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A taxonomic study of two nominal subspecies of pikas (Ochotona princeps) in the Cascade Mountains of Oregon

Richard M. Coots
Portland State University

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APPROVED BY MEMBERS OF THE THESIS COMMITTEE:

[redacted]

Richard B. Forbes, Chairman

[redacted]

John H. Wirtz

[redacted]

Quentin D. Clarkson

Pikas from four colonies in the Cascade Mountains of Oregon were examined. Two colonies were chosen from within the geographical distribution of two nominal subspecies. A discriminate analysis of morphological measurements taken from the specimens showed that each colony could be distinguished from each other. Each colony studied showed more intra-colony similarity than inter-colony similarity, regardless of distance separating the colonies or subspecies designations. The results indicate that the validity of subspecies designations for this species can be questioned.

A TAXONOMIC STUDY OF TWO NOMINAL SUBSPECIES OF PIKAS (*Ochotona princeps*) IN THE CASCADE MOUNTAINS OF OREGON

by

RICHARD M. COOTS, JR.

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The members of the Committee approve the thesis of Richard M. Coots presented May 30, 1972.

[redacted]

Richard B. Forbes, Chairman

[redacted]

Quentin D. Clarkson

[redacted]

John H. Wirtz

APPROVED:

[redacted]

Earl Fisher, Head, Department of Biology

[redacted]

David T. Clark, Dean of Graduate Studies

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INTRODUCTION

Pikas or "conies", as they are often called, were first introduced to science by Pallas in 1769 (Howell, 1924) who published a description of a species from Russia under the name Lepus pusillus. Between 1769 and 1896 several name changes took place which ultimately resulted in adoption of the generic name Ochotona. The first North American species to be recognized was Lepus princeps, described by Richardson in 1828 from specimens taken near the source of the Athabaska River in Alberta (Howell, 1924). Between 1828 and 1924 several more species were described. Howell, in 1924, described three North American speies—O. collaris, O. princeps and O. schisticeps. Between 1924 and 1950 a number of investigators revised O. schisticeps so that all of its subspecies are now considered to be members of the species princeps. Hall (1951) revised the current taxonomic arrangement and described the geographical distribution of the genus Ochotona in North America.

A study of the pikas in the Cascade Mountains of Oregon, has brought to my attention that two nominal subspecies of Ochotona princeps, O. p. brunnescens and O. p. fumosa, share the same type of habitat. After examining specimens of these subspecies, it is my belief that there should be no subspecies designation for the pikas in the Cascade Mountains of Oregon.

MATERIALS AND METHODS

Specimens Examined: All are from Oregon. Clackamas County: 2 1/2 mi E and 1 1/2 mi N Government Camp, 4 (PSU). Klamath County: Crater Lake, 8 (USNM). Linn County: Permillia (Pamelia) Lake, 6 (USNM); Lost Prairie, 32 1/2 mi E Sweet Home, 11 (PSU).

The data procured from each specimen were as follows: sex, total body length, occipital nasal length, zygomatic breadth, breadth of braincase, interorbital breadth, width of palatal bridge, and nasal length. The condition of the pelage was noted as well as color; gross measurements were recorded from data on the skin tags. Skull measurements were taken with a Helios dial caliper to the nearest 0.1 mm.

Four groups of specimens were recognized for analysis, two from within the geographic range of each nominal subspecies. The Pamelia Lake and Lost Prairie groups are within the range of fumosa. The Mt. Hood and Crater Lake groups are within the range of brunnescens.

Pelage color of fumosa and brunnescens seems not to be a valid distinguishing characteristic, for it varies with molt and age. Most of the specimens examined were taken in late summer and early fall, near the time of molting. The series of animals used by Howell in describing fumosa were all in fresh pelage, which made them distinct from brunnescens, the pelage of which was in various degrees of molt.

The data were analyzed by use of a stepwise discriminant analysis from the Biomedical Computer Program BMD07M 1968. The main

function of this method is weighting those variables to provide the greatest discrimination between the four groups of animals. The program orders the arrangement of variables such that the most discriminating one is processed first. The second step processes the variable which adds the most information to the first step. This procedure continues through the entire set of variables. With each step, a tape is printed which places each animal into one of the four groups based upon the information obtained from that step. The program also computes the mean and standard deviation for each variable within each group. These statistics may be found in Appendix I, and II.

