
Biological Sustainability of Live Shearing of Vicuña in Peru

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Abstract: *The vicuña's (Vicugna vicugna) fiber is highly valued as an export product that is made into luxury fabric and clothing. The price of fiber in 2004 was \$566/kg, which makes the fiber a potentially important source of income for Andean agropastoral communities and serves as an incentive to allow vicuña grazing on high-elevation Andean landscapes. It is presumed that a shorn vicuña has little value for poachers, so shearing vicuñas could serve as a disincentive to poaching. Thus, the supply of vicuña fiber may be sustainable if it is procured through live shearing, which should serve as a powerful conservation tool. We evaluated the effects of capture and shearing on the demography of vicuña in one site located in the Salinas Aguada Blanca Reserve, Arequipa, Peru, where vicuñas were captured and shorn in spring and then returned to the wild. We conducted fixed-width line-transect censuses from 1997 to 2003 of this population. We compared the proportion of young born to females that were shorn versus females that were unshorn for the 3 years in which shearing occurred. We evaluated the effect of capture and shearing on proportion of young born to shorn and unshorn females at a second site, Picotani, Puno. The wild population in Arequipa that underwent capture and shearing showed a steady increase in total population and average density between 1997 and 2003. No significant difference was found between the proportion of young per female for shorn and unshorn females at either site. We conclude that in spring, capture and live shearing of vicuñas can be biologically sustainable. Further research is needed to determine whether shearing during winter months is biologically sustainable.*

Keywords: Andes, community-based conservation, *Vicugna vicugna*

La Sostenibilidad Biológica del Trasquilado de Vicuñas Vivas en Perú

Resumen: *La fibra de vicuña (Vicugna vicugna) tiene gran valor como un producto de exportación que es transformado en tela y ropa de lujo. El precio de la fibra en 2004 era de \$566/kg, lo que hace que la fibra sea una fuente de ingreso potencialmente importante para comunidades agropastoriles Andinas y servir como un incentivo para permitir el pastoreo de vicuñas en paisajes Andinos elevados. Se presume que una vicuña trasquilada tiene poco valor para cazadores furtivos, por lo que el trasquilado de vicuñas pudiera servir como un desincentivo para la caza furtiva. Por lo tanto, el abastecimiento de fibra de vicuña puede ser sustentable si se obtiene del trasquilado de animales vivos, y el trasquilado de animales vivos debería ser una poderosa herramienta de conservación. Evaluamos los efectos de la captura y trasquilado sobre la demografía de vicuñas en un sitio localizado en la Reserva Salinas Aguada Blanca, Arequipa, Perú, donde las vicuñas fueron capturadas y trasquiladas en primavera y liberadas. Realizamos censos de esta población en transectos lineales de ancho fijo de 1997 a 2003. Comparamos la proporción de crías de hembras trasquiladas con las de hembras no trasquiladas durante los 3 años en que ocurrió el trasquilado. Evaluamos el efecto de la captura y trasquilado sobre la proporción de crías de hembras trasquiladas y no trasquiladas en un segundo sitio, Picotani, Puno. La población silvestre en Arequipa que fue capturada y trasquilada mostró un incremento constante en la población total y la densidad promedio entre 1997 y 2003. No se encontró diferencia significativa entre la proporción de crías por hembra para hembras trasquiladas y no trasquiladas en ningún sitio. Concluimos que*

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en la primavera, la captura y trasquilado de vicuñas vivas puede ser biológicamente sostenible. Se requiere más investigación para determinar si el trasquilado durante el invierno es biológicamente sostenible.

Palabras Clave: Andes, conservación basada en comunidades, *Vicugna vicugna*

Introduction

The vicuña (*Vicugna vicugna*) is a wild camelid that inhabits the high Andes from approximately 3200 to 5000 m asl. This species has several notable characteristics and offers an excellent case study for examining community-based conservation for three reasons. First, it produces some of the finest fiber in the world (12–14 μ), and its fiber is of considerable interest to fashion houses and textile companies throughout the world (Wheeler & Hoces 1997; Cox 2004; Sahley et al. 2004b). The 2004 market price of vicuña fiber was \$566.00/kg (Z. Wharton, personal communication).

