

## DIETS OF THREE SPECIES OF ANDEAN CARNIVORES IN HIGH-ALTITUDE DESERTS OF ARGENTINA

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We present the 1st data on the diet of the Andean mountain cat (*Leopardus jacobitus*), and the 1st on the colocolo (*Leopardus colocolo*) and the culpeo (*Lycalopex culpaeus*) in high-altitude deserts of northern Argentina, based on fecal analysis. Feces of Andean mountain cats and colocolos were distinguished by DNA analysis. The Andean mountain cat ( $n = 57$ ) was the most specialized, relying heavily on southern mountain vizcachas (*Lagidium viscacia*). The colocolo ( $n = 504$ ) also was specialized, consuming mostly cricetine rodents and tuco-tucos (*Ctenomys*). The culpeo ( $n = 399$ ) was a generalist, consuming all prey items that the cats used, and a greater variety of invertebrates. Short-tailed chinchillas (*Chinchilla chinchilla*) were found in 3 culpeo feces, indicating that this rodent, considered extinct in Argentina, is still present in the wild. Both southern mountain vizcachas and tuco-tucos have a patchy distribution, indicating that very large areas may be required to support populations of the cats that depend on these prey species.

Key words: carnivores, *Chinchilla chinchilla*, *Ctenomys*, food habits, *Lagidium*, *Leopardus colocolo*, *Leopardus jacobitus*, *Lycalopex culpaeus*, mountain vizcacha, South America

The Andean mountain cat (*Leopardus jacobitus*), the colocolo (*Leopardus colocolo*), and the culpeo (*Lycalopex culpaeus*) are medium-sized carnivores found in high-altitude habitats along the Andean cordillera in Peru, Bolivia, Argentina, and Chile. Of these species, the Andean mountain cat is the only one that is restricted to these habitats, and the others are widely distributed throughout a variety of habitats in South America (Redford and Eisenberg 1992). The Andean mountain cat also appears to be much less common in high-altitude habitats than the other, more wide-ranging species (Lucherini and Luengos Vidal 2003; Perovic et al. 2003), and is considered endangered in the International Union for the

Conservation of Nature and Natural Resources (IUCN) *Red List of Threatened Species* (IUCN 2004, [www.iucnredlist.org](http://www.iucnredlist.org)). The colocolo is classified as near threatened by the IUCN (IUCN 2004, [www.iucnredlist.org](http://www.iucnredlist.org)), and the culpeo is of least concern. All 3 species of carnivores are hunted heavily to protect livestock and domestic fowl. The cats, especially the Andean mountain cat, also are hunted to obtain their skins for traditional ceremonial uses. In recent years, intensive large-scale mining has emerged as a major new threat to the high-altitude habitats of these carnivores from Peru to Argentina and Chile.

There are few data for comparisons, but the Andean mountain cat and colocolo appear to be of similar size (~4 kg—Redford and Eisenberg 1992), and the culpeo, a member of the Canidae, is larger (approximately 6 kg in northwestern Argentina—A. J. Novaro and P. Perovic, in litt.). Little is known of the ecology of the Andean mountain cat and colocolo, and although there have been several studies of the

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culpeo in other habitats, there is little information on the species in high-altitude deserts. Mountain vizcachas (*Lagidium viscacia*), large rock-dwelling rodents, have been suggested to be the main prey for Andean mountain cats, based on a few sightings and preliminary data (Villalba et al. 2004), but this has never been tested because there is no published information on the species' diet or prey availability in the habitats it occupies. Likewise, there is little information on the diet of sympatric carnivores, such as the colocolo and culpeo, in high-altitude habitats (Marquet et al. 1993; Romo 1995), but the 2 species are considered to be habitat and diet generalists (Novaro et al. 2004; Sunkist and Sunkist 2002).

Here we present the 1st data on the diet of the Andean mountain cat, and the 1st on the colocolo and the culpeo in high-altitude deserts of northern Argentina. This information will help to elucidate factors affecting their distributions, relative abundances, and habitat use, and the mechanisms that govern their coexistence. Also, knowledge about the diet of these carnivores can be used to improve conservation planning for both carnivores and their prey in the face of traditional and emerging threats in the high-altitude habitats of the Neotropics.