RESULTS

After step five, which contained the five most discriminating variables, the information obtained from the other three variables did not alter the table significantly. The order in which the variables were found to be most discriminating is as follows: total length, width of palatal bridge, nasal length, breadth of braincase and occipital-nasal length. Data on sex, interorbital breadth and zygomatic breadth were included in the program but were found to contribute nothing as discriminating factors. Table I summarizes the information obtained in steps one through five.

An example will show how this table is read. Of the eight animals from Crater Lake, seven would be placed correctly in the Crater Lake category and one in the Mt. Hood category. Each animal is placed within the category with which it is most closely correlated.

Table II shows the within group correlation matrix. From this table, variables which show strong correlations with each other can be detected. It is worth noting that sex (Column 1) is not highly correlated with any of the variables. As would be expected, total body length varies directly with general size measurements of the skull, i.e., occipital-nasal length, zygomatic breadth, breadth of braincase. Other notable high correlations are between zygomatic breadth and breadth of braincase and between occipital-nasal length and nasal length.

Table I. Number of Cases Classified Into Groups

Group	Mt. Hood	Crater Lake	Pamelia Lake	Lost Prairie
Mt. Hood	2	1	0	1
Crater Lake	1	7	0	0
Pamelia Lake	0	0	6	0
Lost Prairie	0	1	1	9

Table II. Within Groups Correlation Matrix

Variables	(S)	(TL)	(ONL)	(ZB)	(BB)	(IOB)	(WPB)	(NL)
Sex (S)	1.00							
Total Length (TL)	-.18	1.00						
Occipital-Nasal Length (ONL)	-.21	.57	1.00					
Zygomatic Breadth (ZB)	-.04	.58	.74	1.00				
Breadth of Braincase (BB)	.02	.59	.65	.85	1.00			
Interorbital Breadth (IOB)	-.01	.04	-.30	-.12	.12	1.00		
Width of Palatal Bridge (WPB)	-.22	.27	.43	.21	-.02	-.48	1.00	
Nasal Length (NL)	-.13	.43	.89	.57	.48	-.39	.50	1.00

DISCUSSION

Figure 1 is a map of the subspecies distribution of the pikas in the Cascade Mountains of Oregon as determined by Howell (1924). As the map indicates, the range of brunnescens is interrupted by that of fumosa. Figure 2, a more recent distribution map of pikas in the Cascade Mountains of Oregon (Hall, 1959), shows the location of the colonies examined.

According to Howell, the animals from Mt. Hood and Crater Lake are the same subspecies and thus should be indistinguishable. The same reasoning should hold for the Lost Prairie and Pamelia Lake animals. Under discriminant analysis, each animal should have a fifty percent chance of being grouped with either of the two colonies of its subspecies. Such was not the case. Results of the discriminant analysis indicate that each of the colonies can be distinguished statistically from each of the others. Each colony studied shows more intra-colony similarity than inter-colony similarity, regardless of the distance separating the colonies.

Fossil records have established that North American pikas had a much greater range in the past than now (Gidley, 1933). Moreover, unlike some of their Asian relatives (Loukashkin, 1940) the North American pikas exist almost exclusively on talus slopes. As the pikas evolved, specializations for living on talus slopes their potential for dispersal probably has become greatly restricted. As a result,

members of a given colony would tend to breed only with each other. The effect would be to increase inter-colony variability and reduce intra-colony variability.

Today thirty-six subspecies of Ochotona princeps are recognized (Figure 3, and Hall, 1959). This would seem to strengthen the argument that pikas have become more restricted in their habitat requirements, therefore helping to explain the greater variation between individual colonies. Burt (1954) suggested that continuously distributed continental species, "would be better understood if we were to discard the subspecies designations and concentrate on the variations and their behavior geographically." Noting that insular and montane populations presented somewhat different problems, Burt still questions the value of using a trinomial to designate distinguishable groups of a species. The apparent nature and probable cause of variation in pikas in Oregon's Cascades leads me to believe that there should be no subspecies designation for these animals. Furthermore, it may be time for a reevaluation of the usefulness of the trinomial concept as applied to North American pikas.

