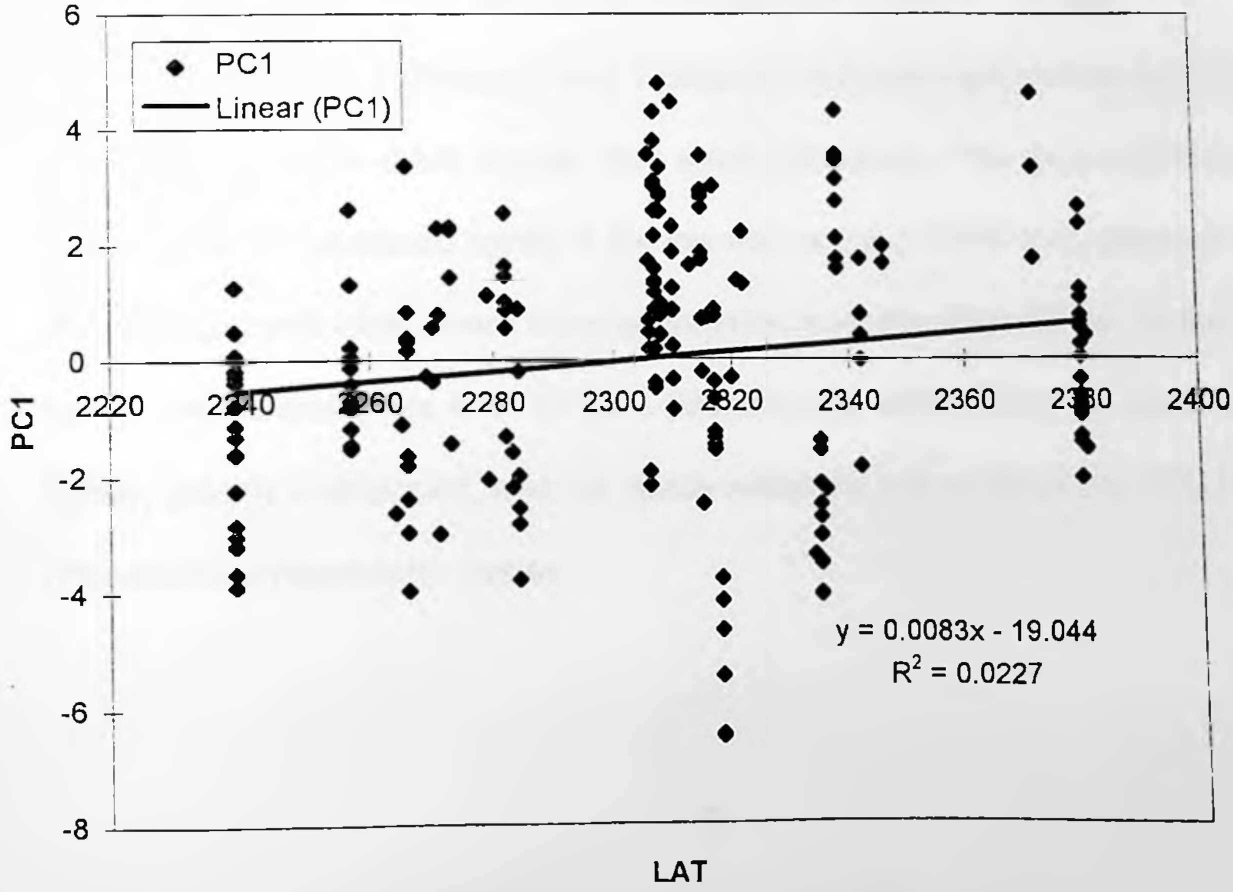
Table 10. Results of MANOVA for effect of age on position of points along the PC axes. The figures are for populations and PC axes where significant differences were found. Age classes with same superscript from the same populations are not significantly different.

Population H on PCI $(p<0.0001)$

Age Class	Mean(±SD)	N
1^{a}	2.4116(1.63)	19
2^{a}	1.9732(2.51)	8
3^{b}	0.4294(1.28)	31
Population N on PCII $(p<0.0023)$		
3^{a}	0.5416(1.22)	3
2^{a}	0.4179(1.05)	4
1^{b}	-0.7002(0.86)	6
Population P on PCII $(p<0.0003)$		
2^{a}	2.0016(3.71)	2
1^{a}	0.8812(2.35)	5
3^{b}	-1.3544(1.75)	9
Population P on PCIII $(p<0.0619)$		
2^{a}	0.9135(1.62)	2
3^{ab}	-0.3511(0.76)	9
1^{b}	-0.9945(1.02)	5

Figure 9. Plots of regression analysis for effect of elevation on PCI scores and effect of latitude on PCI scores.


y = 0.001x - 2.8553
R² = 0.269
PC1
Linear (PC1)
PC1
ELEVATION
6
4
2
0
-2
-4
-6
-8
0
1000
2000
3000
4000
5000


PC1
Linear (PC1)
y = 0.0083x - 19.044
R² = 0.0227
PC1
LAT
6
4
2
0
-2
-4
-6
-8
2220
2240
2260
2280
2300
2320
2340
2360
2380
2400

high CANI scores are large and have long wide skulls with a relatively wide U3.

The amount of variation explained by CANII is 13.0%. Because nine of sixteen characters loaded negatively, CANII was a reflection of shape. Characters that loaded heavily on this axis were: U3, unicuspid toothrow, rostral shape, cranial width, and I1-I1. Loading negatively on this axis were U3, unicuspid toothrow, and rostral shape. High scoring individuals along this axis have short wide rostra and a wide braincase.

The amount of variation explained by CANIII is 10%. Four of the characters loaded negatively. Canonical correlate III was a general size axis. The characters that loaded most heavily on CANIII were U5, interorbital constriction , I1-I1, M2-M2, and hind foot. The only character that loaded negatively on CANIII was hind foot. Individuals with high CANIII scores have wide rostra with a relatively wide U5, and small feet.

Clustering patterns along PCI were clarified by CANI. Though overlapping, OTUs S (Putnam) and T (Mason) clustered tightly to the right of the graph reflecting low CANI scores, thus small individuals. The plots of OTUs X and Y (Mercer) clustered tightly at the low-mid range of CANI and, although they overlapped each other, were more segregated from the other OTUs. In the mid to high range along this axis, OTUs A (Monongalia) and N (Monroe) clustered tightly, greatly overlapped, and fell mostly within the low range of the OTU H (Pocahontas/Randolph) cluster.

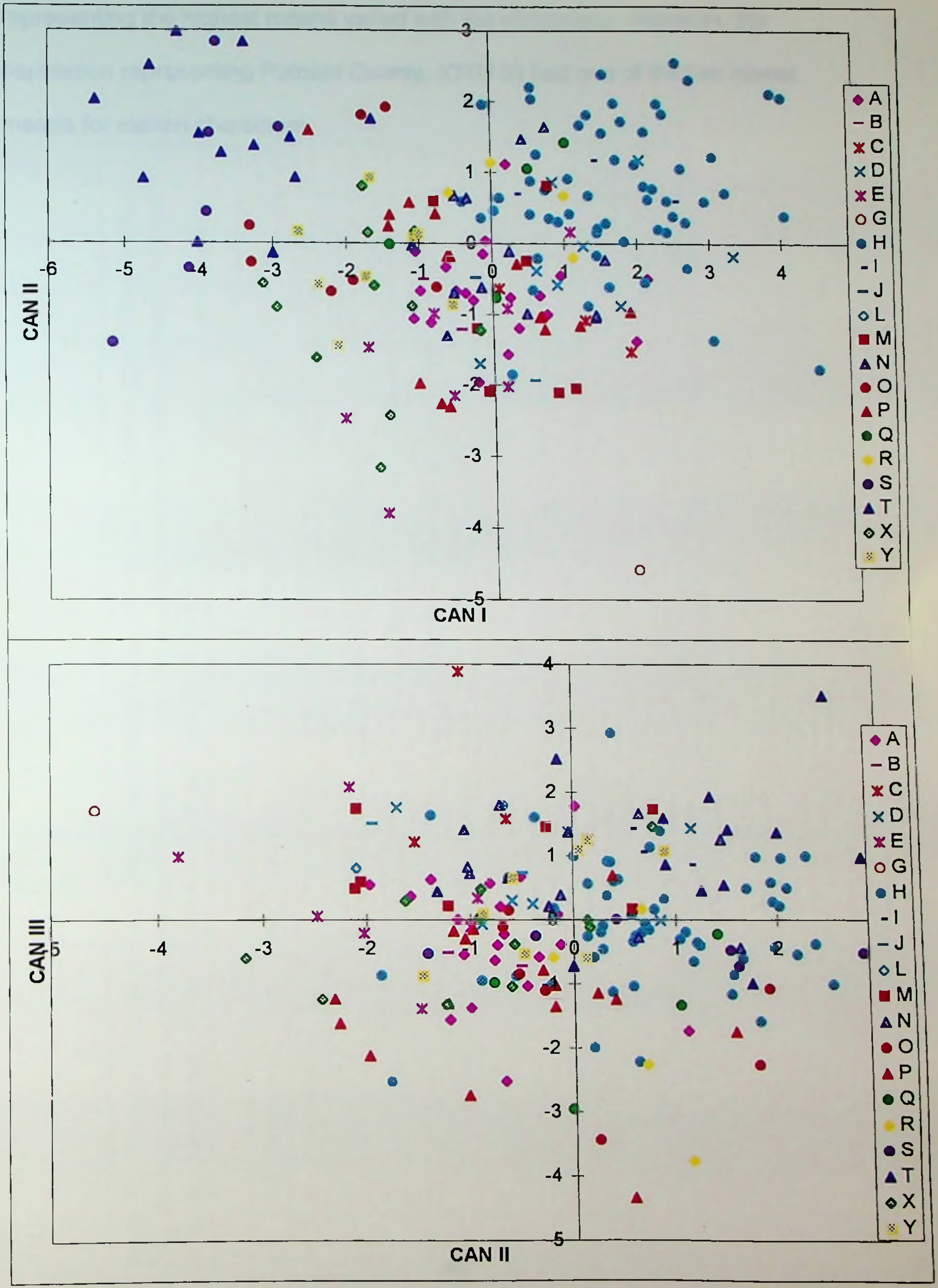
Table 11. Canonical correlation and eigenvalues from the canonical discriminant analysis for within West Virginia *S. c. cinereus*, and total canonical structure of canonical correlates CANI, CANII, and CANIII.

	CANI	CANII	CANIII
Eigenvalue	3.2047	0.8895	0.6860
Proportion	0.4698	0.1304	0.1006
Cumulative	0.4698	0.6002	0.7008
Characters	Total Canonical Structure		
TotL	0.745722	-0.240290	0.240303
TailL	0.867193	-0.259198	0.06290
HF	0.478934	-0.051311	-0.283180
SL	0.852711	0.005530	0.163970
CW	0.738695	0.407102	-0.059178
CH	0.495613	0.377247	-0.240526
IC	0.216773	0.054060	0.372796
MP	0.497390	-0.013187	0.268655
M2-M2	-0.011698	0.065085	0.296406
I1-I1	0.012918	0.393940	0.348032
UT	0.119642	-0.433076	0.239183
P4-M3	0.300479	0.035566	0.149313
U3	0.510399	-0.528254	-0.138888
U4	0.225144	-0.080789	0.038295
U5	0.194186	-0.039101	0.576769
RO	0.177075	-0.420106	0.207103

Scoring low on CANI and mid to high on CANII, OTUs S and T (Putnam and Mason Counties) represented the smallest individuals. The X and Y (Mercer County) clusters spread more along CANII but were representative of small to medium shrews. No further resolution was seen along this axis nor along CANIII.

._Multiple_ _analysis_ _of_ _variance_. Table 12, summarizes the results of this analysis. Eleven of the seventeen characters were found to differ significantly among populations. The Student-Newman-Keuls multiple comparison test (SNK) revealed that most populations did not vary significantly for most variables. The SNK groupings showed that for any given variable only the extreme populations varied significantly from the rest. The populations

Figure 10. Plot of first three canonical variates from the CDA for West Virginia *S. c. cinereus.*


CAN I
CAN II
-6
-5
-4
-3
-2
-1
0
1
2
3
4
3
2
1
0
-1
-2
-3
-4
-5
◆ A
– B
✱ C
× D
✱ E
○ G
● H
- I
– J
◇ L
■ M
▲ N
● O
▲ P
● Q
● R
● S
▲ T
◇ X
▨ Y
CAN II
CAN III
-5
-4
-3
-2
-1
0
1
2
4
3
2
1
0
-2
-3
-4
-5
◆ A
– B
✱ C
× D
✱ E
○ G
● H
- I
– J
◇ L
■ M
▲ N
● O
▲ P
● Q
● R
● S
▲ T
◇ X
▨ Y

representing the highest means varied with the characters. However, the population representing Putnam County, (OTU S) had one of the two lowest means for eleven characters.

Table 12. Results of MANOVA for differences among West Virginia *S. c. cinereus* populations, showing only the populations representing the two highest and lowest mean values for each significantly different variable. Means with the same superscripts are not significantly different.

	High						Low					
var	Pop	mean(±SD)	N	Pop	mean(±SD)	N	Pop	mean(±SD)	N	Pop	mean(±SD)	N
TotL	G	100.00^a(79.27)	1	I	100.50^a(39.63)	4	T	83.00^b(20.48)	15	S	80.00^b(30.36)	6
TalL	G	45.00^a(44.00)	1	K	42.00^a(44.00)	1	T	31.27^b(11.36)	15	S	29.67^b(17.96)	6
SL	K	16.50^a(5.50)	1	C	13.03^a(3.18)	3	T	14.78^b(1.53)	13	S	14.47^b(2.25)	6
CW	K	8.00^a(2.59)	1	D	7.90^a(0.91)	8	L	7.40^b(2.25)	1	S	7.28^b(1.10)	6
CH	Q	5.35^a(1.41)	4	D	5.09^a(1.00)	8	S	4.28^b(1.15)	6	G	4.00^b(2.83)	1
MP	K	5.00^a(1.32)	1	C	4.90^{ab}(0.76)	3	O	4.60^{ab}(0.50)	7	S	4.51^b(0.54)	6
I1I1	I	1.31^a(0.21)	4	K	1.29^a(0.41)	1	E	1.17^{ab}(0.41)	1	L	1.14^b(0.41)	1
UT	K	2.29^a(1.12)	1	C	2.18^a(0.65)	3	R	1.88^b(0.50)	5	S	1.78^b(0.46)	6
U3	F	0.51^a(0.31)	1	G	0.49^a(0.31)	1	S	0.38^b(0.13)	6	T	0.36^b(0.08)	15
U5	C	0.33^a(0.14)	3	I	0.30^a(0.25)	1	R	0.23^b(0.11)	5	F	0.19^b(0.25)	1
RO	K	3.29^a(1.19)	1	C	3.17^a(0.68)	3	R	2.87^b(0.53)	5	S	2.75^b(0.48)	6

DISCUSSION

Age and sex variation

That soricid skulls flatten with age has been well documented (Crowcroft and Ingles, 1959; Jackson, 1928; Levengood, 1987; Pruitt,1954; Pucek, 1963; Rudd, 1955). It was not surprising that a significant difference was found in cranial height among age classes for *S. c. cinereus* and *S. c. fontinalis*. In both taxa the height of the skulls decreased with age. Although no significant differences were found among age classes for *S. l. longirostris* for any character, young adults had the greatest cranial height. Interestingly, adults, not old adults, represented the smallest cranial height. The differences among age classes for *S. l. longirostris* were evident but not significantly different.