## MATERIALS AND METHODS

*Animal care and use.*—This study did not involve the capture and handling of animals. We followed guidelines of the American Society of Mammalogists (Animal Care and Use Committee 1998) for handling fecal samples and for transport of samples.

*Study areas.*—Most fecal samples were collected within 3 areas: Vilama, in northwestern Jujuy Province ( $n = 47$  Andean mountain cat and 15 culpeo samples), northern Catamarca Province ( $n = 276$  colocolo, 1 Andean mountain cat, and 37 culpeo samples), and the San Guillermo–Laguna Brava protected area complex ( $n = 228$  colocolo and 348 culpeo samples) in San Juan and La Rioja provinces (Fig. 1). All 3 carnivore species are present in these 3 main areas. Additional fecal samples from Andean mountain cats were collected from Coranzuli ( $n = 5$ ) in central Jujuy, Santa Catalina ( $n = 3$ ) in northern Jujuy, and Los Alisos National Park in Tucuman Province ( $n = 2$ ).

The Vilama site, at 22.3°S latitude, is 4,600 m above sea level and higher, and had no exotic European hares (*Lepus europaeus*) at the time of our study. Northern Catamarca encompasses a large area at approximately 25.6°S latitude, from Laguna Blanca to Antofalla, including a range of altitudes between 3,200 and 4,400 m above sea level. European hares were present, but at very low densities. The San Guillermo–Laguna Brava region also is a vast area between 28.2°S and 29.5°S latitude, with base plains at about 3,500 m above sea level and mountain peaks of >6,000 m above sea level. European hares were widespread along waterways and in humid meadows.

*Collection of feces.*—Feces were collected in systematic searches for caves in rock outcrops and opportunistically. Samples at all sites except for San Guillermo–Laguna Brava were collected in a single field campaign. Samples were collected in Vilama during the summer (January 1999), in



FIG. 1.—Sites where carnivore feces were collected in northwestern Argentina. Polygons around sites 1, 2, and 3 represent the extent of the areas surveyed at these 3 sites where most of the feces were collected. 1 = Vilama (62 feces), 2 = northern Catamarca (314 feces), 3 = San Guillermo (596 feces), 4 = Coranzuli (5 feces), 5 = Santa Catalina (3 feces), 6 = Los Alisos (2 feces).

Catamarca during the winter (June–July 2001), and in San Guillermo–Laguna Brava throughout the year between November 2003 and November 2005. Large groups of fecal samples from caves contained many old feces, however, so samples were not necessarily from the same season in which they were collected.

*Analysis of diet from feces.*—Culpeo feces were distinguished from those of cats based on form and size. Feces of the 2 cat species were identified by isolating DNA from the samples with a QIAGEN Stool Kit (QIAGEN, Valencia, California), amplifying the 16S rRNA mitochondrial gene (Johnson and O'Brien 1997) from the DNA obtained from the samples, and comparing the resulting sequences to those of known sequences and reference samples. Fifteen fecal samples from culpeo also were analyzed for confirmation. Genetic analysis was done at the Wildlife Genetics International laboratory in Nelson, British Columbia, Canada. When large groups of feces were found in the field, such as in caves or cracks in rocks, 3 or 4 samples from each group were sent to the Wildlife Genetics International for DNA identification. Because samples from the same cave or group were always assigned genetically to the same species, all of the feces in the group were assumed to come from the species identified from those samples. Groups of samples that could not be assigned to a species were discarded.

Feces were dried and washed and contents examined to determine food items. Mammalian food items were identified to species when possible, on the basis of teeth and hairs. Casts of hairs were made on stencil corrector fluid (Korschgen 1980), and their medulla and scale patterns were compared to those characters for the mammals occurring in the study areas

**TABLE 1.**—Diet composition of feces of Andean mountain cats, colocolos, and culpeos, presented as number of individuals of each item found in feces (*n*) and the percent of total food items (% food items), percent of feces that contained that food item (% feces), and body mass used for calculation of mean weight of mammalian prey.