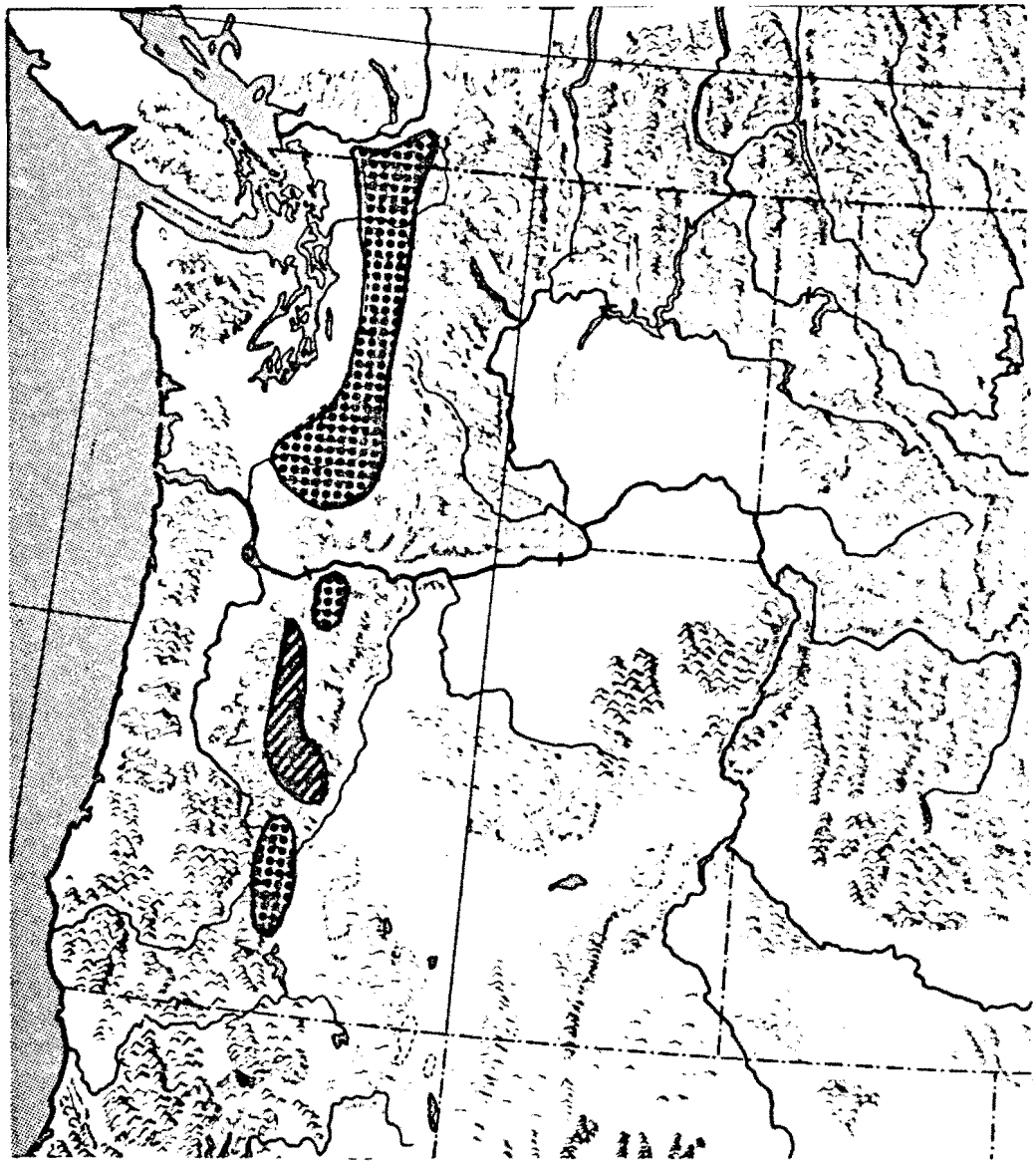

Figure 1. Distribution of pikas in the Cascade Mountains of Oregon as determined by Howell (1924).