The unicuspid toothrow and rostral shape differences found among age classes in *S. c. cinereus* may be a function of tooth wear. The relationship between the size and shape of the individual teeth and toothrows, and overall size is consistent throughout the life of soricids (Junge and Hoffman, 1981). However, excessive tooth wear associated with old age can obscure this relationship.

In *S. c. cinereus*, young adults may have differed from, and measured less than the other two ages for total length, because of the accidental acceptance of subadult specimens into the data set. However, because the external measurements are usually obtained from a skin tag or preparator's catalog data, they are not made by the same person who made the cranial and dental measurements. The fact that, in such a study as this, there may be nearly as many different preparators as specimens allows for a great deal of inherent human error.

Junge and Hoffman (1981) reported measuring skull length, by placing one caliper point on the anterior medial point on the premaxillary and the other point on the posterior end of the skull at midline, as was done in this study, is a good way to avoid the effects of tooth wear and aging. This is not reflected by the significant differences among age classes in *S. c. fontinalis* for skull length. Researchers exploring morphological variation associated with age in shrew skulls have reported differences in cranial width and cranial height, but not skull length (Junge and Hoffman, 1981; Levengood, 1987; Pucek, 1963; Rudd, 1955).

No sexual dimorphism was found for any of the taxa studied. This is consistent with findings of other researchers.

Diagnostic characters

The size of the third unicuspid is often used as diagnostic character for *S. l. longirostris*. One advantage in using U3 as an identifying character is that its size, relative to skull size, does not change with age. However, the dependability of this character as a diagnostic tool may vary within the geographic range of *S. l. longirostris* (Junge and Hoffman, 1981). French (1980) also reported that U3 may be equal in size to U4 in 20% of the individuals within a population.

The usefulness of rostral shape as a diagnostic character is supported by others (Junge and Hoffman, 1981; van Zyll de Jong, 1980). The width across the second molars and the length of the unicuspid toothrow, both components of the rostral shape ratio, also figured prominently as diagnostic characters in these analyses.

Consistent with published descriptions of *S. c. cinereus* (Hall, 1981; Junge and Hoffman, 1981), the West Virginia *S. c. cinereus* were found to be large and long-tailed, with long skulls, long narrow rostra, and relatively large U3. Also based on these analyses, *S. l. longirostris* have short skulls with short, broad rostra, a small third unicuspid and a small tail, similar to the published descriptions of this taxon (French, 1980; Junge and Hoffman, 1981). In West Virginia, therefore, *S. l. longirostris* can presumably be distinguished from *S. c. cinereus* using characters applicable in other areas of sympatry. Though none of the characters describing clustering patterns on the PCA and CDA scatter plots can be used as good diagnostics to distinguish *S. c. fontinalis* from *S. c. cinereus*, they can help demonstrate the morphological differences between these taxa. The prediction made by Jackson (1928), and later substantiated by Poole (1937), that *S. fontinalis* would prove to be a small race of *S. cinereus* was further supported by these analyses.

Taxonomic status and geographic variation

Junge and Hoffman (1981) reported the occurance of extreme character measurements in soricids from the periphery of their geographic ranges. Many studies involving morphological variation in shrews have revealed patterns of geographic or clinal variation, generally exhibiting a decrease in size from northern to southern localities (Huggins and Kennedy, 1989; Jackson, 1928; Junge and Hoffman, 1981; Levengood, 1987). The wide range in character measurements shown in the specimens used in this study reflects these tendencies.

West Virginia lies near the northern border of distribution of *S. l. longirostris.* Northern specimens were found to have more narrow rostra and interorbital constriction than southern specimens. And though all specimens of *S. l. longirostris* were generally smaller than the *S. c. cinereus* specimens, the rostral shape of the northern ones was more like that of small *S. c. cinereus* or *S. c. fontinalis.*

The position of the Roane County *S. l. longirostris* (French, 1977) near the Virginia specimens and the Putnam County *S. c. cinereus* on the PCA scatter plot indicates that these specimens are more like small *S. c. cinereus* and less like the typical southern *S. l. longirostris.* That one of these Virginia *S. l. longirostris* (USNM 283624) originally had been designated *S. c. fontinalis* demonstrates the systematic and taxonomic difficulties of these confusing taxa. Other Virginia specimens have undergone similar reclassifications (French, 1977; Handley, 1981). However, in the CDA, which serves to maximize differences between taxa, French's (1977) *S. l. longirostris* was even further removed on the scatter plot from the *S. l. longirostris* cluster; this suggests that the only documented *S. l. longirostris* from WV may have been misidentified.

The fairly wide range in size shown in *S. l. longirostris* may have been due to the specimens representing a wide geographic area (Junge and Hoffman, 1981; Pucek, 1963). Generally, southern specimens are represented by individuals with a long and wide molariform region and short anterior rostrum. They also have relatively large fifth unicuspids and small third unicuspid. The short, crowded anterior rostrum is typical for this taxon (Caldwell and Bryan, 1982; French, 1980; Junge and Hoffman, 1980) The more northern specimens are represented by individuals with shorter, narrower molariform region than the southern specimens but still have shorter more crowded anterior rostral regions than *S. c. cinereus* or *S. c. fontinalis.*

No clear patterns of geographic or clinal variation were made visible by either the PCA or CDA for *S. c. fontinalis.* This may be due, in part, to their relatively restricted geographic range.

Geographic variation within West Virginia *S. c. cinereus*

The significant differences among age classes and PC scores for the populations tested indicate that at least some of the observed morphological variation within *S. c. cinereus* is a consequence of age. More importantly, the regression analysis demonstrates significant clinal variation along both elevational and, to a lesser extent, latitudinal gradients. In general, individuals from higher elevations and northern latitudes are larger than those from lower elevations and more southern latitudes, a finding consistent with those of Jackson (1928) and others (Huggins and Kennedy, 1989; Levengood, 1987).

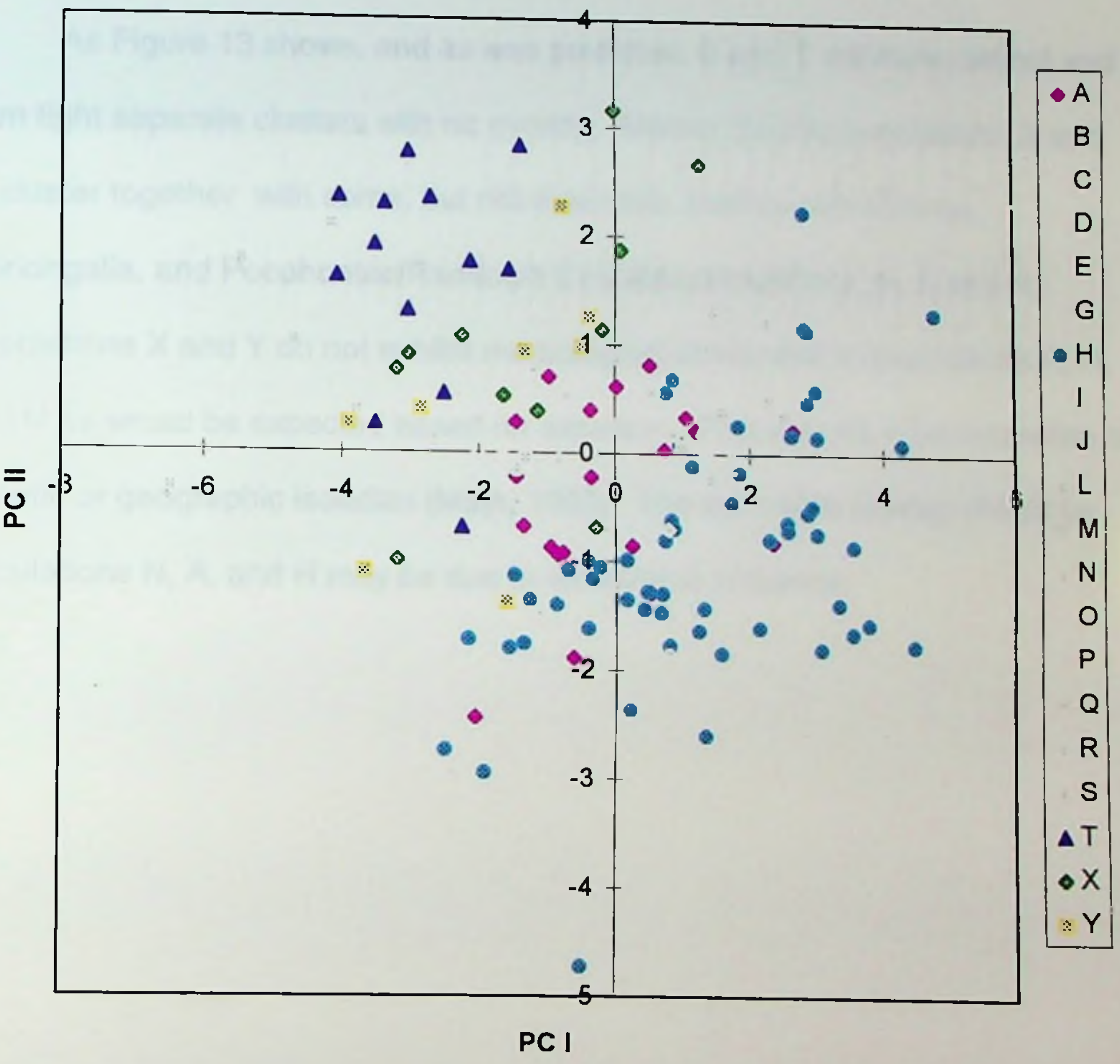
Such a pattern of clinal variation is illustrated in Figure 11. The West Virginia populations representing geographical extremes are Mason County (OTU T) at mid latitude, but lowest elevation, Mercer County (OTUs X and Y) furthest south and at relatively high elevation, Pocahontas/Randolph Counties (OTU H) at mid latitude and highest elevation, and Monongalia County (OTU A) furthest north and also at a relatively high elevation. Mercer County individuals, from both populations, were represented in the analyses by very small individuals with short skulls having narrow crania and short relatively wide rostra. The Mason County population was morphologically similar to the Mercer County shrews. The high elevation Pocahontas/Randolph Counties population were represented by the largest individuals. These specimens have the longest skulls with widest crania and long narrow rostra. Monongalia County individuals fell within the range of the large, high elevation population H shrews and are generally larger than individuals from the other populations discussed.

From about the same latitude and only slightly higher elevation than the Mason County population, individuals representing Putnam County were the smallest specimens observed. The Monroe County population (N), from a fairly southern latitude and high elevation, geographically similar to Mercer County, was represented by individuals more similar to the Monongalia and Pocahontas/Randolph County individuals than to the Mercer County shrews.

In addition to the clinal patterns of morphological variation, the data reveal patterns attributable to other biogeographical processes and influences. In the south, populations X and Y (Mercer County) lie close to population N (Monroe County), but are separated from it by the Bluestone and New River systems. These river systems separate three salamander species complexes (Green and Pauley, 1987) and may be a barrier to gene flow between the Mercer and Monroe County shrews. Mayr (1963) stated that rivers are effective geographical barriers to small mammal dispersal.

Populations T and S (Mason and Putnam Counties) are geographically separated from all other populations by numerous barriers including two Interstate Highways, Kanawha and Ohio Rivers and the absence of conspecific populations across the central portion of the state. In contrast, populations A, H and N (Monongalia, Pocahontas/Randolph, and Monroe Counties) are joined by contiguous conspecific populations along the eastern mountain region of the state.

Based on this distribution, the expected pattern of morphological similarities and differences would be that illustrated in Figure 12. Populations A and H (Monongalia and Pocahontas/Randolph Counties) should be more similar to each other than they are to any other population. Population N (Monroe County) should be more similar to A and H than any others because latitude proved to be less of an influence on variation than elevation, N is similar in elevation to A, and N is part of the contiguous populations along the eastern mountains. Populations X and Y (Mercer County) should be more similar to


PC II
PC I
4
3
2
1
0
-1
-2
-3
-4
-5
-8
-6
-4
-2
0
2
4
6
◆ A
B
C
D
E
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● H
I
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L
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O
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▲ T
◆ X
▨ Y

Figure 11. Distribution of individuals from the geographically extreme populations of *S. c. cinereus* in West Virginia on the first two axes of the PCA scatter plot. The extreme populations are low elevation Mason County (T), high elevation Pocahontas/Randolph Counties (H), southern latitude Mercer County (X and Y), and northern latitude Monongalia County (A).

each other than to any other populations. The predicted morphological similarity between X and Y and the N, A, and H populations would be due to elevation. Populations S and T (Putnam and Mason Counties) are predicted to be similar to each other but not to any other population due to the low elevations and geographical isolation.

As Figure 13 shows, and as was predicted, S and T are most distinct and form tight separate clusters with no overlap. Mercer County populations, X and Y, cluster together with some, but not extensive, overlap with Monroe, Monongalia, and Pocahontas/Randolph Counties populations, N, A and H. Populations X and Y do not exhibit morpological similarities to populations A, H, and N as would be expected based on elevation. This may be a consequence of genetic or geographic isolation (Mayr, 1963). The extensive overlap shown by populations N, A, and H may be due to elevational influence.

Figure 12. Dendogram of expected similarities and differences for 7 biogeographically significant populations of *S. c. cinereus* in West Virginia. The populations are: A=Monongalia, H=Pocahontas/Randolph, N=Monroe, S=Putnam, T=Mason, and X and Y=Mercer Counties.