Prey species	Body mass (g)	Andean mountain cat			Colocolo			Culpeo		
		<i>n</i>	% food items	% feces	<i>n</i>	% food items	% feces	<i>n</i>	% food items	% feces
<i>Phyllotis</i>	60	1	1.3	0	224	21.7	13.4	139	14.9	18.3
<i>Eligmodontia</i>	20	1	1.3	0	21	2.0	2.1	19	2.0	4.0
<i>Abrothrix</i>	30	0	0	0	16	1.6	1.5	10	1.1	1.8
<i>Neotomys</i>		0	0	0	7	0.7	0.6	7	0.8	1.3
Unidentified cricetine		28	37.3	45.6	249	24.2	22.2	93	10.0	19.5
<i>Ctenomys</i>	350	0	0	0	208	20	22.3	74	8.0	18.5
<i>Abrocoma</i>	200	0	0	0	37	3.6	4.0	18	1.9	4.5
<i>Lagidium viscacia</i>	1,500	21	28.0	36.8	55	5.3	6.1	30	3.2	7.5
<i>Chinchilla chinchilla</i> <sup>a</sup>		0	0	0	0	0	0	3	0.3	0.8
Caviidae	230	2	2.7	3.5	2	0.2	0.2	1	0.1	0.3
Marsupials		0	0	0	2	0.2	0.2	1	0.1	0.3
Vicugna, guanaco, or llama		2	2.7	3.5	12	1.2	1.3	130	14.0	32.6
Livestock		0	0	0	5	0.5	0.6	15	1.6	3.8
<i>Lepus europaeus</i>	3,100	2	2.7	3.5	18	1.7	2.0	63	6.8	15.8
Unidentified carnivores		0	0	0	3	0.3	0.3	10	1.1	2.5
Unidentified mammals		3	4.0	5.3	15	1.5	1.7	22	2.4	4.8
Unidentified birds		8	10.7	14	93	9.0	11.0	150	16.1	37.6
Flamingo		0	0	0	0	0	0	7	0.8	1.8
Eggs		0	0	0	2	0.2	0.2	3	0.3	0.8
Reptiles		4	5.3	7.0	49	4.8	5.3	36	3.9	7.3
Coleoptera		0	0	0	8	0.8	0.9	29	3.1	7.0
Orthoptera		0	0	0	0	0	0	1	0.1	0.3
Scorpions		0	0	0	0	0	0	20	2.2	4.8
Unidentified invertebrates		3	4.0	5.3	5	0.5	0.6	56	6.0	13.5
Plants		8			15			16		
Total food items		75			1,030			930		
Total fecal samples		57			504			399		

<sup>a</sup> In samples collected near Antofalla, Catamarca (25°38'34"S, 67°48'37"W).

(Vázquez et al. 2000). Birds and reptiles were identified on the basis of feathers, scales, and bones, and insects were identified to order, when possible.

**Statistical analysis.**—We present the diets of the 3 carnivore species as percent occurrence of food items (number of times an item occurred as percentage of the total number of prey items in all feces) and the percent of feces in which each food item was found. We calculated dietary niche overlap between all pairs of species with Pianka's (1973) index,  $\alpha = \sum p_i q_i / (\sum p_i^2 \sum q_i^2)^{1/2}$ , where  $p_i$  is the proportion of taxon  $i$  in the diet of the 1st species, and  $q_i$  is the proportion of taxon  $i$  in the diet of the 2nd species. This index ranges from 0 (no overlap) to 1 (complete overlap). To determine the probability that overlaps of the observed magnitude are greater or less than those that would be expected randomly, we did 1,000 Monte Carlo randomizations of proportions of different food items in each species' diet to simulate possible overlaps among the 3 species using the program EcoSim 7.72 (Gotelli and Entsminger 2006). We compared diets between sites and between species with the highest overlaps with log-linear analysis of frequencies (Novaro et al. 2000; Zar 1996) using the program Statistica, version 6 (StatSoft, Inc. 2001, www.statsoft.com). To reduce the number of categories for this analysis, we grouped all cricetine rodents and used only the food items with a frequency of  $\geq 10$  for each species.

We evaluated dietary separation among the 3 species by plotting the major axes of dietary variation identified with correspondence analysis (Ray and Sunquist 2001). Only those food items that represented  $\geq 5\%$  of one of the species' diets were included in the analysis. We described the dietary niche breadth of the 3 species with Levins' (1968) formula, standardized by Colwell and Futuyama (1971),  $B_{sta} = (B_{obs} - B_{min}) / (B_{max} - B_{min})$ , where  $B_{obs} = 1 / \sum p_i^2$ ,  $p_i$  is the proportion of taxon  $i$  in the diet,  $B_{min}$  is the minimum possible diversity (=1), and  $B_{max}$  is the maximum possible (=  $n$ , the total number of different taxa consumed by the 3 species).

