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COMMENTARY

Cricetid species richness in the southern Andes: the effect of area. A critique of Caviedes and Iriarte (1989)

Riqueza de especies de cricétidos en los Andes meridionales: el efecto de área. Una crítica a Caviedes e Iriarte (1989)

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ABSTRACT

Recently, Caviedes and Iriarte (1989) tried to explain the lower cricetid species richness of central Chile in comparison to Argentina. However, they did not considered large differences in land area and vegetation diversity of both countries. If these factors are considered, species richness differences between Chile and Argentina are not apparent. The pattern of distribution of common species to both countries considering latitude and altitude is discussed.

Key words: Cricetid rodents, distribution, species richness, Atacama Desert, southern Andes.

RESUMEN

Recientemente Caviedes e Iriarte (1989) intentaron explicar la menor diversidad de roedores cricetidos en Chile central en comparación con Argentina. Sin embargo, ellos no consideraron las grandes diferencias de área de tierra y la diversidad de tipos vegetacionales de ambos países. Si se consideran estos factores las diferencias no son aparentes. Se discute el patrón de distribución de especies comunes a ambos países considerando la latitud y la altitud.

Palabras claves: Roedores cricétidos, distribución, riqueza de especies, Desierto de Atacama, Andes meridionales.

Recently, Caviedes & Iriarte (1989) tried to explain the apparent low species richness of cricetid rodents in central Chile by emphasizing the barrier effect that the Atacama Desert and the Andean mountains might have had on the migration of these rodents from further north or from neighboring Argentina. They considered the distribution of all mammalian orders actually represented on both sides of the Andes in southern South America between 23° and 43°S, as well as a possible scenario that may have influenced the migration routes of cricetid rodents after their arrival to the continent.

Although valuable in stressing the barrier effect of the Atacama Desert to dispersal routes of these rodents, the paper has several critical problems. Some of them have already been pointed out by Marquet (1989) and Meserve & Kelt (1990); however, there are some relevant points that they did not address that deserve to be considered in my opinion.

It is well known that land area has a considerable effect on species richness of organisms in general (Brown & Gibson 1983), but particularly of mammals (Brown 1986). Because of this, it is improper to compare present day species richness of mammal species on the eastern and western side of the Andes of southern South America without considering large differences in land area, especially if these areas also differ greatly in habitat diversity.

Chile is a very narrow strip of land (averaging about 150 km wide) stretching between the Andes and the Pacific Ocean. Its surface area south of 23°S (where Argentina has its northern common limit with

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Chile; the same northern latitude considered by Caviedes & Iriarte) is about 652,500 km². On the other hand, the surface area of Argentina is 2,795,700 km², a 4.3-fold difference. Thus, in order to have meaningful comparisons of species richness on both sides, a correction for this difference should be made. Since Chile is a long narrow country, and since several abiotic factors change with latitude, a more reasonable comparison would be to consider a similar long narrow area on the Argentinian side contiguous to the Chilean border. If we subdivide this area in the same three longitudinal segments that Caviedes & Iriarte (1989) used, and record the presence of cricetid rodent species in each segment, differences in cricetid rodent species richness between the areas are small as compared to those presented by Caviedes & Iriarte (1989) (Table 1).

The higher species richness of mammals found by Caviedes & Iriarte (1989) in Argentina is not only due to a larger area compared, however, but also to the inclusion of a higher diversity of vegetation

TABLE 1

Distribution of cricetid rodents at different latitudes in Chile and in a similar contiguous area of Argentina. Values in parenthesis are those given by Caviedes & Iriarte (1989).

Distribución de roedores cricétidos en Chile y en un área similar y contigua en Argentina a diferentes latitudes. Los valores en paréntesis son los presentados por Caviedes & Iriarte (1989)

