

## THE VICUÑA

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The vicuña (*Vicugna vicugna*) family Camelidae, inhabits the high pastoral zone, or puna, of the central Andes for a distance of 1,300 miles, from latitude 10° S to 29° S. The puna consists of high, rolling, semi-arid grasslands, barren pampas, and volcanic peaks, above the limit of cultivated crops. Vicuñas occur from the upper limit of vegetation, at about 16,000 feet, down to 12,000 feet, but they are common only at sites above 14,000 feet.

## HABITAT

These studies were made principally in the central part of the vicuña range, west of Lake Titicaca. There, approximately three-fourths of the annual precipitation of about 25 inches falls during summer, commencing late in December. Much of the precipitation falls as snow or hail which melts within a day. During the dry winter and drier spring, water disappears from many streams and shallow lakes. The annual range of temperature is from zero to 70° F., with a maximum daily range of about 50° F. In the thin air of these high altitudes, direct sunshine is an important source of warmth, and evaporation is rapid.

In its ecology, the vicuña is similar to the North American pronghorn; in form, it is more like a hornless gazelle. A large vicuña weighs approximately 100 lb., about half as much as the other species of lamoids, the wild guanaco and the two domestic species, the burden-carrying llama, and the wool-bearing alpaca. Llamas, sheep, and other livestock keep the succulent puna grasses, chief food of vicuñas, cropped short. These grasses, principally of the genera *Calamagrostis* and *Festuca*, grow between scattered tufts of coarse, spine-tipped, bunch grasses and low resinous shrubs. Vicuñas relish many broad-leafed herbs, and on grassless pampas their principal foods are woolly rosette plants no larger than a pocket watch. The greener sites, such as the foot of slopes, attract vicuñas. Apparently their need for succulent food is greater than that of the guanaco and llama. On the western Andean slopes at least, the lower limit of the vicuña is probably set by lack of herbage, whereas on the eastern

slopes, the abundance of tall grasses might set the lower limit of distribution. Characteristic of vicuña pastures are communal dung piles, often one-third of a yard thick and five yards across. On well-grassed flats these piles are spaced, with striking regularity, at intervals of about 50 yards.

On the better grasslands, the population density of vicuñas is about 10 acres per animal. Where grass is sparse, the density may be only one-tenth as great, and far less in rocky, sandy, or salty regions. On the basis of an average population density of 50 acres per vicuña, assuming that at this density they occupy half the area of their range in Peru, there are about 240,000 vicuñas in that country. These probably constitute more than half of the total number of living vicuñas.

#### INTRA-GROUP RELATIONS

*Family bands.*—Vicuñas form groups of two kinds—family bands and troops of males. A family band is composed of an adult male with several females and their young of the year. Each band occupies a territory which the male defends against other vicuñas, principally against males. Males that are not members of bands gather into leaderless troops which range widely.

The daily routine of a band is roughly as follows. At sunrise the vicuñas rise from their beds, usually on a high slope, and begin to feed. While feeding they walk forward slowly at the rate of fifty to several hundred yards an hour, depending on the abundance of forage. During the day vicuñas rest for about half an hour at intervals of one or two hours, and they usually drink once. Late in the afternoon they graze continuously and feed on lower sites where the forage is best. Then, half an hour to an hour after sunset, the band walks upslope and lies down for the night.

The male is the leader and defender of the band. Most of the time he grazes close to his females, but if an alien male enters his territory, the resident male runs out and drives the intruder off. He usually returns to his females within 10 minutes; if he delays longer, the females walk grazing towards him. Whenever the male approaches close to one of his females, she walks quickly away in a subordinate attitude, head and ears low. Females of a band are intolerant of each others close approach. If one comes within two yards of another, the latter kicks or spits at the offender, but no hierarchy of dominance among

females is readily apparent. In the event of a serious alarm, the male gives a high whistling trill, the females gather together, and the band flees, the male running behind the females, guarding them from the rear.

Evidently all members of a band are strongly attached to their territory, for if the band is driven off, its members soon return. If the alarm occurs in mid-morning, the vicuñas usually return by mid-afternoon; if disturbed in mid-afternoon they return by sunset; and if disturbed late in the day, or at night, they come back the next day. Return to the territory is leisurely, individual members often returning at different times.

The mating season starts again about one month after the first young are born. During the mating season the male changes little in either appearance or behaviour. Occasionally, however, he follows or chases a female far outside his territory, and he mates with some that are not members of his band. Females give birth on the territory close to other members of the band. Half an hour after birth the infant can stand up; half an hour later it can run a short distance. For several days after birth, mother and young remain together about 50 yards from the rest of the band. In an alarm, they are the first to flee. At a week old the infant associates with other young most of the time, and at the age of six weeks it may stay away from its mother for periods of half an hour. At three months old, the juvenile seeks its mother only in alarm, to nurse, or to rest at night. Until they are at least eight months old, the young spend the night lying alongside their mothers. Young vicuña juveniles play vigorously among themselves, chasing each other, and wrestling with their long supple necks.