Second, the vicuña shares its habitat, the mostly treeless highlands of the Andes, with Andean villagers. The majority of vicuñas live outside protected areas, but even inside protected areas, they coexist with people and domesticated animals that include sheep, alpacas (*Lama pacos*), and llamas (*Lama glama*). Currently over 200,000 families throughout the high Andes of Peru participate in utilization of the vicuña (Consejo Nacional de Camélidos Sudamericanos 2004). In 2003, 613 registered capture and shearing events occurred and 6092 kg of fiber were harvested (Consejo Nacional de Camélidos Sudamericanos 2004).

Finally, the vicuña (with the possible exception of the guanaco [*Lama guanacoe*]) is, to our knowledge, the only wildlife species that can produce commercially valuable product through live shearing. Harvest of the individual animal, unlike many other wildlife species, is not necessary to obtain economic benefit. This has profound implications for the species' conservation and management and for the marketing strategy of its fiber that is made into high-priced luxury clothing.

The system of capture and release adopted nationally in 1995 borrowed from Inka tradition and represents a combination of indigenous and modern technology and culture. The Inkas, and presumably other pre-Columbian cultures, conducted large-scale roundups of vicuña every 3–5 years (Flores-Ochoa & Macquarrie 1995; Lichtenstein & Vila 2003) and sheared many vicuña before their release. Currently in Peru captures are conducted on foot by community members who herd the animals through walls constructed of fish netting that lead to a funnel-shaped enclosure that ends in a smaller fish-net capture pen. Once in the pen all adult vicuñas that have fiber long enough for shearing (approximately 2.5 cm) are, in most cases, shorn with mechanical shears. When mechanical

shears are not available, scissors are used. The flank and back are shorn but not the neck, legs, or tail because fiber quality in these areas is lower. It is estimated that a vicuña can produce on average approximately 250 g of fiber per shearing (Wheeler & Hoces 1997). It may take 2–3 years for vicuñas to completely regrow their fiber to its commercially viable length; thus, although a vicuña may be captured yearly, it is shorn every second or third year.

After shearing vicuñas are released back into the wild within 0.5–1 day of capture, or more commonly, large corrals (Wheeler and Hoces 1997; Lichtenstein 2002; Sahley et al. 2004a). Different communities may vary in capture techniques, and methods are based primarily on the number of vicuñas to be captured and the degree of community organization.

Valid concerns have been raised about the potential effects of stress during capture and shearing on vicuñas and its effects on morbidity and mortality (Bonacic 1996; Wheeler and Hoces 1997), and subsequent biological sustainability of the current techniques of fiber harvest. Vicuñas undergo two different potential stress events: roundup and capture, and loss of fiber, which plays an important thermoregulatory function (Fowler 1989). Capture and handling can cause an elevation in adrenocorticotrophin hormone and elevated cortisol levels. In llamas adverse responses from excessive cortisol response can include depression of immune-system response, lymphoid tissue atrophy, ulceration, and lymphopenia, among other physical ailments (Fowler 1989). Mortality due to stress from capture has been found in white-tail deer (*Odocoileus virginianus*) up to 30 days after capture (Beringer et al. 1996). Factors that influence stress during capture include capture technique, number of animals captured, and amount of time of animal manipulation (Beringer et al. 1996; Bonacic 2000).

Although South American camelids, especially the vicuña, are highly adapted to living in the cold, low-oxygen environments of the high Andes (Jurgens et al. 1988; Fowler 1989), experiments conducted in late winter on a small sample of male vicuñas in Chile showed that total removal of fiber causes high mortality levels, whereas some animals partially shorn exhibited some mortality (Bonacic 1996). For animals shorn in late winter, hypothermia was found in partially shorn animals up to 20 days after shearing (Bonacic 2000). Such physiological stress may be especially important in adult females, which are also shorn and may be both pregnant and lactating at the time of shearing.