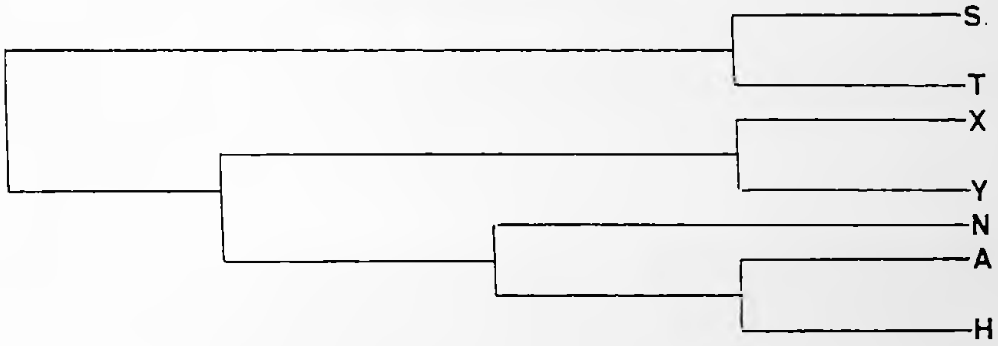
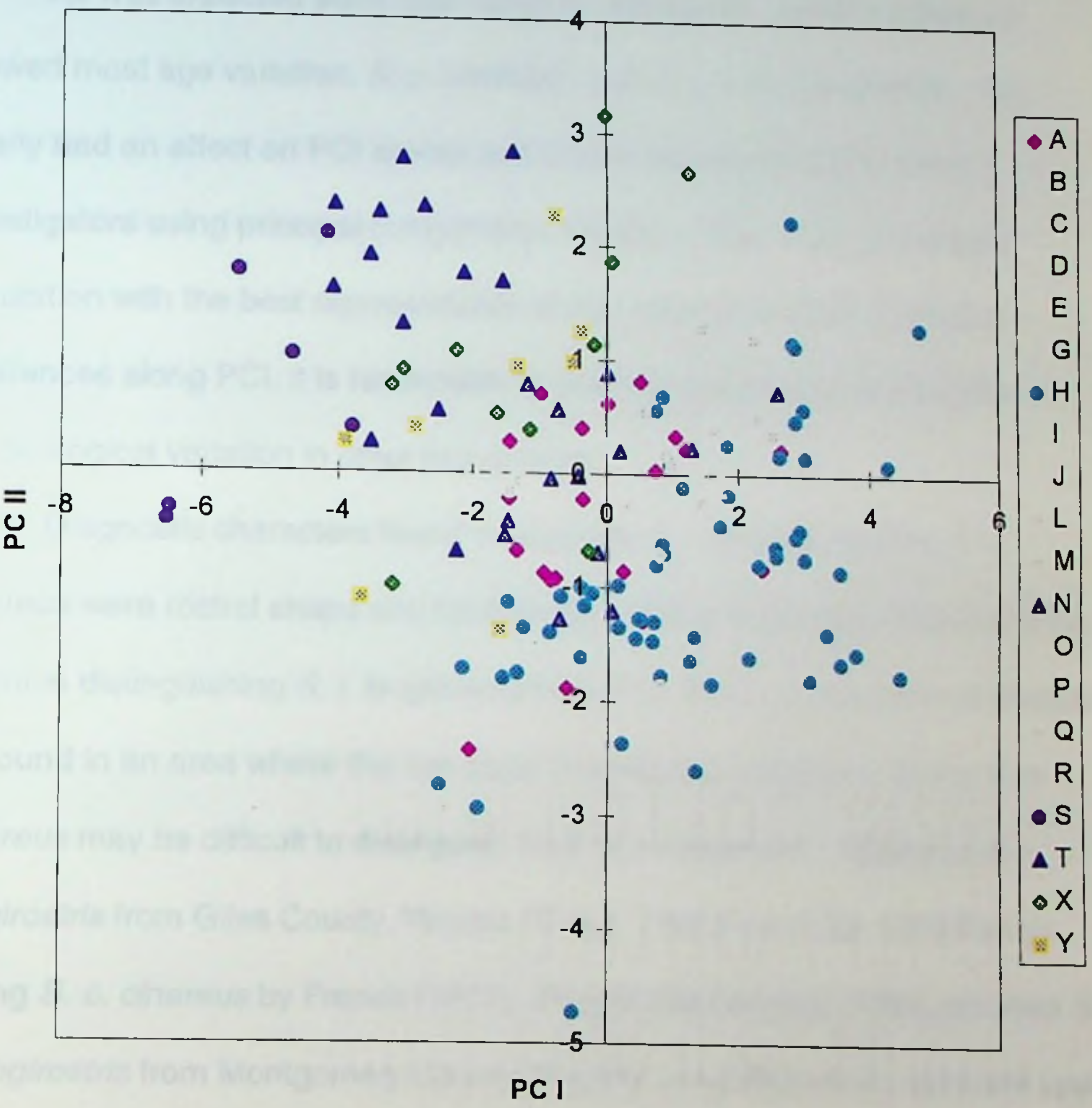

S.
T
X
Y
N
A
H

Figure 13. Plot of 7 biogeographically significant West Virginia *S. c. cinereus* populations along the first two axes of the PCA. The populations represented are Monongalia (A), Pocahontas/Randolph (H), Monroe (N), Putnam (S), Mason (T), and Mercer (X, Y) Counties.


4
3
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-4
-5
-8
-6
-4
-2
0
2
4
6
PC II
PC I
◆ A
B
C
D
E
G
● H
I
J
L
M
▲ N
O
P
Q
R
● S
▲ T
◇ X
▨ Y

Conclusions and Summary

Consistent with other research, (Huggins and Kennedy, 1989; Jones et al., 1991; Levengood, 1987; Rudd, 1955;) no sexual dimorphism was found in any of the taxa studied.

As was expected some age variation was found. *Sorex c. cinereus* showed most age variation, *S. c. fontinalis*, and *S. l. longirostris* none. Age clearly had an effect on PCI scores and should be considered by future investigators using principal components analysis. Also, since the largest population with the best representation of age classes showed significant differences along PCI, it is reasonable to suspect age has some effect on morphological variation in other populations.

Diagnostic characters found to separate *S. l. longirostris* from *S. c. cinereus* were rostral shape and skull length. These characters should also be useful in distinguishing *S. l. longirostris* from *S. c. fontinalis* should an individual be found in an area where the two occur in sympatry. However, young *S. c. cinereus* may be difficult to distinguish from *S. l. longirostris*. Reported *S. l. longirostris* from Giles County, Virginia (Odum, 1944) were later identified as young *S. c. cinereus* by French (1977). Pagels and Handley (1989) reported *S. l. longirostris* from Montgomery County, Virginia, but indicated an apparent upper elevational limit in distribution in the more northern extensions of its range. They also suggested that the Blue Ridge Mountains provide a formidable barrier to northward and westward expansion. Biochemical studies on specimens from the southeastern part of the state, near the Virginia border, may help resolve conflicts. Additional studies in the southeastern part of West Virginia will likely reveal the occurance of *S. l. longirostris* there.

French's (1977) *S. l. longirostris* may have been misidentified. Because no other Roane County specimens are available further collections from Roane County and additional morphometric, biochemical and genetic studies are needed to clarify the taxonomic status of this and any future Roane County specimens. Putnam County individuals are equally problematic. And, as with Roane County, additional collections and analyses are needed.

Sorex c. cinereus from West Virginia show considerable variation and in patterns similar to what has been reported elsewhere (Huggins and Kennedy, 1989; Levengood, 1987; van Zyll de Jong and Kirkland, 1989). Patterns of morphometric variation are clearly more complex as a consequence of biogeography. West Virginia is complex biogeographically. This complexity is reflected in the morphological variation of the soricids.

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APPENDIX I

List of specimens used in this study

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c.cinereus	MUMC 002770	West Virginia	FAYETTE	Beauty Mountain	1840	3804	8103
Sorex c.cinereus	MUMC 003489	West Virginia	FAYETTE	Beauty Mountain	1840	3803	8103
Sorex c.cinereus	MUMC 003973	West Virginia	FAYETTE	Beauty Mountain	1840	3804	8103
Sorex c.cinereus	MUMC 003974	West Virginia	FAYETTE	Beauty Mountain	1840	3804	8103
Sorex c.cinereus	MUMC 004180	West Virginia	FAYETTE	Beauty Mountain	1840	3803	8103
Sorex c.cinereus	MUMC 003807	West Virginia	FAYETTE	Fayetteville	1840	3804	8103
Sorex c.cinereus	MUMC 003808	West Virginia	FAYETTE	Fayetteville	1840	3804	8103
Sorex c.cinereus	MUMC 003809	West Virginia	FAYETTE	Fayetteville	1840	3804	8103
Sorex c.cinereus	MUMC 003869	West Virginia	FAYETTE	McKendree	1240	3753	8104
Sorex c.cinereus	MUMC 003870	West Virginia	FAYETTE	McKendree	1240	3753	8104
Sorex c.cinereus	MUMC 003873	West Virginia	FAYETTE	McKendree	1240	3753	8104
Sorex c.cinereus	MUMC 004116	West Virginia	FAYETTE	McKendree	1240	3753	8104
Sorex c.cinereus	MUMC 005389	West Virginia	FAYETTE	Quinnimont	1600	3751	8101
Sorex c.cinereus	MUMC 005523	West Virginia	GREENBRIER	Greenbrier SF	2200	3744	8021
Sorex c.cinereus	CMNH 081904	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081905	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081906	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081907	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081908	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081909	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081910	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081911	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	CMNH 081912	West Virginia	GREENBRIER	Neola	2200	3802	8002
Sorex c.cinereus	MUMC 002204	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 004349	West Virginia	MASON	McClintic WMA	620	3856	8205
Sorex c.cinereus	MUMC 005355	West Virginia	MASON	McClintic WMA	600	3854	8204
Sorex c.cinereus	MUMC 005366	West Virginia	MASON	McClintic WMA	600	3855	8304
Sorex c.cinereus	MUMC 005367	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 005368	West Virginia	MASON	McClintic WMA	600	3854	8204
Sorex c.cinereus	MUMC 005854	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 005999	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 006000	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 006001	West Virginia	MASON	McClintic WMA	620	3855	8204

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c.cinereus	MUMC 006172	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 006173	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 006174	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 006175	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 006177	West Virginia	MASON	McClintic WMA	620	3855	8204
Sorex c.cinereus	MUMC 006455	West Virginia	MERCER	East River Mountain	2550	3719	8054
Sorex c.cinereus	MUMC 006467	West Virginia	MERCER	East River Mountain	2630	3719	8054
Sorex c.cinereus	MUMC 006485	West Virginia	MERCER	East River Mountain	2650	3719	8054
Sorex c.cinereus	MUMC 006489	West Virginia	MERCER	East River Mountain	2660	3719	8054
Sorex c.cinereus	MUMC 006516	West Virginia	MERCER	East River Mountain	2725	3719	8054
Sorex c.cinereus	MUMC 006517	West Virginia	MERCER	East River Mountain	2725	3719	8054
Sorex c.cinereus	MUMC 006543	West Virginia	MERCER	East River Mountain	2775	3719	8054
Sorex c.cinereus	MUMC 006548	West Virginia	MERCER	East River Mountain	2775	3719	8054
Sorex c.cinereus	MUMC 006566	West Virginia	MERCER	East River Mountain	2825	3719	8054
Sorex c.cinereus	MUMC 006609	West Virginia	MERCER	East River Mountain	2915	3719	8054
Sorex c.cinereus	MUMC 006665	West Virginia	MERCER	East River Mountain	2980	3719	8054
Sorex c.cinereus	MUMC 006711	West Virginia	MERCER	East River Mountain	3050	3719	8054
Sorex c.cinereus	MUMC 006718	West Virginia	MERCER	East River Mountain	3080	3719	8054
Sorex c.cinereus	MUMC 006799	West Virginia	MERCER	East River Mountain	3450	3719	8054
Sorex c.cinereus	MUMC 006800	West Virginia	MERCER	East River Mountain	3450	3719	8054
Sorex c.cinereus	MUMC 006801	West Virginia	MERCER	East River Mountain	3450	3719	8054
Sorex c.cinereus	MUMC 006813	West Virginia	MERCER	East River Mountain	3490	3719	8054
Sorex c.cinereus	MUMC 006818	West Virginia	MERCER	East River Mountain	3490	3719	8054
Sorex c.cinereus	MUMC 006836	West Virginia	MERCER	East River Mountain	2890	3719	8054
Sorex c.cinereus	MUMC 006837	West Virginia	MERCER	East River Mountain	3989	3719	8054
Sorex c.cinereus	CMNH 081913	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004924	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004926	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004931	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004934	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004937	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004938	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004939	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c.cinereus	MUMC 004940	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004942	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004943	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004944	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004945	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004947	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004953	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004954	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004958	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004959	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004979	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004980	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004982	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004985	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 004989	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	MUMC 005001	West Virginia	MONONGALIA	Cooper's Rock	2100	3940	7950
Sorex c.cinereus	CMNH 081914	West Virginia	MONROE	Moncove Lake PHFA	2400	3725	8040
Sorex c.cinereus	CMNH 081915	West Virginia	MONROE	Moncove Lake PHFA	2400	3725	8040
Sorex c.cinereus	CMNH 106642	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106643	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106644	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106645	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106646	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106647	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106648	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106649	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106650	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106651	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106652	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106653	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 106654	West Virginia	MONROE	Moncove Lake PHFA	0	3737	8021
Sorex c.cinereus	CMNH 081916	West Virginia	PENDLETON	Circleville	3840	3842	7935
Sorex c.cinereus	CMNH 081917	West Virginia	PENDLETON	Circleville	3840	3842	7935

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c.cinereus	CMNH 081922	West Virginia	PENDLETON	Circleville	3640	3841	7934
Sorex c.cinereus	CMNH 081923	West Virginia	PENDLETON	Spruce Knob	4862	3842	7932
Sorex c.cinereus	MUMC 004401	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004402	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004403	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004404	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004405	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004407	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004408	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004410	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004411	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004412	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004413	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004415	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004416	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004417	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004418	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004419	West Virginia	POCAHONTAS	Bald Knob	4300	3827	7957
Sorex c.cinereus	MUMC 004430	West Virginia	POCAHONTAS	Bald Knob	4200	3828	7955
Sorex c.cinereus	MUMC 004431	West Virginia	POCAHONTAS	Bald Knob	4200	3828	7955
Sorex c.cinereus	CMNH 080148	West Virginia	POCAHONTAS	Cranberry Glades	3300	0	0
Sorex c.cinereus	MUMC 003001	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 003002	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 003005	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 003006	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 003007	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 003010	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 003012	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 003013	West Virginia	POCAHONTAS	First Fork	4000	3830	7953
Sorex c.cinereus	MUMC 004432	West Virginia	POCAHONTAS	Odey Run	4200	3828	7955
Sorex c.cinereus	MUMC 004433	West Virginia	POCAHONTAS	Odey Run	4200	3828	7955
Sorex c.cinereus	MUMC 004438	West Virginia	POCAHONTAS	Odey Run	4200	3828	7955
Sorex c.cinereus	MUMC 004439	West Virginia	POCAHONTAS	Odey Run	4200	3828	7955