Species	Altitudinal range (m)	23-29°S		30-36°S		37-43°S	
		Arg	Chi	Arg	Chi	Arg	Chi
Oryzomys longicaudatus	<1000				+	+	+
Andinomys edax	>3000	+	?				
Auliscomys micropus	<1800			+	+	+	+
Auliscomys sublimis	>3000	+	?				
Calomys musculinus	<3000	+		+			
Calomys lepidus	>3500	+	+				
Eligmodontia moreni	<2000	+					
Eligmodontia puerulus	>1200	+	+				
Eligmodontia typus	<1000			+		+	+
Euneomys chinchilloides	>1500			+	+	+	+
Graomys griseoflavus	<1000	+		+			
Irenomys tarsalis	<1000					+	+
Phyllotis darwini	<2000		+		+		+
Phyllotis xanthopygus	*	+	+	+	+	+	
Reithrodon physodes	< 800					+	
Akodon albiventer	>3000	+	?				
Akodon andinus	>1200	+	+	+	+		
Akodon longipilis	<1600				+	+	+
Akodon molinae	<1000			+			
Akodon olivaceus	<1500		+		+	+	+
Akodon sanborni	<1000					+	+
Akodon xanthorhinus	< 500					+	
Bolomys lactens	>3000	+					
Chelemys macronyx	500-1800			+	+	+	+
Chelemys megalonyx	< 500				+		
Geoxus valdivianus	<1200					+	+
Notiomys edwardsi	< 500					+	
Total		(11(36)	6(7)	9(29)	10(9)	14(25)	11(11)
Common species		4		5		10	
Jaccard's index of similarity	All species	0.31		0.36		0.56	
	Only species <1000 m	0.0		0.10		0.64	

* *Phyllotis xanthopygus* in Chile is found above 1000 m. but reaches lower altitudes in Argentina.

Sources: Anderson & Olds 1989, Hershkovitz 1962, Meserve & Glanz 1978, Ojeda 1989, Ojeda & Mares 1989, Osgood 1943, Patterson *et al.* 1989, Pearson 1987, Pearson & Pearson 1982, Pine *et al.* 1979, Reise & Venegas 1987, Walker *et al.* 1984, R. Ojeda pers. com, and personal data.

zones in north-central and north-eastern Argentina. Using the criteria of equal and contiguous areas along the Andes mountains, the montane forest, the Chaco formation and other northern Argentinian tropical humid areas having quite different species densities of mammals are automatically excluded because they are found further to the east.

A further analysis of Table 1 indicates some interesting points concerning the distribution and species richness of cricetid rodents in Chile and the Andean Argentinean side.

First, in the northern part of Chile considered here, i.e. south of 23°S lat., species richness is low, and it is about the same in the central and southern parts. The high species richness of the Chilean Puna is located further north than 23°S, closer to the Peruvian border. In the portions of Argentina considered here, species richness is about the same in the northern and central portion and highest in the south (Table 1).

A similar southward increase in species richness along coastal Chile between 25 and 32°S has been directly and indirectly related to plant cover and rainfall, respectively, (Meserve & Glanz 1978) and seems useful in explaining the species richness patterns on both sides of the Andes observed here. In Chile south of 23°S lat., rainfall increases steadily to the south both along the coast and along the Andes (di Castri and Hajek 1976). However, because of the rain shadow effect of the Andes, rainfall in western Argentina seems to be consistently low from north to south (Table 6.3 in Mares *et al.* 1985); increasing only very close to the Chilean border south of 39°S lat. because the Andes have a lower altitude there.

Second, since the Andes mountains are the common border between Chile and Argentina, high altitude species inhabiting the region are common to both countries. These species are the only common ones in the northern and central portions (Table 1). This is probably due to the high altitude of the Andes in these segments contributing to sharp differences between low and high altitude habitats there. However, in the southern portion, low altitude species contribute greatly to raise the number of species common to both sides of the Andes (Table 1). Here the Andes have a lower elevation and the number of passes lying below timberline increases, permitting the continous distribution of common lowland species on both sides (Table 1). Higher species richness in the southern Argentinian segment is due to the inclusion of southern rainforest rodents found in Chile and Argentina, plus those from the western portion of the arid Patagonian steppe (see fig. 5 in Pearson & Pearson 1982).

While the number of species recorded in each area may change with further collections and studies of cricetid rodents in the future, the general pattern will not. Moreover, since the Chilean northern Andes between 23 and 30°S is the most poorly known area for small mammals, species richness in the area may increase with future studies leading to even smaller differences with the Argentinean Andean area (see question marks in Table 1). If the present pattern holds, then there is actually no need to explain a lower diversity of cricetid rodents in central Chile in comparison to Argentina because after compensating for different areas and habitat diversities, these differences disappear. Southern South America as whole has a comparatively low species richness in comparison to an equivalent land area in North America (Eisenberg & Redford 1982). It has been proposed that this lower species richness may be due to reduced land area as one proceeds south and to South America's recent climatic history (Eisenberg & Redford 1982, Mares & Ojeda 1982).

The Atacama Desert is presently a difficult place for cricetid rodents to live since only two species are currently found within its confines below 1000 m. altitude (Table 1). However, present day evidence indicates that the Atacama Desert has not been an insurmountable barrier to the colonization of suitable habitats within the desert, nor to the dispersal of cricetid species between north and central Chile (Marquet 1989). A clearer picture of the history of the Atacama Desert and its biogeographic effect will emerge from further studies on the present day distribution of its flora and fauna, the

phylogenetic relationships between species living in the Atacama Desert and nearby areas, and paleontology.