We used two complementary approaches to determine whether the capture and live shearing of vicuñas is biologically sustainable at the population level. First, we studied a wild population below carrying capacity that was captured in 1999, 2000, and 2002, and shorn if fiber length was appropriate. We considered these activities biologically sustainable if $\lambda \geq 1$ (λ being the multiplicative factor of population growth; Bodmer & Robinson 2004). Vicuñas are strongly influenced by density-dependent factors (Sanchez 1984; Sahley 2000; Bonacic 2002). Thus, in the absence of nondensity-dependent factors, the population observed should exhibit growth during the period of study if the capture-shearing process is biologically sustainable.

Second, we conducted a large-scale, multiyear experiment in two communities in two different life zones to isolate the effects that capture and live shearing of female vicuña might have on the number of young born. We compared the proportion of young produced by unshorn females with that of shorn females. We tested the hypothesis that shearing does not affect the production of young.

Methods

Study Site

The study site in Arequipa, Peru, was within the Salinas Aguada Blanca Reserve at between 4000 and 4200 m asl, which corresponds to the subtropical, subalpine, desert-scrub life zone as characterized by the Holdridge system. This life zone receives an average of 289.5 mm of precipitation per year and has an average temperature of 3–6° C. The study area was approximately 86 km² and was located within the legally recognized campesino community of Tambo Cañahuas. We chose this site because it had easily observable vicuña family groups and members of the community captured and sheared wild vicuñas approximately once a year. The area in which we worked consisted of a flat plain located within mountainous terrain.

The study site in Picotani, Puno, was at an elevation of approximately 4800 m asl, corresponding to the subtropical, alpine, pluvial-tundra life zone, which is characterized by 687–1020 mm of precipitation annually and an average temperature of 2.5–3° C. Vicuñas at this site were on lands outside a protected area that were managed by a business consortium of three campesino communities (called the *Empresa Multicomunal de Picotani*). Vicuñas at this site were in large (1000 ha) corrals and were captured once a year.

We wanted to determine whether there were observable differences in production of young between shorn and unshorn females in the colder, wetter climate compared with Tambo Cañahuas and to compare the effects

of different capture and shearing techniques (mechanical shears [Picotani] vs. scissors [Tambo Cañahuas]) in the two populations. Mechanical shears remove more fiber at a uniform length than scissors in a shorter period of time (3 minutes) but may increase vicuñas' exposure to cold. The use of scissors is not as efficient and requires that an animal be restrained longer (45 minutes). We also looked at potential effects of large (Picotani) versus small-scale (Tambo Cañahuas) captures.

Estimate of Carrying Capacity and Biomass

As part of a larger ecological study, we determined biomass of natural forage in the Tambo Cañahuas study site from 1997 to 2000. In 1997 we used 16.1 m² randomly selected quadrats for biomass estimation. In subsequent years we added five more randomly selected quadrats. We used scissors to cut all vegetation (excluding shrubs) to ground level. We then placed vegetation in plastic bags according to species, measured fresh weight of the vegetation in each bag, and then oven dried vegetation samples from each bag for 24 hours. Dried samples were again weighed to estimate dry weight. We used the mean dry-weight biomass of the sample as an estimate of natural forage production. Carrying capacity varied up to twofold between and within years (C.T.S. et al., unpublished data). We used the data from July 1997 (the lowest biomass observed during the study) to conservatively estimate carrying capacity for purposes of this study.

To estimate carrying capacity, we used data on mean weight of adult vicuñas and 3.5% of body weight (Hoffman et al. 1983) as an estimate of metabolic forage needed. We assumed 10% consumption of forage production to meet these needs. Although this estimate does not take into account foraging requirements of lactating or pregnant females, we used the results to construct a reasonable hypothesis regarding the carrying capacity of our study area.