Mean body masses of prey are frequently reported as an additional method for comparing diet partitioning among carnivores (Jaksic and Braker 1983; Ray and Sunquist 2001; Romo 1995). Because we did not identify most birds and reptiles to species, we could not estimate body mass for avian and reptilian prey, so we compared only that of mammalian prey. Body masses of mammalian prey (Table 1) were obtained from the authors' unpublished trapping data and weights presented in Redford and Eisenberg (1992). Frequency distributions of body mass of mammalian prey were consistently skewed for all predators and sites. Therefore, we calculated the mean weight of mammalian prey as the arithmetic mean of the body masses of all the prey individuals found in the scats, with confidence intervals estimated with log

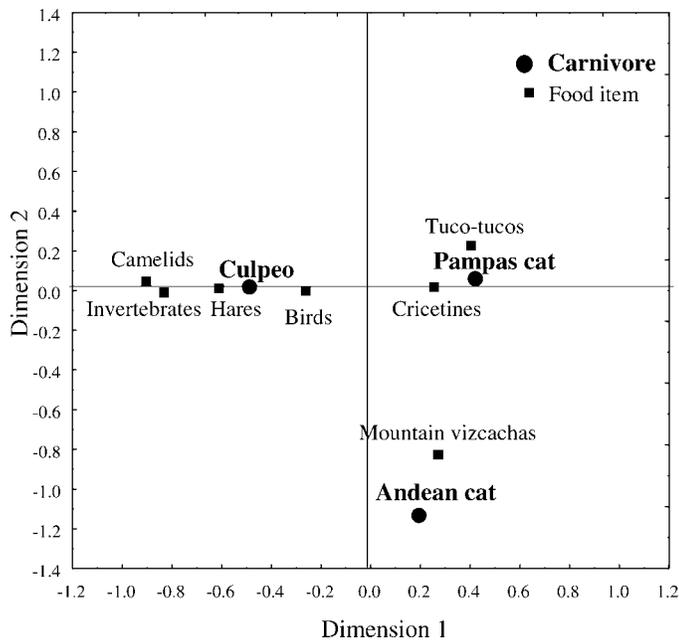


FIG. 2.—Dimensions 1 and 2 of the correspondence analysis comparing frequency of occurrence of food items by carnivore species.

transformations of the data that are back-transformed. Geometric means, as used by Jaksic and Braker (1983), tend to underestimate mean weights of prey. Arithmetic means provide more realistic estimates of the mean weight of mammalian prey consumed by predators, and allow computing asymmetrical confidence intervals, which is consistent with highly skewed distributions (Fowler et al. 2003). Livestock and camelids (guanacos and llamas [*Lama glama*] and vicuñas [*Vicugna vicugna*]) in the feces were assumed to be scavenged, and were excluded from calculations of mean weight of mammalian prey, although these carnivores may occasionally prey on newborns of these species, as reported by local shepherds.

**RESULTS**

For all 3 carnivores, cricetine rodents were the most frequent food item, representing 29% or more of the food items for each species (Table 1). However, frequency of cricetines in fecal samples was greatest for colocolos (50% of food items). The 2nd most frequently consumed item was tuco-tucos (*Ctenomys*) for colocolos, southern mountain vizcachas for Andean mountain cats, and birds for culpeos. Most of the plant material found in feces was grasses, so we assumed that this was consumed incidentally and did not count as a food item. The diets of the colocolo and Andean mountain cat had an overlap of 0.82, those of the colocolo and the culpeo 0.85, and those of the culpeo and Andean mountain cat 0.78. The simulated mean overlap obtained from Monte Carlo randomizations was 0.47 (variance = 0.01), and the observed overlap was greater than that expected by chance ( $P = 0.01$ ).

Although overlap in diet among the 3 species was higher than random, the diets of the 3 species were clearly

TABLE 2.—Mean weight of mammalian prey (g; 95% confidence interval in parentheses) for Andean mountain cats, colocolos, and culpeos for the entire study, and separately for San Guillermo and Catamarca sites for colocolos and culpeos.