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c.cinereus	MUMC 004440	West Virginia	POCAHONTAS	Odey Run	4200	3828	7955
Sorex c.cinereus	MUMC 004442	West Virginia	POCAHONTAS	Odey Run	4200	3828	7955
Sorex c.cinereus	MUMC 004443	West Virginia	POCAHONTAS	Odey Run	4200	3828	7955
Sorex c.cinereus	MUMC 004423	West Virginia	POCAHONTAS	Shaver's Fork	3860	3826	7957
Sorex c.cinereus	MUMC 004424	West Virginia	POCAHONTAS	Shaver's Fork	3860	3826	7957
Sorex c.cinereus	MUMC 004425	West Virginia	POCAHONTAS	Shaver's Fork	3860	3826	7957
Sorex c.cinereus	MUMC 004426	West Virginia	POCAHONTAS	Shaver's Fork	3860	3826	7957
Sorex c.cinereus	MUMC 004427	West Virginia	POCAHONTAS	Shaver's Fork	3860	3826	7957
Sorex c.cinereus	MUMC 004428	West Virginia	POCAHONTAS	Shaver's Fork	3860	3826	7957
Sorex c.cinereus	MUMC 004429	West Virginia	POCAHONTAS	Shaver's Fork	3860	3826	7957
Sorex c.cinereus	CMNH 081924	West Virginia	PRESTON	Cooper's Rock	1500	3941	7944
Sorex c.cinereus	CMNH 081925	West Virginia	PRESTON	Cooper's Rock	1500	3941	7944
Sorex c.cinereus	CMNH 081926	West Virginia	PRESTON	Cranesville Swamp	2540	3932	7928
Sorex c.cinereus	CMNH 081927	West Virginia	PRESTON	Cranesville Swamp	2540	3932	7928
Sorex c.cinereus	CMNH 081929	West Virginia	PRESTON	Cranesville Swamp	2540	3932	7928
Sorex c.cinereus	MUMC 002519	West Virginia	PUTNAM	Buffalo	700	3838	8154
Sorex c.cinereus	MUMC 002520	West Virginia	PUTNAM	Buffalo	700	3838	8154
Sorex c.cinereus	MUMC 002521	West Virginia	PUTNAM	Buffalo	700	3838	8154
Sorex c.cinereus	MUMC 002915	West Virginia	PUTNAM	Buffalo	700	3838	8154
Sorex c.cinereus	MUMC 002918	West Virginia	PUTNAM	Buffalo	700	3838	8154
Sorex c.cinereus	MUMC 003983	West Virginia	RALEIGH	Fall's Branch	1600	3745	8056
Sorex c.cinereus	MUMC 003984	West Virginia	RALEIGH	Fall's Branch	1600	3745	8056
Sorex c.cinereus	MUMC 003507	West Virginia	RALEIGH	Glade Creek	1820	3746	8102
Sorex c.cinereus	MUMC 003508	West Virginia	RALEIGH	Glade Creek	1820	3746	8102
Sorex c.cinereus	MUMC 003497	West Virginia	RALEIGH	Grandview SP	2400	3751	8104
Sorex c.cinereus	MUMC 003498	West Virginia	RALEIGH	Grandview SP	2400	3751	8104
Sorex c.cinereus	MUMC 005827	West Virginia	RALEIGH	Grandview SP	2360	3759	8104
Sorex c.cinereus	MUMC 005828	West Virginia	RALEIGH	Grandview SP	2360	3759	8104
Sorex c.cinereus	MUMC 005831	West Virginia	RALEIGH	Grandview SP	2400	3749	8104
Sorex c.cinereus	MUMC 005833	West Virginia	RALEIGH	Grandview SP	2400	3750	8104
Sorex c.cinereus	MUMC 005861	West Virginia	RALEIGH	Grandview SP	2360	3750	8104
Sorex c.cinereus	MUMC 002681	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8138
Sorex c.cinereus	MUMC 002682	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8138

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c.cinereus	MUMC 002685	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8131
Sorex c.cinereus	MUMC 003431	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8101
Sorex c.cinereus	MUMC 003445	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8101
Sorex c.cinereus	MUMC 003446	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8101
Sorex c.cinereus	MUMC 003447	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8101
Sorex c.cinereus	MUMC 003448	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8101
Sorex c.cinereus	MUMC 003449	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8101
Sorex c.cinereus	MUMC 003454	West Virginia	RALEIGH	Kate's Wetland	2600	3746	8101
Sorex c.cinereus	MUMC 002688	West Virginia	RANDOLPH	Barton Knob	3920	3837	7955
Sorex c.cinereus	MUMC 002691	West Virginia	RANDOLPH	Barton Knob	3920	3837	7955
Sorex c.cinereus	MUMC 002839	West Virginia	RANDOLPH	Barton Knob	4000	3837	7956
Sorex c.cinereus	MUMC 002842	West Virginia	RANDOLPH	Barton Knob	4000	3837	7956
Sorex c.cinereus	MUMC 002843	West Virginia	RANDOLPH	Barton Knob	4000	3837	7956
Sorex c.cinereus	MUMC 002844	West Virginia	RANDOLPH	Barton Knob	4000	3837	7956
Sorex c.cinereus	MUMC 002846	West Virginia	RANDOLPH	Barton Knob	4000	3837	7956
Sorex c.cinereus	MUMC 003652	West Virginia	RANDOLPH	Barton Knob	4000	3837	7956
Sorex c.cinereus	MUMC 003653	West Virginia	RANDOLPH	Barton Knob	4000	3837	7956
Sorex c.cinereus	MUMC 002972	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002974	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002976	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002977	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002978	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002979	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002980	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002981	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 002982	West Virginia	RANDOLPH	Cheat Bridge	4120	3835	7953
Sorex c.cinereus	MUMC 001424	West Virginia	RANDOLPH	Durbin	3650	3836	7952
Sorex c.cinereus	MUMC 003011	West Virginia	RANDOLPH	First Fork	4120	3835	7953
Sorex c.cinereus	MUMC 002840	West Virginia	RANDOLPH	Lambert Run	3800	3836	7956
Sorex c.cinereus	MUMC 002845	West Virginia	RANDOLPH	Lambert Run	3800	3826	7956
Sorex c.cinereus	CMNH 081931	West Virginia	RANDOLPH	Otter Creek	2440	3858	7937
Sorex c.cinereus	CMNH 081932	West Virginia	RANDOLPH	Otter Creek	2440	3858	7937
Sorex c.cinereus	CMNH 081933	West Virginia	RANDOLPH	Otter Creek	2320	3858	7936

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c.cinereus	CMNH 081934	West Virginia	RANDOLPH	Otter Creek	2320	3858	7936
Sorex c.cinereus	CMNH 081935	West Virginia	RANDOLPH	Otter Creek	2320	3858	7936
Sorex c.cinereus	CMNH 081936	West Virginia	RANDOLPH	Otter Creek	2320	3858	7936
Sorex c.cinereus	CMNH 081937	West Virginia	RANDOLPH	Otter Creek	2320	3858	7936
Sorex c.cinereus	CMNH 081938	West Virginia	RANDOLPH	Otter Creek	2320	3858	7936
Sorex c.cinereus	MUMC 002942	West Virginia	RANDOLPH	Shaver's Fork	3680	3833	7955
Sorex c.cinereus	MUMC 002702	West Virginia	TUCKER	Canaan Valley SP	3240	3902	7927
Sorex c.cinereus	MUMC 002703	West Virginia	TUCKER	Canaan Valley SP	3240	3902	7927
Sorex c.cinereus	MUMC 002704	West Virginia	TUCKER	Canaan Valley SP	3240	3902	7927
Sorex c.cinereus	MUMC 002706	West Virginia	TUCKER	Canaan Valley SP	3240	3902	7927
Sorex c.cinereus	MUMC 002707	West Virginia	TUCKER	Canaan Valley SP	3240	3902	7927
Sorex c.cinereus	MUMC 002714	West Virginia	TUCKER	Canaan Valley SP	3240	3902	7927
Sorex c.cinereus	CMNH 081940	West Virginia	TUCKER	Dolly Sods	3950	3904	7918
Sorex c.cinereus	CMNH 081941	West Virginia	TUCKER	Dolly Sods	3950	3904	7918
Sorex c.cinereus	CMNH 081942	West Virginia	TUCKER	Dolly Sods	3950	3904	7918
Sorex c.cinereus	CMNH 081945	West Virginia	TUCKER	Dolly Sods	3950	3904	7918
Sorex c.cinereus	MUMC 005309	West Virginia	TUCKER	Glade Run	3100	3906	7919
Sorex c.cinereus	MUMC 005310	West Virginia	TUCKER	Glade Run	3100	3906	7919
Sorex c.cinereus	MUMC 005312	West Virginia	TUCKER	Glade Run	3100	3906	7919
Sorex c.cinereus	MUMC 005314	West Virginia	TUCKER	Glade Run	3100	3906	7919
Sorex c.cinereus	CMNH 081928	West Virginia	TUCKER	Laneville Cabin	2620	3858	7924
Sorex c.cinereus	CMNH 081939	West Virginia	TUCKER	Laneville Cabin	2620	3858	7924
Sorex c.cinereus	CMNH 081946	West Virginia	TUCKER	Laneville Cabin	2620	3858	7924
Sorex c.cinereus	CMNH 081948	West Virginia	TUCKER	Laneville Cabin	2620	3858	7924
Sorex c.cinereus	CMNH 106655	West Virginia	WEBSTER	Holly River SP	0	3840	8019
Sorex c. fontinalis	CMNH 045704	Maryland	MONTGOMERY	Bethesda	0	0	0
Sorex c. fontinalis	CMNH 045705	Maryland	MONTGOMERY	Bethesda	0	0	0
Sorex c. fontinalis	USNM 076587	Maryland		Hyattsville	0	0	0
Sorex c. fontinalis	USNM 076593	Maryland		Hyattsville	0	0	0
Sorex c. fontinalis	USNM 076709	Maryland		Hyattsville	0	0	0
Sorex c. fontinalis	USNM 112843	Maryland		Laurel	0	0	0
Sorex c. fontinalis	USNM 186677	Maryland		Sandy Spring	0	0	0
Sorex c. fontinalis	CMNH 039133	Pennsylvania	CHESTER	Chrome	400	0	0

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex c. fontinalis	CMNH 033757	Pennsylvania	YORK	Delta	0	0	0
Sorex c. fontinalis	CMNH 033758	Pennsylvania	YORK	Delta	0	0	0
Sorex c. fontinalis	CMNH 039137	Pennsylvania	LANCASTER	March Forge	0	0	0
Sorex c. fontinalis	CMNH 033756	Pennsylvania	BEDFORD	New Paris	0	0	0
Sorex c. fontinalis	CMNH 037288	Pennsylvania	CHESTER	Nottingham	0	0	0
Sorex c. fontinalis	CMNH 033755	Pennsylvania	BEDFORD	Osterburg	0	0	0
Sorex c. fontinalis	CMNH 039150	Pennsylvania	LANCASTER	Pequea	180	0	0
Sorex c. fontinalis	CMNH 039152	Pennsylvania	LANCASTER	Pequea	180	0	0
Sorex c. fontinalis	CMNH 039153	Pennsylvania	LANCASTER	Pequea	180	0	0
Sorex c. fontinalis	CMNH 039154	Pennsylvania	LANCASTER	Pequea	180	0	0
Sorex c. fontinalis	CMNH 039156	Pennsylvania	LANCASTER	Pequea	0	0	0
Sorex c. fontinalis	CMNH 037253	Pennsylvania	SCHUYIKILL	Ravine	0	0	0
Sorex c. fontinalis	CMNH 037258	Pennsylvania	LEHIGH	Slatington	0	0	0
Sorex c. fontinalis	CMNH 037252	Pennsylvania	SCHUYIKILL	Tremont	0	0	0
Sorex c. fontinalis	CMNH 037277	Pennsylvania	LANCASTER	Wrightsdale	0	0	0
Sorex c. fontinalis	CU 011965	West Virginia	HAMPSHIRE	Romney	800	0	0
Sorex c. fontinalis	CU 011966	West Virginia	HAMPSHIRE	Romney	800	0	0
Sorex l. longirostris	CMNH 055243	Georgia	QUITMAN	Georgetown	0	0	0
Sorex l. longirostris	USNM 151738	Maryland	CALVERT	Chesapeake Beach	0	0	0
Sorex l. longirostris	USNM 514943	Maryland	CHARLES	Nanjoy	0	0	0
Sorex l. longirostris	CMNH 055245	South Carolina	CHARLESTON	Coffee Break Swamp	0	0	0
Sorex l. longirostris	CMNH 059713	South Carolina	CHARLESTON	Coffee Break Swamp	0	0	0
Sorex l. longirostris	CMNH 059714	South Carolina	CHARLESTON	Coffee Break Swamp	0	0	0
Sorex l. longirostris	CMNH 092583	South Carolina	AIKEN	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092584	South Carolina	AIKEN	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092585	South Carolina	AIKEN	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092586	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092588	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092589	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092591	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092593	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092594	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092595	South Carolina	BARNWELL	Savannah River	0	0	0

Taxon	Catalog number	State	County	Locality	Elevation'	Latitude	Longitude
Sorex l. longirostris	CMNH 092597	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092598	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092599	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092601	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 092603	South Carolina	BARNWELL	Savannah River	0	0	0
Sorex l. longirostris	CMNH 070858	Virginia	CAMPBELL	Brookneal	0	0	0
Sorex l. longirostris	USNM 278683	Virginia		Burke	0	0	0
Sorex l. longirostris	USNM 087190	Virginia		Fall's Church	0	0	0
Sorex l. longirostris	CMNH 060559	Virginia	NEW KENT	Lanexa	0	0	0
Sorex l. longirostris	USNM 266304	Virginia		Seward Forest	0	0	0
Sorex l. longirostris	USNM 266305	Virginia		Seward Forest	0	0	0
Sorex l. longirostris	USNM 283624	Virginia		Shenandoah NP	0	0	0
Sorex l. longirostris	USNM 290472	Virginia		Shenandoah NP	0	0	0
Sorex l. longirostris	USNM 290473	Virginia		Shenandoah NP	0	0	0
Sorex l. longirostris	USNM 265551	Virginia	AMELIA		0	0	0
Sorex l. longirostris	USNM 265553	Virginia	AMELIA		0	0	0
Sorex l. longirostris	USNM 320408	Virginia	CULPEPPER		0	0	0
Sorex l. longirostris	USNM 526835	Virginia	ESSEX		0	0	0
Sorex l. longirostris	USNM 526838	Virginia	ESSEX		0	0	0
Sorex l. longirostris	USNM 565900	Virginia	FAIRFAX		0	0	0
Sorex l. longirostris	USNM 565903	Virginia	FAIRFAX		0	0	0
Sorex l. longirostris	USNM 565904	Virginia	FAIRFAX		0	0	0
Sorex l. longirostris	USNM 565905	Virginia	FAIRFAX		0	0	0
Sorex l. longirostris	CMNH 080163	West Virginia	ROANE	Walton	720	3835	8124