Ochotona princeps fumosa

Ochotona princeps brunnescens

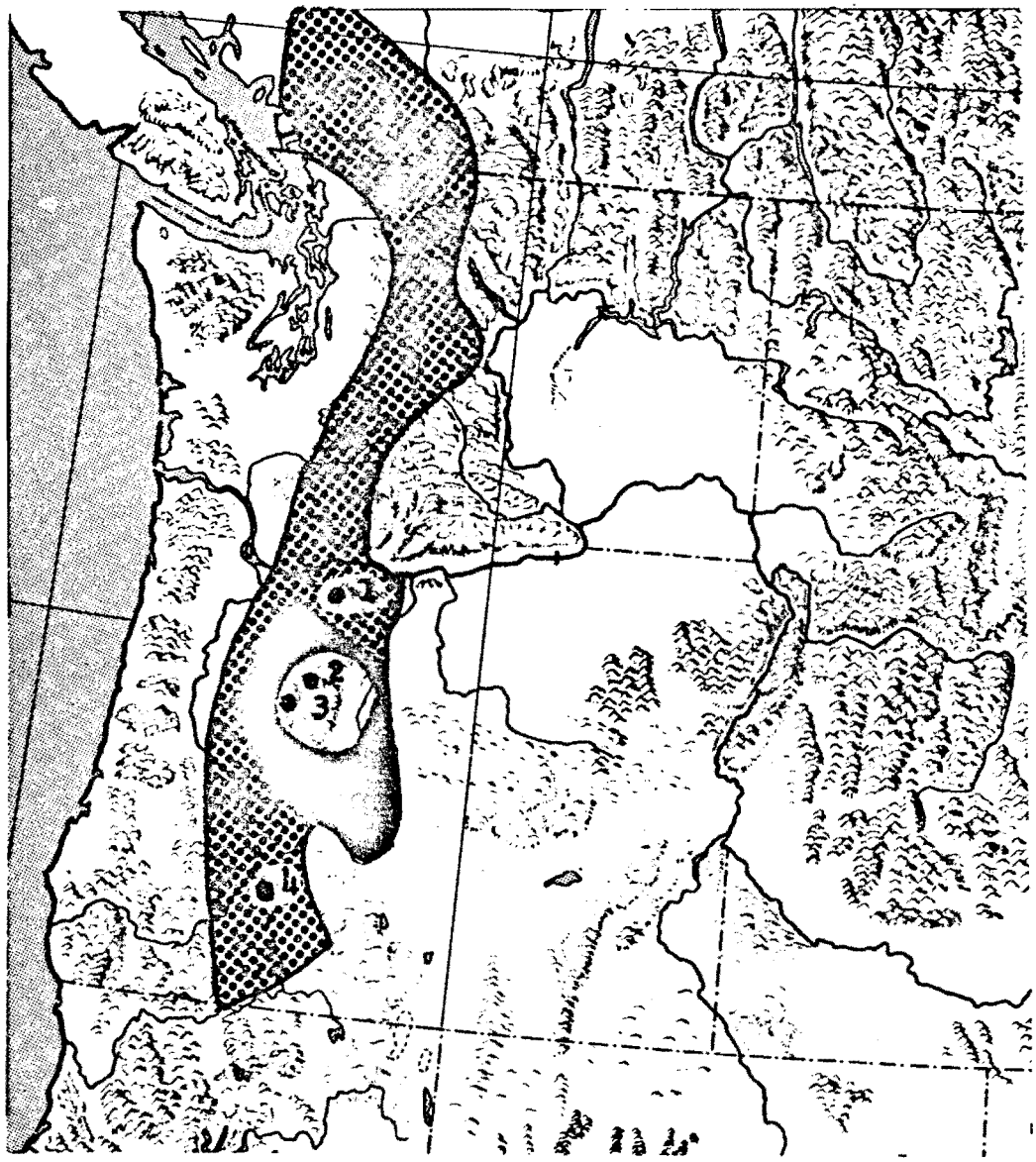

Figure 2. Current distribution map of pikas in the Cascade Mountains (Hall,1959), and location of populations sampled for this study. 1-Mt. Hood; 2-Pamelia Lake; 3-Lost Prairie; 4-Crater Lake.