Vicuña Capture and Shearing

Most animal handling and all shearing were conducted by members of the community or, occasionally, government representatives. In Tambo Cañahuas, Arequipa, capture of vicuñas was generally initiated at 0700 hours, with 50–70 men, women, and children participating. Village participants were distributed along the first capture area (70–80 ha) that was surrounded by a 2 m tall fence of fish netting. Villagers hid behind shrubs, small mounds of dirt, or in 1-m deep trenches located throughout the area. Villagers would maintain watch with binoculars and communicate with hand signals when vicuñas approached.

Once the vicuña were in the capture area, villagers jumped out of their hiding places and grabbed a large prepositioned rope tied with bright ribbons that allowed them to herd the vicuñas into a smaller capture area. All herding was done on foot, and villagers walked, or more

often ran, as the capture progressed. Capture took place once vicuñas entered a funnel-shaped chute that led into a capture corral, also made of fish netting. Usually 1–3 family groups were captured at a time (from 5 to 15 vicuñas/capture). Vicuñas were captured by hand, laid on a tarp, tied at the legs, and shorn. In Tambo Cañahuas, Arequipa, most shearing was conducted with shearing scissors, although toward the last year of our study, some animals were shorn mechanically. All captured adult male and female vicuñas that had not been shorn the previous year or had fiber long enough for shearing (2.5 cm) were shorn. Young born in that year were not shorn and were released with the adults when shearing was completed. Shearing with scissors took approximately 30–45 minutes/vicuña. Although men conducted the shearing, both men and women assisted with capture and handling of vicuñas while shearing. Care was taken not to injure or unnecessarily cause distress to animals, especially pregnant females.

During the shearing process, we examined vicuñas' teeth to estimate their age class (Hoffman et al. 1983) and determine sex. We tagged animals with plastic, colored, and numbered duflex (Nasco, Fort Atkinson, WI) goat/sheep tags. The duflex tags are designed to reduce the chance of infection due to tagging. We disinfected the ear area with iodine before and after tagging. We observed no subsequent infection, injury, or discomfort because of tagging. We placed tags on the right ear of males and left ear of females. Tag color was determined by age class, and numbers on tags were used to identify individuals. At Tambo Cañahuas vicuñas were shorn and marked by age class in 1999, 2000, and 2002. No shearing or capture was conducted in 1998 or 2001.

The first 2 years of tagging in Tambo Cañahuas (1999 and 2000) we identified four age classes: old adult (older than 8 years), adult (3–8 years), nonreproductive adult (1–2 years), and young (born that year). The last year of tagging (2002) at Tambo Cañahuas, we identified three age classes (adult, nonreproductive adult, and young).

After all eligible vicuñas were shorn they were released into the wild by opening the capture corral; release occurred within 3 hours of capture. Over the 3 years of capture, shearing, and tagging, four capture-related mortalities occurred because of injury from running into mesh fencing and/or poles.

Capture and Shearing at Picotani

In contrast to Cañahuas, vicuñas at Picotani were enclosed in a 1000-ha corral and numbered over 3000. Thus, the scale of capture and fiber production was much greater than that of Cañahuas, and subsequent investment in infrastructure and organization has led to some differences in capture and shearing technique. At Picotani capture activities began at 0800 hours, and approximately 200 persons were involved. These individuals organized

themselves into different subgroups for animal capture, classification, and shearing; cleaning the shearing area; and classifying and weighing fiber prior to placing it in bags.

Vicuñas were herded, as in Cañahuas, with ropes and colored plastic ribbons. In addition, cans with rocks were hung on the ropes to create noise and a formidable barrier. The vicuñas were slowly herded into smaller capture corrals made of wire and wood. Villagers placed brown jute fabric around the corrals, which inhibited vicuñas from running into the fencing. Capture of animals took approximately 2 hours, and 300–400 vicuñas were captured per attempt.