APPENDIX II

List of character measurements for all specimens

Taxon	Catalog number	Sex	Age	Date collected	TotL	TalL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. c.	CMNH 080148	.	1	1-Oct-61	97	42	11	3.8	16.5	8	4.9	2.86	5	3.71	1.29	2.29	3.71	0	0	0
S. c. c.	CMNH 081904	F	2	7-Aug-86	90	40	12	3	15.5	7.9	5	2.89	4.64	3.7	1.27	2	3.64	0.43	0.37	0.34
S. c. c.	CMNH 081905	M	2	5-Aug-86	85	43	12	3	0	7.7	4.6	2.71	4.71	3.57	1.21	2.14	3.71	0	0	0
S. c. c.	CMNH 081906	F	2	6-Aug-86	94	40	13	3	15.5	0	4.8	2.86	4.57	3.71	1.29	2.14	3.57	0	0	0
S. c. c.	CMNH 081907	M	1	7-Aug-86	100	44	13	3	15.7	7.6	4.8	2.71	4.86	3.57	1.26	2.14	3.74	0.44	0.41	0.29
S. c. c.	CMNH 081908	F	1	9-Aug-86	100	42	12	3	15.9	7.6	4.9	2.61	4.59	3.71	1.29	2.11	3.64	0.44	0.41	0.29
S. c. c.	CMNH 081909	M	2	8-Aug-86	95	41	12	2.5	15.7	7.5	4.7	2.79	4.67	3.73	1.29	2.11	3.71	0.43	0.4	0.31
S. c. c.	CMNH 081910	M	3	8-Aug-86	92	38	12	4	15.7	7.5	4.6	2.63	4.96	3.59	1.24	2.01	3.74	0.43	0.36	0.29
S. c. c.	CMNH 081911	F	1	9-Aug-86	91	37	12	3	15.2	7.6	4.8	2.5	4.57	3.57	1.29	2.01	3.5	0.41	0.39	0.29
S. c. c.	CMNH 081912	M	3	9-Aug-86	102	38	12	4	15.7	7.6	4.8	2.69	4.8	3.73	1.26	2.06	3.5	0.44	0.41	0.29
S. c. c.	CMNH 081913	M	3	28-May-86	97	36	11	4.8	15.7	7.7	4.6	2.7	4.76	3.66	1.29	2.01	3.76	0.43	0.34	0.31
S. c. c.	CMNH 081914	M	1	11-Aug-86	78	38	11	2	15.3	7.4	5.1	2.71	4.57	3.43	1.14	2	3.57	0	0	0
S. c. c.	CMNH 081915	M	1	12-Aug-86	85	41	12	2.5	15.4	7.8	4.7	2.71	4.57	3.43	1.21	2	3.5	0	0	0
S. c. c.	CMNH 081916	M	3	16-Jul-86	94	39	12	4.4	15.3	7.7	4.8	2.86	4.74	3.73	1.24	2.09	3.71	0.44	0.41	0.29
S. c. c.	CMNH 081917	M	1	16-Jul-86	79	31	11	2.6	14.4	7.5	5.2	3	4.29	3.64	1.21	1.86	3.43	0	0	0
S. c. c.	CMNH 081922	F	3	19-Jul-86	112	42	12	3.8	15.4	7.4	4.6	2.74	4.77	3.76	1.3	2.01	3.71	0.44	0.41	0.27
S. c. c.	CMNH 081923	F	3	19-Jul-86	110	45	12	3.6	15.6	7.4	4	2.87	4.89	3.73	1.17	2.04	3.69	0.49	0.43	0.3
S. c. c.	CMNH 081924	M	3	29-May-86	96	35	11	4.2	15.2	7.5	4.8	2.61	4.77	3.57	1.21	2.03	3.89	0.43	0.4	0.29
S. c. c.	CMNH 081925	M	3	31-May-86	91	39	12	4.3	14.9	7.5	4.6	2.6	4.64	3.59	1.19	1.93	3.53	0.46	0.34	0.3
S. c. c.	CMNH 081926	M	3	3-Jun-86	104	42	12	4.7	16.3	7.7	4.9	2.66	5	3.83	1.26	2.21	3.86	0.46	0.43	0.31
S. c. c.	CMNH 081927	M	3	3-Jun-86	101	42	12	4.8	15.9	7.6	4.7	2.86	4.96	3.71	1.27	2.17	3.71	0.44	0.41	0.37
S. c. c.	CMNH 081928	.	2	28-Jul-86	0	0	0	0	15.5	7.6	4.7	2.74	4.74	3.57	1.16	2.03	3.69	0.51	0.39	0.19
S. c. c.	CMNH 081929	F	1	4-Jun-86	89	39	11	3.4	15.9	7.8	4.6	2.79	4.74	3.79	1.23	2.16	3.7	0.43	0.43	0.3
S. c. c.	CMNH 081931	F	1	29-Jul-86	95	38	12	3.6	15.8	7.7	5.1	2.67	4.77	3.71	1.26	2.03	3.73	0.43	0.43	0.29
S. c. c.	CMNH 081932	M	1	30-Jul-86	98	40	12	3.6	15.5	7.8	5.3	2.7	4.71	3.69	1.24	2.11	3.6	0.46	0.36	0.31
S. c. c.	CMNH 081933	F	3	31-Jul-86	88	42	11	4	15.9	8	5	2.91	4.96	3.86	1.21	2.13	3.79	0.46	0.43	0.29
S. c. c.	CMNH 081934	F	2	4-Aug-86	88	39	11	3	15.9	7.7	4.4	2.77	4.91	3.76	1.24	2.26	3.79	0.46	0.43	0.31
S. c. c.	CMNH 081935	M	1	31-Jul-86	97	42	12	0	16	8.1	5.4	2.87	4.73	3.6	1.27	2.17	3.57	0.43	0.43	0.31
S. c. c.	CMNH 081936	.	1	31-Jul-86	101	44	12	0	15.6	7.9	5.2	2.74	4.64	3.6	1.17	2.13	3.6	0.44	0.4	0.29
S. c. c.	CMNH 081937	F	3	31-Jul-86	104	38	12	6	16	7.9	4.8	2.74	5.03	3.71	1.31	2.14	3.84	0.46	0.37	0.3
S. c. c.	CMNH 081938	M	2	3-Aug-86	104	44	13	3.8	16.2	8.1	5.5	2.77	4.8	3.66	1.2	2.17	3.69	0.46	0.37	0.31
S. c. c.	CMNH 081939	F	1	28-Jul-86	0	0	0	0	15.6	8.1	5.1	2.71	4.86	3.57	1.29	2.14	3.57	0	0	0

Taxon	Catalog number	Sex	Age	Date collected	TotL	TalL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. c.	CMNH 081940	F	1	23-Jul-86	95	42	12	3	15.6	7.5	4.9	2.71	4.71	3.71	1.29	2.14	3.57	0	0	0
S. c. c.	CMNH 081941	F	1	25-Jul-86	88	40	12	3.5	15.7	7.7	5	3	4.86	3.71	1.29	2.14	3.71	0	0	0
S. c. c.	CMNH 081942	M	1	24-Jul-86	95	40	13	3.2	15.6	7.6	4.9	2.57	4.71	3.57	1.29	2.14	3.71	0	0	0
S. c. c.	CMNH 081945	F	1	26-Jul-86	101	42	13	3.5	15.9	7.7	5.1	2.86	4.86	3.71	1.21	2.14	3.86	0	0	0
S. c. c.	CMNH 081946	F	1	26-Jul-86	86	39	11	3	15.8	7.4	5.1	2.86	4.71	3.71	1.21	2.14	3.71	0	0	0
S. c. c.	CMNH 081948	.	1	28-Jul-86	95	41	11	3	15.3	7.9	5.1	2.71	4.57	3.57	1.21	2	3.43	0	0	0
S. c. c.	CMNH 106642	M	2	11-Jul-90	101	38	11	4	15.1	7.5	4.5	2.64	4.73	3.57	1.2	2	3.6	0.44	0.36	0.27
S. c. c.	CMNH 106643	M	1	15-Jul-90	90	38	11	3	15.5	7.7	5.2	2.6	4.61	3.56	1.21	2	3.66	0.4	0.36	0.29
S. c. c.	CMNH 106644	M	2	15-Jul-90	103	41	11	5	15.9	7.9	4.9	2.79	4.79	3.71	1.16	2.14	3.73	0.44	0.37	0.31
S. c. c.	CMNH 106645	F	3	14-Jul-90	99	38	11	5	15.3	7.5	4.5	2.76	4.64	3.67	1.21	2	3.56	0.41	0.41	0.29
S. c. c.	CMNH 106646	M	3	14-Jul-90	97	36	11	4	15.3	7.7	4.7	2.77	4.76	3.67	1.23	2	3.66	0.41	0.39	0.31
S. c. c.	CMNH 106647	M	1	14-Jul-90	94	38	10	4	15.5	7.9	5.1	2.86	4.64	3.57	1.29	1.89	3.64	0.43	0.36	0.3
S. c. c.	CMNH 106648	F	2	14-Jul-90	104	40	11	5	15.3	7.7	4.4	2.73	5.01	3.6	1.16	1.99	3.66	0.49	0.39	0.31
S. c. c.	CMNH 106649	F	2	14-Jul-90	96	36	11	5	15.1	7.6	4.6	2.73	4.61	3.57	1.14	2.09	3.47	0.4	0.41	0.29
S. c. c.	CMNH 106650	M	1	14-Jul-90	100	42	11	3	15.5	7.7	4.8	2.71	4.71	3.57	1.21	1.86	3.64	0.43	0.4	0.29
S. c. c.	CMNH 106651	M	1	14-Jul-90	95	40	11	3	15.5	7.5	4.7	2.43	4.61	3.57	1.21	1.93	3.5	0.4	0.39	0.29
S. c. c.	CMNH 106652	M	1	14-Jul-90	94	38	11	3	15.9	7.7	5.1	2.5	4.71	3.6	1.26	1.86	3.64	0.4	0.36	0.26
S. c. c.	CMNH 106653	M	3	15-Jul-90	103	40	11	5	15.2	7.5	4.5	2.61	4.86	3.57	1.21	2	3.59	0.46	0.41	0.29
S. c. c.	CMNH 106654	M	1	15-Jul-90	94	38	11	4	15.4	7.4	4.7	2.64	4.71	3.57	1.19	1.93	3.43	0.44	0.39	0.29
S. c. c.	CMNH 106655	F	3	16-Aug-90	98	40	12	4	15.3	7.4	4.6	2.86	4.67	3.71	1.14	1.97	3.59	0.43	0.39	0.29
S. c. c.	MUMC 001424	M	3	2-Aug-58	105	41	0	5.4	16.2	8.1	4.7	2.89	4.91	3.74	1.31	1.97	3.66	0.49	0.41	0.29
S. c. c.	MUMC 002204	.	2	9-Sep-79	84	30	9	0	14.6	7.3	4.7	2.6	4.77	3.73	1.26	1.97	3.64	0.4	0.33	0.3
S. c. c.	MUMC 002519	F	3	14-Apr-88	84	29	10	0	14.6	7.2	4.1	2.81	4.49	3.6	1.17	1.64	3.5	0.36	0.37	0.23
S. c. c.	MUMC 002520	M	3	14-Apr-88	80	29	11	0	14.1	7.2	4.3	2.71	4.49	3.57	1.23	1.57	3.59	0.37	0.36	0.29
S. c. c.	MUMC 002521	M	3	14-Apr-88	80	31	11	0	14.6	7.5	4.4	2.73	4.69	3.74	1.29	1.71	3.63	0.41	0.39	0.26
S. c. c.	MUMC 002681	M	3	27-Apr-89	0	34	11	0	14.7	7.5	4.4	2.66	4.51	3.66	1.14	1.8	3.44	0.41	0.39	0.29
S. c. c.	MUMC 002682	M	3	27-Apr-89	89	37	11	0	14.9	7.3	4.5	2.57	4.69	3.71	1.24	1.73	3.66	0.41	0.4	0.24
S. c. c.	MUMC 002685	M	3	27-Apr-89	89	39	11	0	15	7.5	4.7	2.76	4.64	3.59	1.21	1.79	3.66	0.41	0.43	0.26
S. c. c.	MUMC 002688	M	3	25-Apr-89	89	37	12	0	15.2	7.8	5	2.81	4.69	3.63	1.27	1.79	3.66	0.43	0.4	0.29
S. c. c.	MUMC 002691	M	3	25-Apr-89	90	40	12	0	15.7	7.7	4.7	2.89	4.59	3.67	1.27	1.86	3.66	0.41	0.41	0.26
S. c. c.	MUMC 002702	M	3	15-Sep-88	90	38	11	0	15.2	7	4.3	2.87	4.77	3.56	0.96	2.03	3.49	0.43	0.39	0.3
S. c. c.	MUMC 002703	M	3	15-Sep-88	88	37	12	0	15.7	7.5	4.6	2.86	4.79	3.5	1.11	2.04	3.57	0.46	0.39	0.29