Species	Overall	San Guillermo	Catamarca
Andean mountain cat	713 (464–1,094)		
Colocolo	299 (276–324)	308 (277–344)	287 (254–324)
Culpeo	628 (543–727)	683 (586–799)	93 (71–122)

differentiated in the correspondence analysis, with Andean mountain cats consuming more southern mountain vizcachas, colocolos consuming more cricetines and tuco-tucos, and culpeos consuming mainly hares, invertebrates, birds, and carrion from camelids (Fig. 2). The Andean mountain cat had a diet specialized toward southern mountain vizcachas, the colocolo specialized on tuco-tucos and cricetines, and the culpeo had a more generalized diet.

The log-linear analysis of frequency of food items in the diet was done between the colocolo and the culpeo, the 2 species with the highest diet overlap index, and between San Guillermo and northern Catamarca, which were the 2 sites for which data were available for both species. Diets of colocolos and culpeos were significantly different from each other ( $\chi^2 = 503.98$ ,  $d.f. = 26$ ,  $P < 0.0001$ ), and the difference varied between San Guillermo and northern Catamarca ( $\chi^2 = 45.24$ ,  $d.f. = 16$ ,  $P < 0.001$ ). The colocolo consumed more cricetines, southern mountain vizcachas, and tuco-tucos in Catamarca, and more *Abrocoma*, hares, and reptiles in San Guillermo. The culpeo consumed more invertebrates and cricetine rodents in Catamarca, and more carrion from camelids and hares in San Guillermo (Table 3).

Overall, standardized niche breadth was similar for Andean mountain cats ( $B_{sta} = 0.19$ ) and colocolos ( $B_{sta} = 0.15$ ), but much greater for culpeos ( $B_{sta} = 0.62$ ). For the culpeo and colocolo, separate calculations for the San Guillermo and Catamarca sites indicated a wider niche breadth for both species in San Guillermo ( $B_{sta} = 0.17$  for colocolo and 0.63 for culpeo) than in Catamarca ( $B_{sta} = 0.13$  for colocolo and 0.47 for culpeo).

The mean weights of mammalian prey and associated confidence intervals for Andean mountain cats and culpeos were greater than those of colocolos, because of their greater consumption of southern mountain vizcachas and European hares, respectively, the 2 largest prey items included in this analysis (Table 2). Mean weight of mammalian prey was similar for colocolos in San Guillermo and Catamarca. However, mean weight of mammalian prey for culpeos was much greater in San Guillermo than in Catamarca.

**DISCUSSION**

These 3 carnivores of the high-altitude deserts of Argentina used the same food resources, but in different proportions. The most specialized of the 3 appeared to be the Andean mountain cat, which relied most heavily on southern mountain vizcachas. This was clearly demonstrated in the correspondence analysis,

**TABLE 3.**—Major ( $\geq 5\%$  of the diet of  $\geq 1$  of the species at  $\geq 1$  of the sites) food items of colocolos and culpeos at the San Guillermo and northern Catamarca sites in Argentina, presented as percent of total food items.

Food item	Colocolo		Culpeo	
	San Guillermo	Catamarca	San Guillermo	Catamarca
Cricetines	49.82	52.89	29.70	38.46
<i>Ctenomys</i>	17.08	25.17	8.82	6.59
<i>Abrocoma</i>	6.16	0.46	2.20	6.16
<i>Lagidium</i>	3.52	8.08	3.63	0
Camelids	1.76	0.46	15.69	6.59
European hares	2.99	0.23	8.17	0
Birds	10.04	9.70	16.47	17.58
Reptiles	8.10	0.69	3.89	3.30
Invertebrates	0.53	2.31	10.38	24.18
Total food items	579	457	92	771
Total fecal samples	276	228	37	348

and also was reflected in the greater mean weight of mammalian prey for this species. The southern mountain vizcacha was the most important food item for the Andean mountain cat in terms of biomass, given that the body mass of an adult southern mountain vizcacha is about 25 times that of the most frequent food item (cricetine mice).