After herding into the handling corral, vicuñas were captured by hand and inspected to determine whether they were suitable for shearing. Calves <1-year old were transferred to another corral along with vicuñas not suitable for shearing. These animals were then released. To prevent accidents villagers proceeded slowly and with care.

Animals selected for shearing were transferred to a shed with capacity to hold 50 vicuñas. Prior to shearing vicuñas had their back legs tied together. The front legs were then tied together and stretched so that the vicuña was as horizontal as possible to the floor. This position allowed for efficient shearing and lowered the probability of injury. Vicuñas were shorn with mechanical shears, which took from 3 to 5 minutes; animals were then released into a capture corral. When the group of 50 vicuñas was processed, they were released back into their large enclosure. Tagging procedures in 2002 were the same as for Cañahuas. We categorized vicuñas into three age groups: calves, nonreproductive adults, and reproductive adults. Capture and shearing at Picotani was conducted over 4 days. No mortality due to capture was observed.

Effect of Shearing on Number of Young Born

We determined the proportion of young born to both shorn and unshorn females at both study sites during fixed-width transect censusing (see below) at Tambo Cañahuas and total count censusing at Picotani. Unshorn females at each study site were used as controls. To determine the effect of shearing on number of young born, we identified females that had been shorn that year and observed family groups and maternal behavior (Vila 1992) to determine whether they gave birth. We also observed females who had not been shorn and determined whether they had young or not. Censuses to determine proportion of young were conducted from March through May, the months when most vicuñas are born at both sites.

In Tambo Cañahuas we tagged vicuñas in 1999, 2000, and 2002 (in 1998 and 2001 animals were not captured and shorn). We were thus able to observe effects on production of young in 2000, 2001, and 2003. In Picotani we tagged vicuñas in 2001 and determined the effects

on production of young in 2002. To determine the effect of shearing on the proportion of young born to females, we used the chi-square test to compare the proportion of young born to shorn and unshorn females, pooling data obtained in 2000, 2001, and 2003 for Tambo Cañahuas. For Picotani Puno we used the chi-square test to compare the proportion of young born to shorn and unshorn females in 2002.

Effect of Shearing on Population Dynamics at Tambo Cañahuas

We examined population dynamics at Tambo Cañahuas only, where vicuñas were not enclosed and ranged freely. We believed that density-dependent factors associated with corralled animals at Picotani, Puno, and associated behavioral changes would confound our analysis of the effects of shearing on population dynamics at the Picotani site.

At Tambo Cañahuas we estimated densities with 10 fixed-width line transects that together totaled 42 km. For each census, we drove along transects at a velocity of 5–10 km/hour and noted animals within a 500-m range along each side of each transect so that our total fixed-width survey area was 42 km². Because our study area was a treeless plain, visibility within 500 m was excellent and we were able to observe and identify untagged, tagged, or shorn vicuñas easily. Positively identifying family groups was possible because of differences in group size and the presence of tagged animals in groups. We calculated the density for each fixed-width transect and then took the average of the 10 transect densities to estimate mean total vicuña density in the study area for every census conducted. We conducted a total of 47 censuses from 1997 to 2003. We also took the mean of the averages for each census within a year to get an estimate of yearly density. From our mean densities, we calculated standard error.

We estimated total numbers of vicuña in our study area by taking the number of positively identifiable family groups observed over 1 year and adding these to the maximum number of bachelor groups of vicuñas (which entered and left the study area regularly) and nonidentifiable solitary vicuñas seen in 1 day. We calculated lambda (λ) from our total count estimates and estimated the number of young born per year through total counts of positively identified family groups. We used our total count data to calculate r , the intrinsic rate of increase, for the population.