Taxon	Catalog number	Sex	Age	Date collected	TotL	TalL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. c.	MUMC 002704	M	2	15-Sep-88	83	37	12	0	15	7.5	4.7	2.77	4.66	3.71	1.17	2.04	3.6	0.44	0.43	0.26
S. c. c.	MUMC 002706	F	2	15-Sep-88	89	39	12	0	15.1	7.3	4.5	2.77	4.8	3.6	0	2.11	3.69	0.43	0.44	0.3
S. c. c.	MUMC 002707	F	1	15-Sep-88E	84	35	11	0	15.5	7.2	4.7	2.73	4.86	3.59	1.16	2.19	3.71	0.46	0.41	0.29
S. c. c.	MUMC 002714	F	1	15-Sep-88	90	35	11	0	15.6	7.7	4.6	2.79	4.9	3.73	1.2	2.11	3.89	0.44	0.43	0.29
S. c. c.	MUMC 002770	M	1	25-May-89	87	36	11	0	14.8	7.3	4.3	2.6	4.69	3.66	1.14	1.96	3.56	0.4	0.4	0.27
S. c. c.	MUMC 002839	M	3	10-Jun-89	98	39	11	4.1	15.1	7.8	4.7	2.79	4.67	3.57	1.19	1.74	3.63	0.39	0.41	0.26
S. c. c.	MUMC 002840	M	2	11-Jun-89	106	42	11	5	16	7.8	4.9	2.67	4.7	3.57	1.29	1.89	3.57	0.43	0.39	0.29
S. c. c.	MUMC 002842	M	3	12-Jun-89	92	39	11	4	15.7	7.6	4.9	2.86	4.63	3.54	1.2	1.74	3.6	0.41	0.37	0.3
S. c. c.	MUMC 002843	M	3	12-Jun-89	96	42	12	4	16.4	8	5.1	2.8	5	3.63	1.17	1.96	3.77	0.43	0.41	0.3
S. c. c.	MUMC 002844	M	3	7-Jun-89	99	35	12	4	15	7.6	4.9	2.64	4.69	3.59	1.27	1.86	3.5	0.43	0.37	0.3
S. c. c.	MUMC 002845	F	2	10-Jun-89	98	35	12	3	16.1	7.6	5.3	2.74	4.94	3.57	1.27	1.96	3.71	0.46	0.36	0.33
S. c. c.	MUMC 002846	M	3	10-Jun-89	93	37	11	5	15.7	7.8	4.6	2.87	4.97	3.74	1.21	1.93	3.71	0.43	0.4	0.3
S. c. c.	MUMC 002915	.	1	18-May-88	77	29	11	0	14.6	7.6	4.7	2.57	4.43	3.64	1.19	1.9	3.46	0.34	0.41	0.27
S. c. c.	MUMC 002918	.	3	4-May-88	77	30	12	0	14.7	7.1	4	2.6	4.57	3.73	1.27	1.89	3.64	0.39	0.41	0.26
S. c. c.	MUMC 002942	M	3	12-Jul-89	93	38	12	3.8	15.5	7.9	4.9	2.89	4.84	3.79	1.36	1.97	3.76	0.47	0.34	0.3
S. c. c.	MUMC 002972	F	1	28-Jul-89	98	41	13	3.2	15.4	7.7	5.1	2.73	4.76	3.7	1.23	2.26	3.66	0.47	0.44	0.27
S. c. c.	MUMC 002974	M	2	29-Jul-89	103	44	13	4.4	15.6	7.9	5.1	2.79	4.93	3.83	1.24	2.01	3.84	0.4	0.41	0.26
S. c. c.	MUMC 002976	M	2	1-Aug-89	100	39	13	4.4	15.4	8	4.7	2.86	4.89	3.71	1.26	2.04	3.76	0.47	0.43	0.29
S. c. c.	MUMC 002977	M	3	29-Jul-89	99	41	12	5	14.9	7.7	4.7	2.5	4.51	3.63	1.16	1.74	3.57	0.41	0.29	0.29
S. c. c.	MUMC 002978	M	3	29-Jul-89	95	41	12	5	15.8	7.9	4.8	2.59	4.79	3.67	1.26	1.86	3.77	0.43	0.34	0.29
S. c. c.	MUMC 002979	F	3	29-Jul-89	101	44	11	3.6	16.2	8	5.3	2.83	4.94	3.61	0.91	2	3.69	0.51	0.43	0.3
S. c. c.	MUMC 002980	F	3	29-Jul-89	102	40	12	6.8	15.7	8.1	4.8	2.79	4.73	3.66	1.16	2.01	3.69	0.41	0.43	0.29
S. c. c.	MUMC 002981	M	3	28-Jul-89	100	39	13	4.1	15.5	7.8	4.7	2.76	4.94	3.83	1.26	1.97	3.83	0.41	0.43	0.26
S. c. c.	MUMC 002982	F	1	28-Jul-89	98	42	6	3.6	16.2	8.1	5.2	2.97	4.89	3.79	1.17	2.13	3.76	0.43	0.41	0.27
S. c. c.	MUMC 003001	M	3	23-Jun-89	95	40	12	4.5	15.8	7.9	4.9	2.96	4.86	3.71	1.17	1.74	3.79	0.41	0.34	0.24
S. c. c.	MUMC 003002	F	2	23-Jun-89	95	39	12	5.7	16	8	4.8	2.79	4.96	3.69	1.2	2	3.74	0.41	0.41	0.26
S. c. c.	MUMC 003005	F	2	24-Jun-89	113	40	11	5.2	15.8	7.8	4.7	2.73	4.89	3.61	1.19	1.89	3.63	0.46	0.43	0.24
S. c. c.	MUMC 003006	M	1	24-Jun-89	99	40	11	3.7	16.1	8.2	5.2	2.8	4.8	3.63	1.26	1.96	3.67	0.43	0.41	0.31
S. c. c.	MUMC 003007	M	1	24-Jun-89	100	41	12	4.2	16.7	8.4	5.4	3.17	4.99	3.67	1.26	2	3.71	0.46	0.4	0.27
S. c. c.	MUMC 003010	F	3	27-Jul-89	100	40	11	5	15.9	7.8	4.7	2.66	4.83	3.51	1.24	1.94	3.63	0.43	0.4	0.31
S. c. c.	MUMC 003011	M	3	29-Jul-89	101	39	13	0	15.4	7.5	4.5	2.59	4.86	3.6	1.2	1.87	3.57	0.44	0.4	0.31
S. c. c.	MUMC 003012	M	3	28-Jul-89	100	36	12	0	15.8	7.7	4.6	2.63	4.79	3.67	1.29	1.76	3.64	0.43	0.41	0.3

Taxon	Catalog number	Sex	Age	Date collected	TotL	TalL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. c.	MUMC 003013	M	3	28-Jul-89	100	38	12	0	15.4	7.6	4.7	2.69	4.66	3.59	1.21	1.86	3.57	0.43	0.41	0.26
S. c. c.	MUMC 003431	F	3	6-Jul-89	89	36	12	0	14.9	7.6	4.7	2.54	4.54	3.59	1.11	1.79	3.43	0.4	0.41	0.14
S. c. c.	MUMC 003445	M	3	7-Jun-89	93	35	12	0	15.3	7.7	4.5	2.61	4.27	3.66	1.19	2	3.71	0.43	0.36	0.23
S. c. c.	MUMC 003446	M	2	7-Jun-89	87	34	12	0	15.6	7.6	5	2.83	4.79	3.79	1.2	2.07	3.71	0.41	0.36	0.29
S. c. c.	MUMC 003447	.	1	7-Jun-89	85	37	12	0	15.3	7.6	5.1	2.57	4.67	3.64	1.21	2.04	3.66	0.43	0.43	0.31
S. c. c.	MUMC 003448	M	2	7-Jun-89	89	34	12	0	15.5	7.5	4.6	2.61	4.71	3.8	1.2	2.11	3.67	0.49	0.46	0.29
S. c. c.	MUMC 003449	.	1	7-Jun-89	90	41	12	0	16.1	7.6	5.3	2.6	4.9	3.74	1.19	2.26	3.77	0.46	0.41	0.3
S. c. c.	MUMC 003454	.	1	19-Jul-89	83	34	12	0	15.2	7.8	5.4	2.77	4.6	3.74	0	2.04	3.66	0.49	0.39	0.26
S. c. c.	MUMC 003489	.	1	8-Jun-89	75	31	11	0	15.2	7.7	5	2.83	4.57	3.54	1.2	1.96	3.67	0.4	0.39	0.23
S. c. c.	MUMC 003497	.	1	8-Aug-89	85	43	11	0	15.8	7.9	5.7	2.73	4.77	3.53	1.2	2.14	3.66	0.47	0.41	0.24
S. c. c.	MUMC 003498	M	3	8-Aug-89	85	36	12	0	14.8	7.6	4.6	2.57	4.5	3.59	1.17	1.86	3.43	0.43	0.39	0.29
S. c. c.	MUMC 003507	F	1	8-Jul-89	92	38	12	2.8	15.8	7.6	4.8	2.71	4.76	3.71	1.29	1.86	3.74	0.44	0.39	0.29
S. c. c.	MUMC 003508	M	2	8-Jul-89	92	38	11	2.5	15.3	7.8	5.1	2.71	4.5	3.54	1.17	1.79	3.57	0.41	0.4	0.14
S. c. c.	MUMC 003652	M	3	5-Jun-89	89	37	13	0	16.1	7.9	4.7	2.86	4.67	3.57	1.21	2	3.66	0.43	0.4	0.26
S. c. c.	MUMC 003653	M	3	7-Jun-89	90	37	12	0	15.3	8	4.7	2.83	4.57	3.73	1.23	1.79	3.63	0.4	0.36	0.29
S. c. c.	MUMC 003807	.	1	21-Oct-89	94	37	12	0	15.4	7.6	5.1	2.74	4.63	3.69	1.23	2.14	3.64	0.43	0.41	0.29
S. c. c.	MUMC 003808	.	1	21-Oct-89	87	34	11	0	14.8	7.9	4.9	2.73	4.49	3.6	1.21	1.93	3.57	0.4	0.41	0.26
S. c. c.	MUMC 003809	F	1	21-Oct-89	82	32	12	0	14.7	7.3	5	2.63	4.4	3.57	1.23	1.93	3.5	0.44	0.29	0.27
S. c. c.	MUMC 003869	.	1	21-Oct-89	84	38	12	0	14.8	7.3	5.8	2.53	4.53	3.54	1.14	1.97	3.54	0.43	0.4	0.29
S. c. c.	MUMC 003870	.	1	21-Oct-89	89	39	12	0	15.7	8	5.2	2.8	4.76	3.61	1.24	2.03	3.66	0.43	0.4	0.29
S. c. c.	MUMC 003873	.	1	21-Oct-89	94	37	13	0	15.6	8	5.4	2.6	4.81	3.63	1.26	2.14	3.71	0.44	0.4	0.29
S. c. c.	MUMC 003973	.	1	4-Nov-89	80	32	12	0	14.7	7.2	4.8	1.8	4.61	3.69	1.24	2.03	3.69	0.41	0.4	0.3
S. c. c.	MUMC 003974	.	1	4-Nov-89	87	33	12	0	15.1	7.6	4.8	2.79	4.71	3.6	1.21	2.11	3.66	0.44	0.41	0.27
S. c. c.	MUMC 003983	.	1	4-Nov-89	80	35	11	0	14.6	7.4	4.9	2.66	4.43	3.57	0	1.79	3.5	0.4	0.34	0.2
S. c. c.	MUMC 003984	.	1	4-Nov-89	92	37	12	0	15	7.9	5.1	2.69	4.64	3.6	1.17	1.91	3.64	0.41	0.34	0.24
S. c. c.	MUMC 004116	.	1	1-Oct-89	90	38	12	0	15.5	7.8	5	2.73	5	3.57	1.19	2.16	3.74	0.47	0.39	0.29
S. c. c.	MUMC 004180	M	1	1-Oct-89	80	31	12	0	15.3	7.8	4.9	2.73	4.66	3.76	1.24	1.87	3.76	0.41	0.36	0.23
S. c. c.	MUMC 004349	.	1	17-May-90	88	34	11	2.6	15.5	7.6	5	2.6	4.57	3.7	1.29	1.89	3.61	0.39	0.36	0.2
S. c. c.	MUMC 004401	F	3	5-Jul-90	91	38	12	5.2	15.9	8	5	2.86	4.77	3.86	1.24	1.84	3.74	0.41	0.41	0.26
S. c. c.	MUMC 004402	F	1	6-Jul-90	97	42	13	3.2	16.1	8	5.3	2.69	4.77	3.69	1.23	1.99	3.66	0.43	0.36	0.29
S. c. c.	MUMC 004403	F	1	11-Jul-90	93	43	12	3.3	16.3	8.1	5.5	2.66	4.79	3.76	1.29	1.83	3.69	0.4	0.36	0.24
S. c. c.	MUMC 004404	F	1	12-Jul-90	96	42	12	3.8	15.5	7.7	5.1	2.61	4.69	3.7	1.29	1.86	3.43	0.41	0.41	0.3