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LITERATURE CITED

ANDERSON S & N OLDS (1989) Notes on Bolivian mammals. 5. Taxonomy and distribution of *Bolomys* (Muridae, Rodentia). American Museum Novitates 2935.

BROWN JH (1986) Two decades of interaction between the MacArthur-Wilson model and the complexities of mammalian distributions. In: Heaney LR & BD Patterson (eds) Island biogeography of mammals: 231-251. Linnean Society of London. Academic Press, London.

BROWN JH & AC GIBSON (1983) Biogeography. 643 pp. The C.V. Mosby Company, St. Luois, Missouri.

CAVIEDES CN & AW IRIARTE (1989) Migration and distribution of rodents in central Chile since the Pleistocene: the paleogeographic evidence. Journal of Biogeography 16: 181-187.

DI CASTRI F & ER HAJEK (1976) Bioclimatología de Chile. Pontificia Universidad Católica de Chile. Santiago, Chile.

EISENBERG J & KH REDFORD (1982) Comparative niche structure and evolution of mammals of the Nearctic and southern South America. In: Mares MA & HH Genoways (eds) Mammalian biology in South America. 6: 77-84. Special Publication Series, Pymatuning Laboratory of Ecology, University of Pittsburgh, Philadelphia.

GREER JK (1965) Mammals of Malleco Province Chile. Publications of the Museum, Michigan State University 3: 49-152.

HERSHKOVITZ P (1962) Evolution of Neotropical cricetine rodents (Muridae) with special reference to the phyllotine group. Fieldiana, Zoology 46: 1-524.

MARES MA & RA OJEDA (1982) Patterns of diversity and adaptation in South American hystricognath rodents. In: Mares MA & HH Genoways (eds) Mammalian biology in South America. 6: 393-432. Special Publication Series, Pymatuning Laboratory of Ecology, University of Pittsburgh, Philadelphia.

MARES MA, J MORELLO & G GOLDSTEIN (1985) The Monte desert and other subtropical semi-arid biomes of Argentina, with comments on their relation to North American arid areas. In: Evenari M, Noy-Meir I & Goodall DW (eds) Hot desert and arid shrubland: 203-237. Elsevier, Amsterdam.

MARQUET PA (1989) Paleogeography of South American cricetid rodents: A critique to Caviedes & Iriarte. Revista Chilena de Historia Natural. 62: 193-197.

MESERVE PL & WE GLANZ (1978) Geographical ecology of small mammals in the northern Chilean arid zone. Journal of Biogeography 5: 135-148.

MESERVE PL & DA KELT (1990) The role of aridity and isolation on central Chilean small mammals - a reply to Caviedes & Iriarte (1989). Journal of Biogeography. In press.

OJEDA RA (1989) Small-mammal responses to fire in the Monte Desert, Argentina. Journal of Mammalogy 70: 416-420.

OJEDA RA & MA MARES (1989) A biogeographic analysis of the mammals of Salta province, Argentina. Special Publication, Museum, Texas Tech University 27: 1-66.

OSGOOD WH (1989) The mammals of Chile. Field Museum Natural History, Zoological Series, 30: 1-268.

PATTERSON BD, PL MESERVE & BK LANG (1989) Distribution and abundance of small mammals along an elevational transect in temperate rainforest of Chile. Journal of Mammalogy 70: 67-78.

PEARSON, OP (1987) Mice and the postglacial history of the Traful Valley of Argentina. Journal of Mammalogy 68: 469-478.

PEARSON OP & AK PEARSON (1982) Ecology and biogeography of the southern rainforest of Argentina. In: Mares MA & HH Genoways (eds) Mammalian biology in South America. Special Publication Series 6: 129-142. Pymatuning Laboratory of Ecology, University of Pittsburgh, Philadelphia.

PINE RH, SD MILLER & ML SCHAMBERGER (1979) Contribution to the mammalogy of Chile. Mammalia 43: 339-376.

REISE D & W VENEGAS (1987) Catalogue of records, localities and biotopes from research work on small mammals in Chile and Argentina. Gayana, Zoología, (Chile) 51: 103-130.

WALKER LI, AE SPOTORNO & J ARRAU (1984) Cytogenetic and reproductive studies of two nominal subspecies of *Phyllotis darwini* and their experimental hybrids. Journal of Mammalogy 65: 220-230.