To determine whether Andean mountain cats are selecting for southern mountain vizcachas, it would be necessary to compare biomass of southern mountain vizcachas in the cat's diet with available biomass in areas with different densities of southern mountain vizcachas and alternative prey. Although most of our Andean mountain cat samples came from the same site, southern mountain vizcachas represented 53% of the prey items in the 10 samples from other sites. Wildcats (*Felis silvestris*) in Spain that were considered to be rodent specialists switched to European rabbits (*Oryctolagus cuniculus*) where these were available, suggesting a facultative specialization according to availability (Malo et al. 2004), and such a case cannot be ruled out for Andean mountain cats without additional data.

The colocolo also had a specialized diet, in contrast to what we had expected based on the little published information (Sunquist and Sunquist 2002). Tuco-tucos, although not as large as southern mountain vizcachas, are much larger than cricetine rodents, and, thus, likely represent the most important food item for colocolos in terms of biomass. Although the colocolo has a wide geographic distribution (Sunquist and Sunquist 2002), this distribution roughly follows that of tuco-tucos (Eisenberg and Redford 1999; Redford and Eisenberg 1992). Nine feces from colocolos from the only previous dietary study of this species at high-altitude sites in Peru contained mostly mice (Romo 1995). The mean weight of vertebrate prey of colocolos was much higher in Peru (629 g) than in this study in Argentina, because of the presence of a *Cuniculus taczanowskii*, with a mass of almost 5 kg, in 1 of the 9 feces analyzed.

The culpeo was much more of a generalist than the 2 cat species, consuming all the prey items that the cats used, and

a greater variety of invertebrates. At high-altitude sites in Peru, culpeos consumed proportions of mice (35.5%), birds (12.2%), and invertebrates (5%) similar to those of culpeos in this study, but did not consume European hares and carrion from camelids (Romo 1995). At a high-altitude site in Chile, culpeos preyed mostly on cricetine rodents and insects, but also consumed *Abrocoma*, tuco-tucos, and southern mountain vizcachas, and approximately 12% of their diet was birds (Marquet et al. 1993). Camelids, which were uniformly important food items at our 3 sites in Argentina, comprising  $\geq 10\%$  of the diet at each, represented  $< 1\%$  at this Chilean site. This greater importance of camelids at Vilama, Catamarca, and San Guillermo may reflect a greater availability because of large populations of vicuñas and guanacos at these sites.

Although culpeos consumed more introduced European hares at our sites than did the 2 cats, their diet was comprised mostly of native, rather than exotic prey. This is in contrast to culpeos in the Patagonian steppe, which relied predominantly on European hares and carrion of livestock (Novaro et al. 2000). The greater reliance on native prey in the high-altitude deserts indicates that the native prey base is more intact, and there are relatively lower densities of exotic prey than in the Patagonian steppe. The remains of short-tailed chinchillas (*Chinchilla chinchilla*) found in 3 culpeo scats from Antofalla in Catamarca indicate that this rodent, which was considered extinct in Argentina (Gudynas 1989), is still present in the wild in these habitats.

Differences in diets of culpeos and colocolos among our sites may be due to some extent to differences in availability of prey according to latitude and altitude. Although all sites were in high-altitude deserts, average temperature and plant productivity decrease with increasing latitude. This gradient may explain the greater consumption of invertebrates by culpeos in the more northerly site of Catamarca compared to San Guillermo. Other differences could be related to greater density of camelids and cougars (*Puma concolor*) in San Guillermo, which would lead to greater availability of carrion of camelids (A. J. Novaro et al., in litt.).

The coexistence of these 3 species of carnivores in the high-altitude deserts appears to be facilitated by partitioning of food resources. This could be a long-term, evolutionary response to interspecific competition, which has resulted in a narrowing of the niche breadth for the 2 cat species (Futuyma and Moreno 1988). Nevertheless, there was a relatively high overlap among carnivores in terms of food items used, and both culpeos and colocolos consumed southern mountain vizcachas, the major prey of the Andean mountain cat. According to the Lotka-Volterra model of interspecific competition, intensity of competition between species is the product of their shared use of a resource and relative abundances (Begon et al. 1990). High relative abundance of culpeos and colocolos (Lucherini and Luengos Vidal 2003; Perovic et al. 2003) is confirmed by the relative abundances of scats of the 3 species found in this study. Therefore, colocolos and culpeos could be exerting intense resource competition on the Andean mountain cat, in spite of the fact that they consume comparatively fewer southern mountain vizcachas. The expansion of the European hare could favor the culpeo, increase its density, and have

a negative impact on the southern mountain vizcacha through apparent competition (Holt 1977), which could reduce prey availability for the Andean mountain cat, and through direct resource and interference competition.