Taxon	Catalog number	Sex	Age	Date collected	TotL	TalL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. c.	MUMC 004405	F	1	11-Jul-90	94	41	13	3.2	15.7	7.9	5.5	2.66	4.83	3.6	1.26	1.86	3.71	0.44	0.39	0.3
S. c. c.	MUMC 004407	M	1	3-Aug-90	103	45	13	3.3	16.1	8.1	5.2	2.67	4.93	3.6	1.27	1.94	3.71	0.4	0.43	0.31
S. c. c.	MUMC 004408	F	1	5-Aug-90	93	43	12	3.5	16.5	8	5.5	2.71	5	3.71	1.29	2	3.93	0.44	0.41	0.31
S. c. c.	MUMC 004410	M	3	7-Jul-90	95	39	12	3.5	15.4	7.9	5	2.67	4.8	3.57	1.24	1.83	3.61	0.43	0.41	0.31
S. c. c.	MUMC 004411	F	1	13-Jul-90	95	41	12	3.8	15.8	8	5.1	2.86	4.77	3.76	1.19	1.87	3.57	0.46	0.4	0.3
S. c. c.	MUMC 004412	F	1	13-Jul-90	97	42	11	4	16.2	7.8	5.2	2.6	4.93	3.64	1.26	2.04	3.71	0.46	0.43	0.33
S. c. c.	MUMC 004413	M	1	13-Jul-90	95	40	11	3.6	16.3	8.1	5.5	2.71	4.87	3.73	1.27	2.01	3.71	0.43	0.43	0.31
S. c. c.	MUMC 004415	M	3	29-Jul-90	92	39	11	4	16.2	7.7	4.9	2.86	4.8	3.54	1.2	1.94	3.7	0.44	0.4	0.31
S. c. c.	MUMC 004416	M	3	11-Jul-90	101	41	14	4.2	16	7.7	4.7	2.79	4.94	3.71	1.34	1.94	3.76	0.44	0.43	0.3
S. c. c.	MUMC 004417	M	3	11-Jul-90	98	44	14	4.8	15.4	7.9	4.9	2.86	4.57	3.47	1.29	1.76	3.63	0.43	0.34	0.21
S. c. c.	MUMC 004418	F	1	12-Jul-90	100	45	14	3.4	16.1	8.1	5.3	2.71	4.86	3.61	1.2	2.03	3.71	0.44	0.43	0.31
S. c. c.	MUMC 004419	M	3	27-Jul-90	91	42	14	4.2	15.7	7.8	4.6	2.79	4.8	3.69	1.34	1.79	3.74	0.43	0.4	0.29
S. c. c.	MUMC 004423	M	3	10-Jul-90	95	40	13	4.6	15.6	7.8	4.9	2.67	4.93	3.74	1.31	1.79	3.77	0.41	0.39	0.27
S. c. c.	MUMC 004424	M	2	11-Jul-90	98	39	12	4	16	7.9	5	2.86	4.97	3.6	0	1.96	3.64	0.46	0.41	0.27
S. c. c.	MUMC 004425	M	2	11-Jul-90	99	40	11	4	15.1	7.5	4.6	2.6	4.64	3.6	1.29	1.76	3.57	0.41	0.36	0.27
S. c. c.	MUMC 004426	F	3	11-Jul-90	100	39	11	4.6	15.5	7.8	4.9	2.81	4.66	3.73	1.3	1.83	3.66	0.44	0.41	0.27
S. c. c.	MUMC 004427	M	3	23-Jul-90	102	41	12	0	15.7	7.8	4.5	2.57	4.83	3.59	1.23	1.97	3.6	0.43	0.41	0.23
S. c. c.	MUMC 004428	M	3	6-Jul-90	97	40	13	4	15.3	7.7	4.8	2.71	4.57	3.63	1.14	1.69	3.61	0.37	0.39	0.26
S. c. c.	MUMC 004429	M	2	8-Jul-90	106	45	14	4.2	16.4	7.7	4.8	2.86	5.04	3.73	1.27	2	3.83	0.44	0.31	0.29
S. c. c.	MUMC 004430	F	1	2-Aug-90	99	45	13	3.5	16.1	8	5.3	2.71	4.93	3.71	1.24	2	3.79	0.43	0.4	0.26
S. c. c.	MUMC 004431	F	1	2-Aug-90	94	39	12	3.4	16.4	7.7	5.1	2.64	5	3.59	1.21	2.07	3.73	0.47	0.43	0.29
S. c. c.	MUMC 004432	M	2	1-Aug-90	96	42	13	3.8	16.4	8	5.5	2.57	4.93	3.76	1.3	2.29	3.64	0.44	0.43	0.34
S. c. c.	MUMC 004433	F	3	2-Aug-90	108	42	13	4.6	16	7.9	4.7	2.74	4.79	3.61	1.21	2.14	3.54	0.43	0.43	0.3
S. c. c.	MUMC 004438	F	1	3-Aug-90	91	36	13	3	15.7	7.9	5.3	2.71	4.73	3.6	1.23	2.01	3.64	0.43	0.34	0.23
S. c. c.	MUMC 004439	F	1	30-Jul-90	92	40	11	3.6	15.6	7.9	5	2.64	4.66	3.6	1.24	2.14	3.63	0.4	0.37	0.29
S. c. c.	MUMC 004440	F	3	31-Jul-90	103	43	11	4.4	15.8	7.6	4.8	2.74	5.09	3.64	1.24	2.14	3.83	0.41	0.41	0.27
S. c. c.	MUMC 004442	F	1	31-Jul-90	97	42	12	3.2	15.9	8.3	5.4	2.6	4.83	3.6	1.2	2.11	3.71	0.4	0.4	0.29
S. c. c.	MUMC 004443	F	2	31-Jul-90	94	39	12	3	15.4	7.9	5.2	2.76	4.69	3.69	1.23	2.14	3.57	0.41	0.39	0.26
S. c. c.	MUMC 004924	F	1	26-Jun-90	98	38	12	0	15.6	7.9	5	2.69	4.69	3.64	1.2	2	3.73	0.4	0.4	0.19
S. c. c.	MUMC 004926	M	1	15-May-89	94	38	13	0	15.6	7.5	4.6	2.57	4.8	3.5	1.17	2.01	3.6	0.41	0.41	0.27
S. c. c.	MUMC 004931	M	3	1-May-89	103	41	12	0	15.6	7.9	4.7	2.6	4.74	3.64	1.21	2.03	3.61	0.44	0.37	0.21
S. c. c.	MUMC 004934	F	3	26-Jun-89	95	36	12	0	15.3	7.4	4.5	2.6	4.7	3.66	1.17	2	3.69	0.41	0.39	0.26

Taxon	Catalog number	Sex	Age	Date collected	TotL	TalL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. c.	MUMC 004937	F	3	8-May-90	94	36	12	0	15.2	7.5	4.5	2.61	4.67	3.6	1.17	2.01	3.51	0.41	0.41	0.27
S. c. c.	MUMC 004938	F	1	15-May-90	103	41	13	0	15.5	7.6	4.6	2.66	4.61	3.54	1.23	2	3.54	0.41	0.43	0.17
S. c. c.	MUMC 004939	M	2	15-May-90	98	41	13	0	15.3	7.4	4.6	2.51	4.71	3.57	1.24	2	3.59	0.41	0.33	0.27
S. c. c.	MUMC 004940	M	2	5-Jun-89	94	36	12	0	15.2	7.5	4.8	2.61	4.69	3.7	1.23	1.91	3.57	0.43	0.36	0.27
S. c. c.	MUMC 004942	M	2	5-Jun-89	95	36	13	0	15.2	7.6	4.6	2.64	4.64	3.64	1.19	1.97	3.57	0.43	0.34	0.26
S. c. c.	MUMC 004943	F	1	22-May-90	97	38	12	0	15.3	7.5	4.7	2.6	4.74	3.67	1.23	2.03	3.63	0.43	0.4	0.29
S. c. c.	MUMC 004944	M	2	29-May-90	99	37	13	0	15.6	7.7	4.9	2.44	4.71	3.57	1.19	2.11	3.54	0.46	0.4	0.29
S. c. c.	MUMC 004945	F	2	29-May-90	103	41	12	0	15.4	7.6	4.7	2.6	4.79	3.6	1.19	2.17	3.56	0.44	0.4	0.27
S. c. c.	MUMC 004947	.	1	29-May-90	97	40	13	0	15.2	7.6	4.7	2.66	4.69	3.61	1.2	1.96	3.57	0.4	0.37	0.27
S. c. c.	MUMC 004953	M	2	10-Jul-90	104	43	13	0	15.8	7.8	4.6	2.6	4.9	3.66	1.23	2.16	3.59	0.46	0.43	0.29
S. c. c.	MUMC 004954	M	2	10-Jul-90	102	42	13	0	15.5	7.6	4.7	2.5	4.86	3.73	1.24	2.01	3.74	0.4	0.43	0.27
S. c. c.	MUMC 004958	.	2	10-Jul-89	0	40	13	0	15.4	7.7	4.6	2.86	4.79	3.71	1.2	2.01	3.63	0.44	0.4	0.34
S. c. c.	MUMC 004959	.	3	10-Jul-89	97	38	12	0	15.5	7.6	4.5	2.73	4.71	3.63	1.29	1.97	3.7	0.43	0.31	0.21
S. c. c.	MUMC 004979	M	1	17-Jul-89	0	42	13	0	16	7.8	5.1	2.74	4.86	3.64	1.17	2.11	3.6	0.44	0.37	0.31
S. c. c.	MUMC 004980	F	1	17-Jul-89	0	38	12	0	15.2	7.7	5	2.54	4.6	3.5	1.17	2	3.5	0.4	0.36	0.33
S. c. c.	MUMC 004982	M	3	17-Jul-89	97	38	14	0	14.8	7.6	4.7	2.61	4.57	3.57	1.21	1.91	3.46	0.44	0.36	0.21
S. c. c.	MUMC 004985	M	3	12-Jun-89	0	40	13	0	15.1	7.5	4.8	2.36	4.6	3.57	1.23	1.97	3.57	0.43	0.4	0.23
S. c. c.	MUMC 004989	F	2	8-May-90	109	42	13	0	15.8	7.8	4.6	2.7	4.89	3.67	1.26	2.03	3.74	0.43	0.4	0.27
S. c. c.	MUMC 005001	F	2	8-May-89	99	39	13	0	15.2	7.2	4.4	2.6	4.71	3.64	1.23	2	3.66	0.44	0.39	0.3
S. c. c.	MUMC 005309	M	1	18-Aug-90	0	0	12	3	15.7	7.9	5.1	2.6	4.79	3.59	1.2	2.14	3.71	0.43	0.41	0.33
S. c. c.	MUMC 005310	F	1	18-Aug-90	94	37	11	3	0	7.4	4.8	2.49	4.61	3.59	1.19	2.11	3.59	0.41	0.44	0.29
S. c. c.	MUMC 005312	F	1	15-Sep-90	110	40	11	0	15.8	7.7	5.1	2.74	4.76	3.69	1.29	2.03	3.64	0.43	0.41	0.26
S. c. c.	MUMC 005314	.	3	18-Sep-90	101	40	10	0	15.4	7.5	4.5	2.77	5.03	3.79	1.21	2.11	3.77	0.46	0.4	0.31
S. c. c.	MUMC 005355	M	3	17-Sep-91	75	31	11	0	14.7	7.6	4.7	2.74	4.51	3.74	1.24	2	3.57	0.31	0.41	0.29
S. c. c.	MUMC 005366	M	1	17-Sep-91	75	30	11	0	15.2	7.3	4.6	2.83	4.54	3.61	1.21	1.99	3.6	0.33	0.4	0.26
S. c. c.	MUMC 005367	M	1	17-Sep-91	76	32	11	0	14.5	7.3	4.7	2.54	4.49	3.69	1.17	1.96	3.47	0.4	0.37	0.29
S. c. c.	MUMC 005368	.	1	17-Sep-91	74	29	11	0	0	7.4	4.9	2.64	4.37	3.71	1.21	1.79	3.66	0.29	0.31	0.27
S. c. c.	MUMC 005389	F	1	12-Jul-91	97	43	11	3	15.6	7.8	5.1	2.6	4.71	3.6	1.2	2.03	3.57	0.43	0.41	0.26
S. c. c.	MUMC 005523	M	3	22-Sep-91	94	40	11	4	15.4	7.5	4.3	2.63	4.59	3.59	1.19	1.77	3.54	0.4	0.36	0.27
S. c. c.	MUMC 005827	M	3	27-Jul-92	94	40	12	0	15.2	7.3	4.6	2.51	4.61	3.6	1.23	1.9	3.53	0.46	0.31	0.24
S. c. c.	MUMC 005828	F	1	27-Jul-92	91	40	12	0	15.6	7.7	5.3	2.59	4.63	3.66	1.2	2.13	3.6	0.44	0.4	0.29
S. c. c.	MUMC 005831	M	3	27-Jul-92	101	44	12	0	15.5	7.7	4.6	2.69	4.69	3.57	1.26	1.91	3.57	0.43	0.36	0.23

Taxon	Catalog number	Sex	Age	Date collected	TotL	TalL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. c.	MUMC 005833	F	3	10-Jun-92	101	41	14	0	15.2	7.7	4.6	2.71	4.61	3.73	1.26	1.91	3.57	0.44	0.36	0.23
S. c. c.	MUMC 005854	F	2	1-Aug-91	92	35	11	3	14.7	7.3	4.3	2.86	4.49	3.63	1.23	1.93	3.54	0.37	0.34	0.27
S. c. c.	MUMC 005861	F	3	20-May-92	109	44	13	5.5	15.3	7.6	4.8	2.71	4.66	3.81	1.17	1.89	3.6	0.43	0.4	0.27
S. c. c.	MUMC 005999	M	1	22-Aug-91	87	32	11	0	14.5	7.6	4.7	2.76	4.69	3.67	1.27	1.9	3.57	0.43	0.34	0.29
S. c. c.	MUMC 006000	M	1	22-Aug-91	85	30	11	0	14.8	7.4	4.6	2.73	4.63	3.63	1.3	1.91	3.64	0.37	0.4	0.26
S. c. c.	MUMC 006001	M	1	22-Aug-91	81	32	11	0	14.7	7.6	4.7	2.69	4.77	3.74	1.31	1.9	3.79	0.36	0.36	0.29
S. c. c.	MUMC 006172	M	1	17-Oct-93	83	34	10	3.5	15	7.6	4.6	2.74	4.71	3.83	1.24	2.03	3.73	0.36	0.39	0.29
S. c. c.	MUMC 006173	F	2	17-Oct-93	91	30	11	4.5	14.6	7.4	4.5	2.64	4.69	3.86	1.43	1.97	3.61	0.34	0.37	0.3
S. c. c.	MUMC 006174	F	1	17-Oct-93	84	29	10	4	14.4	7.3	4.6	2.61	4.6	3.69	1.3	1.93	3.71	0.33	0.36	0.27
S. c. c.	MUMC 006175	M	1	17-Oct-93	80	28	12	3	0	7.4	4.6	2.64	4.71	3.9	1.31	2.07	3.67	0.4	0.41	0.27
S. c. c.	MUMC 006177	F	1	17-Oct-93	90	33	11	3	14.9	7.4	4.7	2.74	4.66	3.67	1.26	2	3.69	0.39	0.41	0.27
S. c. c.	MUMC 006455	M	3	8-Aug-94	89	34	11	4	15.3	7.6	4.8	2.6	4.79	3.5	1.17	2.04	3.61	0.43	0.34	0.26
S. c. c.	MUMC 006467	F	3	29-May-94	91	38	11	5	14.9	7.5	4.5	2.51	5.03	3.74	1.26	2.11	3.76	0.51	0.41	0.29
S. c. c.	MUMC 006485	F	3	3-Sep-94	91	36	11	3.5	15.1	7.4	4.8	2.67	4.69	3.67	1.16	1.89	3.6	0.41	0.41	0.29
S. c. c.	MUMC 006489	M	2	1-Jul-94	87	38	11	4.5	14.9	7.5	4.4	2.64	4.8	3.74	1.2	2.14	3.71	0.4	0.46	0.29
S. c. c.	MUMC 006516	M	3	3-Sep-94	90	39	11	4.5	15	7.9	4.8	2.74	4.71	3.57	1.14	2.03	3.59	0.5	0.29	0.27
S. c. c.	MUMC 006517	M	2	3-Sep-94	87	35	12	4	14.9	7.4	4.9	2.71	4.43	3.53	1.21	1.89	3.46	0.41	0.33	0.29
S. c. c.	MUMC 006543	M	3	17-Jun-94	85	34	11	4.5	14.9	7.1	4.7	2.74	4.66	3.71	1.14	1.9	3.57	0.41	0.36	0.27
S. c. c.	MUMC 006548	M	3	3-Sep-94	88	36	11	4	15.2	7.5	4.6	2.74	4.89	3.6	1.27	1.97	3.7	0.47	0.36	0.31
S. c. c.	MUMC 006566	M	2	29-May-94	87	33	11	5	15.6	7.5	4.7	2.84	4.94	3.69	1.29	1.97	3.86	0.4	0.37	0.29
S. c. c.	MUMC 006609	F	3	1-Jul-94	0	0	12	4.5	15.4	7.4	4.8	2.76	4.9	3.71	1.16	2.1	3.84	0.4	0.46	0.27
S. c. c.	MUMC 006665	M	2	17-Jun-94	83	36	12	4	14.4	7.3	4.7	2.74	4.66	3.64	1.21	1.94	3.71	0.4	0.36	0.29
S. c. c.	MUMC 006711	M	3	17-Jun-94	87	34	10	4	14.9	7.6	4.6	2.9	4.83	3.73	1.21	2	3.71	0.41	0.4	0.29
S. c. c.	MUMC 006718	M	3	8-Aug-94	85	34	11	4	14.8	7.4	4.2	2.64	4.47	3.49	1.21	1.91	3.49	0.4	0.36	0.29
S. c. c.	MUMC 006799	M	2	3-Sep-94	83	35	11	4	14.5	7.3	4.5	2.73	4.6	3.6	1.26	1.86	3.47	0.5	0.39	0.29
S. c. c.	MUMC 006800	M	3	3-Sep-94	94	39	11	5.5	15.1	7.5	4.7	2.71	4.76	3.79	1.31	1.91	3.61	0.4	0.46	0.29
S. c. c.	MUMC 006801	M	2	3-Sep-94	84	38	11	4	15	7.4	4.7	2.74	4.77	3.59	1.19	1.96	3.64	0.41	0.43	0.26
S. c. c.	MUMC 006813	M	3	17-Jun-94	91	40	12	4.5	15.2	7.5	4.7	2.76	4.71	3.59	1.2	1.87	3.57	0.41	0.33	0.27
S. c. c.	MUMC 006818	M	2	8-Aug-94	86	38	11	4	15.1	7.5	4.4	2.6	4.57	3.41	1.24	1.86	3.57	0.34	0.33	0.26
S. c. c.	MUMC 006836	M	2	29-May-94	90	36	11	5	15.2	7.4	4.6	2.79	3.51	3.71	1.21	1.99	3.73	0.4	0.39	0.27
S. c. c.	MUMC 006837	M	3	3-Sep-94	86	35	11	4	15.4	7.7	4.6	2.71	4.77	3.76	1.2	1.99	3.71	0.44	0.39	0.26
S. c. f.	CMNH 033755	M	3	27-May-49	96	36	12	4	14.9	7.2	4.7	2.64	4.66	3.54	1.16	1.97	3.57	0.4	0.4	0.29