During our censuses we recorded the following data when vicuñas were sighted: (1) group type (family, bachelor herd, solitary, or nondifferentiated); (2) number of individuals per group (for all group types) and composition of family groups (number of adult females, number of young, presence of adult male); (3) GPS location, distance from vehicle (determined with range-finder binoculars),

and angle from vehicle location (determined with a compass); (4) identity of females that had young; (5) identity of individuals and their age and sex category based on their tag; and (6) whether an animal had been shorn in that year or not.

Results

Estimate of Carrying Capacity

Average biomass for the month we observed the least forage production, July 1997, was 9.9 g/m² ($n = 16$, $SD = 3.4$), or 9900 kg/km². On the basis of a 10% consumption estimate, we approximated a carrying capacity of 9.9 vicuñas/km². Mean vicuña density for 1997 was 2.8 vicuñas/km². Although our estimate was simplified, carrying capacity estimates increased more than twofold over a year and between years. Our data on plant biomass in comparison with vicuña density indicated that the population was below carrying capacity in all years of this study (C.T.S. et al., unpublished data). Previous censuses (Fernandez 1995) show that the population in Tambo Cañahuas, Arequipa, suffered a severe poaching event in 1993 that reduced the population significantly. Therefore, our calculation was purposefully conservative and suggests that the hypothesis that the population was under carrying capacity when we began our study is a reasonable one.

Population Dynamics

Vicuñas at Tambo Cañahuas exhibited consistent population growth during the study whether or not capture and live shearing occurred. Both total numbers and average density/year increased over the length of our study (Table 1; 1997, 1999, 2000, 2002 were shearing years). Log-transformed numbers of vicuña indicate that the exponential growth rate of the vicuña population at Tambo Cañahuas was 0.193 between 1997 and 2002 (Fig. 1).

Production of Young in Shorn vs. Unshorn Females

Data from adult, reproductive-age females indicated that at both study sites, there was no significant difference in the number of young per female between shorn and unshorn females (Table 2; $n = 239$, $\chi^2 = 0.58$, $df = 1$, $p = 0.44$; $n = 173$, $\chi^2 = 0.03$, $df = 1$, $p = 0.84$).

Discussion

Biological Sustainability

Two robust lines of evidence suggest that capture, handling, and live shearing of vicuñas can be biologically sustainable. First, there was consistent population growth of

Table 1. Population dynamics of vicuñas at Tambo Canahuas, Arequipa, Peru, 1997–2003.*

Year	Number	λ	Mean density/ km^2 (n, SE)	Number of young	Young/female
1997	187		2.8 (5, 0.6)	38	0.48
1998	242	1.22	1.27 (7, 0.24)	53	0.70
1999	264	1.09	2.8 (11, 0.33)	35	0.33
2000	284	1.07	2.0 (9, 0.20)	55	0.48
2001	382	1.3	4.8 (4, 0.40)	68	0.44
2002	543	1.4	3.7 (4, 0.43)	106	0.39
2003				61	0.51

*Sampling effort for 2003 was only for the first half of the year. Because of this unequal sampling, we excluded census estimates but included data on production of young.

the wild population, which was under carrying capacity, in areas where capture and shearing occurred regularly. Second, the scale (large or small) of shearing and the method of shearing (mechanical shears or scissors) did not affect production of young.

Although these results are encouraging, several important caveats exist. In both our study areas shearing of vicuñas was conducted in the spring (late September through November), when the extreme temperature fluctuations that occur in winter have ceased. Presently in Peru shearing of vicuñas is determined through coordination of regional associations and the governmental agency