Ochotona princeps fumosa

Ochotona princeps brunnescens

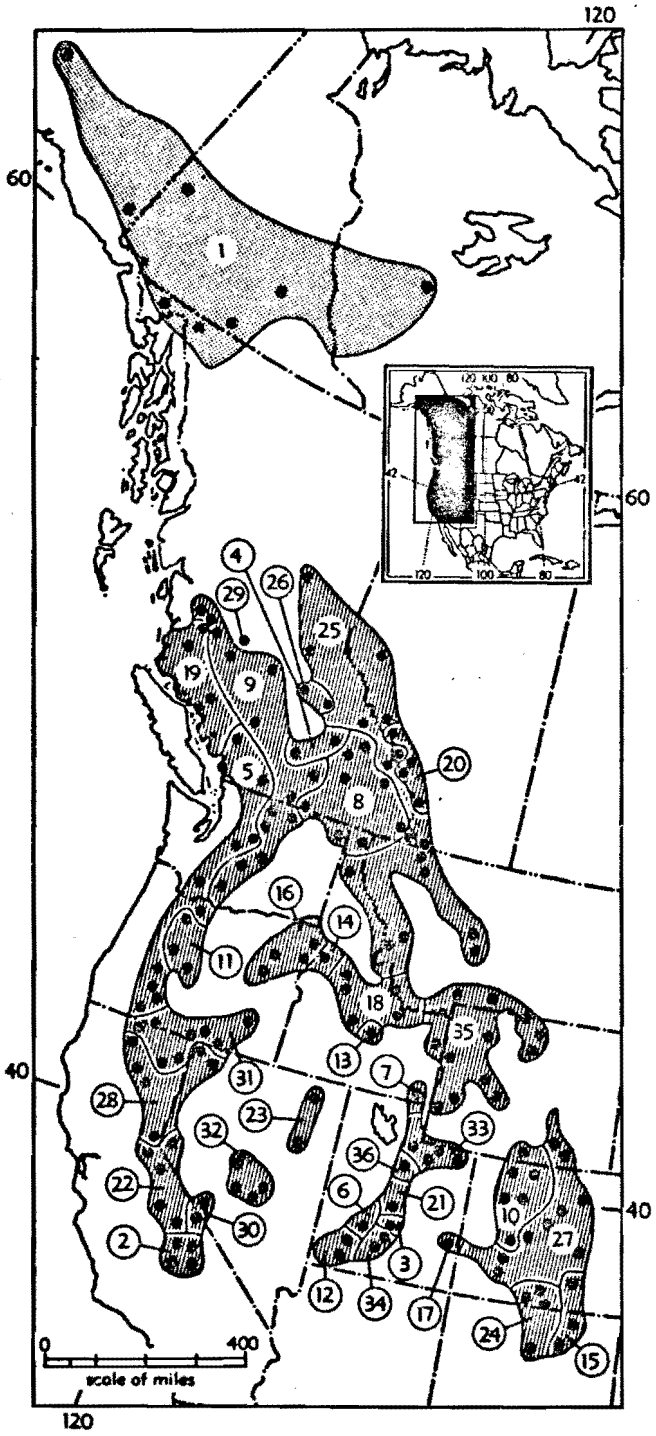

Figure 3. Geographical distribution of the subspecies of Ochotona princeps (Hall, 1959).

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Appendix I. Mean values for the variables measured on each colony of pikas.

Variables	Colony			
	Mount Hood	Crater Lake	Pamelia Lake	Lost Prairie
Sex	1.50	1.50	1.83	1.45
Total Length	188.50	188.75	195.16	206.90
Occipital-Nasal Length	41.40	42.19	43.93	45.05
Zygomatic Breadth	20.93	21.40	21.57	22.58
Breadth of Braincase	17.68	17.95	18.07	18.85
Interorbital Breadth	5.38	5.21	5.08	5.01
Width of Palatal Bridge	2.23	2.50	2.32	2.42
Nasal Length	12.93	13.26	14.05	14.81

Appendix II. Standard deviations for the variables measured on each colony of pikas.

	Colony			
Variables	Mount Hood	Crater Lake	Pamelia Lake	Lost Prairie
Sex	.58	.53	.40	.52
Total Length	16.38	9.87	5.98	5.47
Occipital–Nasal Length	2.89	1.51	.92	1.22
Zygomatic Breadth	.90	.80	.40	.79
Breadth of Braincase	.41	.48	.31	.78
Interorbital Breadth	.46	.30	.33	.38
Width of Palatal Bridge	.26	.17	.12	.19
Nasal Length	1.49	.65	.83	.60