Taxon	Catalog number	Sex	Age	Date collected	TotL	TailL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. c. f.	CMNH 033756	F	3	14-Mar-50	86	35	11	2.6	14.7	7.3	4.3	2.59	4.77	3.71	1.24	1.97	3.71	0.56	0.36	0.23
S. c. f.	CMNH 033757	F	2	21-Apr-50	88	35	11	4.1	14.5	7.4	4.5	2.73	4.64	3.73	1.23	1.93	3.67	0.36	0.39	0.27
S. c. f.	CMNH 033758	F	2	21-Apr-50	93	34	11	5.1	14.7	7.2	4.2	2.61	4.73	3.63	1.16	2	3.69	0.43	0.36	0.29
S. c. f.	CMNH 037252	M	1	4-Oct-49	87	35	11	3.2	15.3	7.5	4.6	2.6	4.76	3.64	1.34	2.01	3.71	0.43	0.4	0.29
S. c. f.	CMNH 037253	M	1	11-Oct-49	96	38	11	3.4	15.5	7.4	4.3	2.6	4.77	3.67	1.24	2.11	3.69	0.43	0.43	0.27
S. c. f.	CMNH 037258	F	2	28-Mar-50	90	38	11	3.3	15.5	7.5	4.4	2.6	4.8	3.57	1.21	2.14	3.59	0.49	0.4	0.29
S. c. f.	CMNH 037277	F	2	11-Jan-50	88	35	12	2.5	14.9	7.3	4.1	2.59	4.71	3.73	1.2	2.07	3.6	0.37	0.41	0.29
S. c. f.	CMNH 037288	F	2	23-Jan-50	83	30	11	2.5	14	7.1	3.9	2.63	4.4	3.71	1.19	1.83	3.49	0.4	0.41	0.21
S. c. f.	CMNH 039133	M	2	1-Mar-51	87	35	12	3.3	14.6	7.3	4.3	2.51	4.6	3.64	1.26	1.93	3.63	0.41	0.4	0.26
S. c. f.	CMNH 039137	M	2	12-Mar-51	92	35	12	2.7	14.5	7.2	4.3	2.6	4.59	3.63	1.2	1.94	3.63	0.43	0.41	0.3
S. c. f.	CMNH 039150	M	2	29-Mar-51	92	35	11	3.7	14.9	7.3	4.2	2.74	4.6	3.51	1.26	1.97	3.51	0.41	0.37	0.29
S. c. f.	CMNH 039152	F	3	29-Mar-51	95	36	11	3.5	14.6	7.5	4.3	2.64	4.49	3.69	1.19	1.86	3.54	0.41	0.41	0.29
S. c. f.	CMNH 039153	M	2	29-Mar-51	85	31	12	3.7	14.6	7.4	4.4	2.47	4.64	3.74	1.26	2	3.73	0.36	0.4	0.24
S. c. f.	CMNH 039154	M	2	29-Mar-51	87	32	12	3.6	14.5	7.1	4.4	2.36	4.71	3.54	1.17	2.01	3.63	0.43	0.36	0.29
S. c. f.	CMNH 039156	F	2	2-Apr-51	87	34	11	3.9	15.4	7.5	4.4	2.61	4.94	3.66	1.17	1.99	3.71	0.49	0.46	0.27
S. c. f.	CMNH 045704	F	1	22-Jun-54	85	32	10	2.5	15.3	7.4	4.9	2.66	4.57	3.74	1.26	1.97	3.63	0.4	0.34	0.29
S. c. f.	CMNH 045705	F	1	27-Jun-54	85	33	11	2.6	15.2	7.4	4.7	2.87	4.63	3.73	1.1	2	3.61	0.39	0.34	0.17
S. c. f.	CU 011965	M	2	19-Apr-49	87	32	11	0	15.1	7.6	4.6	2.64	4.71	3.76	1.29	1.83	3.7	0.43	0.34	0.26
S. c. f.	CU 011966	M	2	19-Apr-49	91	33	11	0	14.6	7.5	4.5	2.63	4.54	3.59	1.24	1.91	3.6	0.46	0.31	0.29
S. c. f.	USNM 076587	F	2	2-Feb-96	86	34	11	0	14.3	7.1	4.2	2.64	4.74	3.6	1.23	1.86	3.64	0.37	0.4	0.26
S. c. f.	USNM 076593	M	2	16-Feb-96	86	33	11	0	14.6	7.2	4.2	2.69	4.57	3.74	0	0	3.63	0.43	0.36	0.21
S. c. f.	USNM 076709	M	3	18-Mar-96	98	37	11	0	14.6	7	4.5	2.63	4.64	3.54	1.23	1.86	3.57	0.41	0.36	0.27
S. c. f.	USNM 112843	F	1	10-Dec-01	0	0	0	0	15.2	7.2	4.6	2.57	4.66	3.51	1.2	1.86	3.6	0.44	0.43	0.23
S. c. f.	USNM 186677	.	1	10-Sep-87	0	0	0	0	15.2	6.9	4.6	2.5	4.67	3.4	1.17	1.74	3.54	0.41	0.36	0.23
S. l. l.	CMNH 055243	F	1	25-Jul-78	84	31	10	2.4	14.2	7.6	4.6	2.89	4.71	3.89	1.03	1.86	3.6	0.34	0.33	0.36
S. l. l.	CMNH 055245	M	3	3-Aug-78	90	30	12	5.5	15.2	7.3	4.6	3.01	4.86	3.9	1.07	1.86	3.76	0.33	0.37	0.31
S. l. l.	CMNH 059713	M	3	2-Apr-79	79	33	10	3.5	14.4	7.2	4.5	3	4.71	4	1.26	1.73	3.71	0.33	0.4	0.29
S. l. l.	CMNH 059714	M	1	3-Apr-79	85	34	11	3.8	15.1	7.8	5	3.19	4.77	4.04	1.17	1.89	3.61	0.37	0.39	0.31
S. l. l.	CMNH 060559	F	1	1-Jan-49	90	33	10	0	14.5	7.2	4.4	3.03	4.57	3.89	1.01	1.74	3.57	0.26	0.31	0.3
S. l. l.	CMNH 070858	.	1	20-May-80	78	28	11	0	14.5	7.1	4.8	2.74	3.64	3.89	1.07	1.76	3.56	0.3	0.3	0.3
S. l. l.	CMNH 080163	F	3	15-Apr-63	80	29	11	0	13.9	7.1	3.9	2.86	4.34	3.54	1.14	1.81	3.5	0.36	0.31	0.29
S. l. l.	CMNH 092583	F	3	13-Oct-83	83	33	10	3	14.2	7.2	4.6	3.01	4.77	3.89	1.19	1.79	3.71	0.31	0.34	0.31

Taxon	Catalog number	Sex	Age	Date collected	TotL	TailL	HF	Wt	SL	CW	CH	IC	MP	M2M2	I1I1	UT	P4M3	U3	U4	U5
S. l. l.	CMNH 092584	M	1	8-Nov-83	83	33	10	3	14.9	7.2	4.6	2.9	4.61	3.84	1.07	1.86	3.64	0.37	0.29	0.31
S. l. l.	CMNH 092585	F	1	3-Oct-83	81	31	10	2	14.3	7.3	4.5	2.77	4.36	3.86	1.01	1.77	3.43	0.33	0.4	0.31
S. l. l.	CMNH 092586	M	1	24-Jul-82	79	31	10	3	14.5	7.2	4.7	2.93	4.49	4.04	1.14	1.87	3.71	0.31	0.4	0.3
S. l. l.	CMNH 092588	M	1	28-Sep-83	85	33	10	3	0	7.3	4.3	3.14	4.5	4	1.21	1.71	3.57	0.31	0.29	0.26
S. l. l.	CMNH 092589	F	1	3-Oct-83	84	28	10	3	14.7	7.4	4.5	3.01	4.57	3.76	1.06	1.86	3.57	0.33	0.36	0.29
S. l. l.	CMNH 092591	M	1	2-Oct-83	80	30	10	3	14.7	7.4	4.7	3.07	4.66	3.89	1.04	1.83	3.69	0.33	0.31	0.29
S. l. l.	CMNH 092593	M	2	1-May-83	80	31	10	3	0	0	0	2.86	4.43	4	1.07	1.71	3.57	0.29	0.36	0.26
S. l. l.	CMNH 092594	M	1	17-Feb-84	85	32	10	4	14.2	7.2	4.7	2.99	4.5	4.04	1.14	1.9	3.63	0.31	0.36	0.33
S. l. l.	CMNH 092595	M	1	6-Jun-84	86	31	10	4	14.9	7.6	5.1	3.03	4.57	4	1.06	1.86	3.57	0.31	0.34	0.27
S. l. l.	CMNH 092597	M	1	5-Sep-84	87	34	11	4	14.6	7.2	4.3	2.93	4.46	3.67	1.06	1.79	3.43	0.31	0.36	0.29
S. l. l.	CMNH 092598	M	2	10-Sep-84	84	32	10	3	13.9	7.2	4.5	2.66	4.23	4	1.13	1.69	3.5	0.27	0.37	0.3
S. l. l.	CMNH 092599	M	2	26-Sep-84	85	32	10	4	0	0	0	2.86	4.29	3.71	1.14	1.57	3.43	0.29	0.36	0.26
S. l. l.	CMNH 092601	F	1	8-Nov-83	82	30	11	3	14	7.2	4.5	3	4.37	3.9	1	1.73	3.43	0.31	0.31	0.31
S. l. l.	CMNH 092603	F	1	7-Jul-84	77	32	11	3	14.5	7.4	4.6	2.86	4.5	3.73	1.03	1.83	3.56	0.33	0.29	0.3
S. l. l.	USNM 087190	M	1	3-Jan-97	79	33	11	0	14	7.1	4.4	2.87	4.57	3.83	1.19	1.61	3.6	0.31	0.36	0.24
S. l. l.	USNM 151738	M	1	3-Jul-58	0	0	0	0	0	6.7	4.4	1.43	4.57	3.81	1.23	1.76	3.5	0.34	0.31	0.26
S. l. l.	USNM 265551	M	2	28-Mar-40	83	30	12	0	14.1	7.3	4.2	2.86	4.5	3.83	1.14	1.57	3.59	0.33	0.29	0.24
S. l. l.	USNM 265553	M	2	4-Apr-40	90	33	11	0	14.3	7	4.5	2.76	4.49	3.73	1.14	1.64	3.64	0.31	0.36	0.2
S. l. l.	USNM 266304	F	1	22-Nov-40	85	30	11	0	14	7.3	4.5	2.93	4.33	3.69	1.14	1.57	3.57	0.29	0.29	0.2
S. l. l.	USNM 266305	F	2	5-Dec-40	76	25	10	0	13.9	7.2	4.7	2.71	4.49	3.71	1.13	1.63	3.49	0.29	0.33	0.26
S. l. l.	USNM 278683	M	1	21-Oct-45	0	0	0	0	14.2	7.4	5.1	2.89	4.46	3.67	1.21	1.71	3.53	0.34	0.3	0.29
S. l. l.	USNM 283624	M	3	4-Oct-48	78	29	10	0	14.2	7	4.5	2.73	4.43	3.64	1.23	1.59	3.37	0.27	0.34	0.2
S. l. l.	USNM 290472	.	1	12-Oct-49	74	26	9	0	13.4	7.1	4.3	2.64	4.23	3.71	1.11	1.43	3.37	0.29	0.31	0.23
S. l. l.	USNM 290473	M	1	14-Oct-49	75	31	10	0	14.3	7.5	4.6	2.73	4.43	3.8	1.19	1.47	3.6	0.33	0.31	0.23
S. l. l.	USNM 320408	F	3	4-May-61	86	30	10	0	14.7	7.2	4.5	2.87	4.74	3.86	1.14	1.71	3.77	0.3	0.31	0.23
S. l. l.	USNM 514943	F	3	10-Oct-77	0	0	0	0	0	7.3	4.6	2.79	0	3.83	0	0	3.57	0	0.36	0.29
S. l. l.	USNM 526835	F	3	21-May-78	84	30	10	7	14.3	7.6	4.7	3	4.54	3.97	1.23	1.57	3.63	0.26	0.4	0.23
S. l. l.	USNM 526838	M	3	28-May-78	89	33	10	3	14.5	7.4	4.4	2.93	4.61	3.93	1.21	1.6	3.64	0.3	0.31	0.21
S. l. l.	USNM 565900	.	1	19-Aug-89	0	0	0	0	14.4	7.3	4.8	2.86	4.53	3.8	1.21	1.6	3.53	0.31	0.33	0.23
S. l. l.	USNM 565903	.	1	13-Sep-89	0	0	0	0	14.2	7	4.3	2.8	4.43	3.57	1.07	1.66	3.31	0.33	0.33	0.24
S. l. l.	USNM 565904	.	1	21-Sep-89	0	0	0	0	0	6.9	4.7	2.8	4.4	0	0	1.61	3.49	0.3	0.36	0.23
S. l. l.	USNM 565905	.	1	21-Sep-89	0	0	0	0	14.1	7.3	4.4	2.86	4.54	3.81	1.19	1.64	3.57	0.3	0.37	0.21