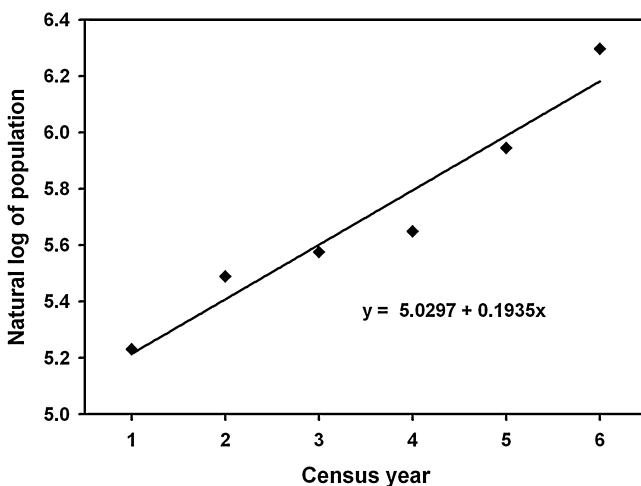


Figure 1. Population growth for vicuñas at the Tambo Cañahuas, Arequipa, Peru, study site.

Table 2. Number of young born to shorn and unshorn females in Tambo Cañahuas, Arequipa, Peru in 2000, 2001, and 2003 and in Picotani, Puno, Peru, in 2003.

	Shorn females	Unshorn females	Total
Tambo Canahuas			
young	66	49	115
without young	64	60	124
total	130	109	239
Picotani, Puno			
young	64	53	117
without young	29	27	56
total	93	80	173

CONACS (Consejo Nacional de Camélidos Sudamericanos, or National Council of South American Camelids). Determination of the shearing schedule is based on availability of CONACS personnel and shearing equipment (communities often have to share equipment). Shearing of vicuñas in Peru starts in May and continues through November (Consejo Nacional de Camélidos Sudamericanos 2004). The months of May through August can be extremely cold, and shearing during winter, when pasture biomass can be low and temperatures are at their most extreme, may cause physiological stresses that have population-level effects. Experiments conducted on a small sample of vicuñas in Chile in the month of March indicate partial shearing of vicuñas (back and flanks, as practiced in Peru) results in some respiratory disease and vicuña mortality; however, the sample size in this study was too small to be statistically significant (Bonacic 1996). We emphasize that our conclusions on sustainability of shearing can only be applied to vicuñas shorn in spring.

Our second major concern, not explicitly addressed in this study, is the overall sustainability of the current vicuña management and shearing program in Peru and other countries, such as Chile and Argentina, that have invested heavily in captive-management programs for vicuña. Potential problems, including increased inbreeding, behavioral changes, disease transmission, and larger landscape and population-level disturbances associated with this strategy have been noted (Sahley 2000; Lichtenstein 2002; Vila 2002; Sahley et al. 2004a); yet little research has been conducted to evaluate biological or socioeconomic impacts of this type of management. In Peru a government-sponsored program led to a significant proportion of vicuñas being kept within corrals of approximately 1000 ha (size of enclosures varies within Peru, C.T.S., unpublished data.). Because an estimated 27,405 of the potential 118,000 vicuñas in Peru exist in corrals at varying densities and under varying conditions (Consejo Nacional de Camélidos Sudamericanos 2004), it is imperative that this strategy be evaluated and that guidelines based on sound conservation science be carefully

formulated and take into account animal welfare, disease control, and safe introduction into corrals and rerelease into the wild.

Conclusion

Our results show that management and utilization of the vicuña through live capture and shearing can be biologically sustainable at the population level, and we suggest that a management plan based on the sustainable use of wild vicuñas be prioritized. We recommend that the biological sustainability of shearing in winter months be determined as an urgent priority. Because identification of shorn individuals is generally easy and marking vicuñas with tags is relatively cost-effective, we suggest that government technicians in collaboration with communities mark individuals when captured following suggested guidelines (Hoffman et al. 1983; Sahley et al. 2004c) and determine effects on population in different life zones, seasons, and conditions. Improving the institutional capacity of community, regional, and national associations that use vicuñas is a critical component to long-term sustainability of this program. Once appropriate standards are established for vicuña management, we believe that increasing the scope of the live-shearing program for wild vicuñas can be considered a conservation option for this species. We hope that the marketing motto introduced in 1995, "a vicuña shorn is a vicuña saved," will prove true for Peru and other South American countries.

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