In addition to separation of resource use, spatial and temporal separation among species also may result from interspecific competition. The mean elevation at which evidence of colocolos was encountered in northern Argentina was significantly lower than that at which evidence of Andean mountain cats was encountered (Perovic et al. 2003). Nevertheless, colocolos were found at up to 4,500 m above sea level, and in Catamarca we found feces of the 3 species within the same rock outcrop. In Bolivia, a radiocollared Andean mountain cat was more active at night (Villalba et al. 2004), and photographs of colocolos and culpeos taken with camera traps at the San Guillermo site also are mostly nocturnal (A. J. Novaro et al., in litt.). However, the high frequency of birds in the culpeo diet may suggest more diurnal activity. Tuco-tucos were major prey items for 2 diurnal and 1 nocturnal raptor in Patagonia (Monserrat et al. 2005), and southern mountain vizcachas are more nocturnal in the summer and diurnal in the winter at the San Guillermo site (R. S. Walker, in litt.). Thus, examination of our data provides no clear evidence of spatial or temporal segregation among these 3 species, although such separation may occur.

Two contrasting hypotheses have been proposed about the competitive ability of widespread versus geographically restricted species (Glazier and Eckert 2002). One maintains that widespread species, such as the colocolo, have become widespread because they are competitively dominant over related, geographically restricted species, such as the Andean mountain cat. The alternative hypothesis is that wide-ranging species are ecological generalists that have been able to opportunistically colonize a wide range of habitats, whereas related narrow-ranging species are ecological specialists that competitively dominate specific habitats or resources. The commonly found positive association between size of range and local abundance, as is the case for the Andean mountain cat and colocolos, has been considered to support the 1st hypothesis (Brown 1984). However, specialized, restricted species could be more efficient resource exploiters and still have smaller local populations because they use rarer or lower-quality resources (Glazier and Eckert 2002). This could be the case for the Andean mountain cat, if it is indeed a more efficient exploiter of mountain vizcachas. The mountain vizcacha should be a high-quality resource because of its large body size, but it may be rarer than other resources, because it has a very patchy distribution, being a strict specialist for rocky habitats (Walker et al. 2003). Because of use of this habitat by the mountain vizcacha to escape predators, it also may be a more difficult prey to catch than many other species. On the other hand, the more widely distributed and more locally abundant colocolo also appears to have specialized in the high-altitude deserts, at least to some extent, on a more abundant, but also patchily distributed resource, the tuco-tuco, which requires soil types that are adequate for its burrows.

This patchy distribution of major prey species of the 2 cats suggests that very large areas may be required to support individual cats and populations. Nevertheless, human activities that impact even a small proportion of a cat's range may have an inordinately large effect on that individual if the area affected is an important patch or habitat feature, such as a rock outcrop with mountain vizcachas, an area of sandy soil with tuco-tucos, or meadows and streams that provide habitat for cricetine mice.

## RESUMEN

Presentamos los primeros datos sobre la dieta del gato andino (*Leopardus jacobitus*) y los primeros datos en desiertos de altura del norte de Argentina para el gato de pajonal (*Leopardus colocolo*) y el zorro culpeo (*Lycalopex culpaeus*) en base al análisis de heces. Las heces de gato andino y de pajonal fueron diferenciadas con análisis de ADN. El gato andino ( $n = 57$ ) fue el más especializado, dependiendo principalmente de chinchillón (*Lagidium viscacia*). El gato de pajonal ( $n = 504$ ) también fue especializado, consumiendo especialmente cricétidos y tuco-tucos (*Ctenomys*). El culpeo ( $n = 399$ ) fue un generalista, consumiendo todas las presas que utilizaron los gatos y una mayor variedad de invertebrados. La chinchilla grande (*Chinchilla chinchilla*) fue hallada en 3 heces de culpeo, indicando que este roedor, considerado extinto en Argentina, aún está presente en el medio silvestre. Tanto chinchillones como tuco-tucos tienen distribuciones naturalmente fragmentadas, por lo que podrían requerirse grandes áreas para mantener poblaciones de los felinos que dependan de estas presas.

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