Most of my studies were made in an area of about 1,000 acres at an altitude of 15,000 feet near latitude 16° S. That area was occupied by 20 bands which I observed over a period of six months. In December the average number in a band was one male, five females, and two juveniles. The largest band had 18 females and nine juveniles. Two bands had no females or young much of the time. Several bands retained the same membership for periods of weeks. Minor changes in membership were caused when one or two females and their young joined or left a band. Major changes occurred, on three occasions, when a territorial male was injured or sick. In each instance, all his females left him and joined one or two adjacent bands. Shortly before young were born, the population of the study area was approximately 60 mature vicuñas, two or more years of age, per square mile, with a sex ratio of one male to four females.

More than half the young were born in March. At the end of the season of birth, early in May, 46 per cent of the mature females had young.

Some time before young were born, 35 per cent of the population consisted of yearlings which occurred at a density of about 25 per square mile. These represented the annual population increase. Commencing ten weeks before the first infants were born, yearlings of both sexes gradually left the bands. Of these departing yearlings, most of the females joined territorial males that had no females, while the males joined male troops.

*Male troops*—Troops consist mainly of one and two-year-old vicuñas, but about 10 per cent of the members may be injured or other adult males. These troops are largest early in the year, after new yearlings have joined them. Commonly a troop has 20 or 30 members, and I once observed a troop of 75. The troop is an open society whose members join and leave freely without more notice than a few stares from the others. A large troop may stay within an area of 50 acres throughout an entire day, but on other occasions it may move 2,000 yards in one hour. As the group moves, some members lie down or loiter until about 200 yards behind the others, but then run to catch up. Male troops roam in search of good forage and, as most good forage is in occupied territories, a troop usually suffers attacks by territorial males several times a day. These attacks often split a troop in two, but inasmuch as the alarmed males tend to collect together, attacks by territorial males sometimes consolidate separate troops into one larger group.

#### INTER-GROUP RELATIONS

*Bands and Troops*.—The band male defends his territory by means of display and pursuit with equal vigour throughout the year. An observer can learn the boundaries of a territory by noting the points that intruding males must reach before the resident male dashes to meet them. He rarely needs to defend borders that adjoin rock slides or barren ground, for aliens seldom approach from these areas. Most encounters take place where the territorial boundary crosses a favourite feeding site.

When a troop of males approaches his territory, the resident male, who may be 200 yards distant, runs about 50 yards toward them and postures. In this display he stands stiffly erect, commonly on the top of a dung pile or other high point, with head, ears, and tail high, and his side toward the approaching group. If the troop continues to approach, the resident male



*Photo : Carl B. Koford.*

**VICUÑA. A TERRITORIAL MALE IN THREATENING POSTURE**



*Photo : Carl B. Koford.*

**A MALE VICUÑA POSTURES AT HIS TERRITORIAL BOUNDARY AND  
TWO ALIENS RETREAT SUBMISSIVELY**

walks, then runs, toward it and, when about 20 yards from the intruders, he displays. Then, if they do not retreat, he attacks, vigorously chasing individuals and small groups but rarely touching them. As the troop starts away, he prances behind, herding them, and he may follow them to 200 yards outside of his territory, before returning to his band. In this manner, an adult male sometimes drives a large troop about 300 yards in five minutes ; at other times progress is much slower. Since a troop tends to return again and again to good forage, a male may have to drive off the same troop several times during a single day. In fleeing from one male, a troop sometimes enters the territory of a second who takes up the attack ; so two or three territorial males may harass the troop at the same time, driving it this way and that in confusion. Under attack, the troop commonly retreats upslope to barren ground. Late in the afternoon troops become bolder and resident males more tolerant, for all vicuñas are absorbed in grazing.

Most encounters between neighbouring family bands occur when they gradually draw together while grazing on opposite sides of their mutual territorial boundary. If the bands are less than 100 yards apart, the males usually graze between their females and the opposite band. From time to time they stare, posture, or run a few steps toward the closest members of the opposite group, which then retreat. When any member of one band (except a very young one) reaches the territorial boundary, the male of the opposite group gives chase. In his pursuit he may run a short distance into the territory of his neighbour, who drives him out, and the chase may turn in a brief "pendulum" action. Commonly encounters end with the males standing several yards apart, displaying, grunting, and spitting for a minute, before they return to grazing. On rare occasions adult males fight violently, wrestling and tripping each other with necks and heads, clashing with chests and forelegs, biting and shrieking.

If a female of a neighbouring band enters his territory, the resident male chases her. But when an unattached female, apparently not a member of any band, enters a territory the resident male usually pays little attention and allows her to join his females. These, on the other hand, nose and closely inspect the newcomer, and sometimes they chase her. Usually the alien female soon departs, but if she stays for a few days she is accepted. On occasions when a band is driven far from its territory by men or dogs, the displaced band enters the territory of others and is attacked by the resident male. But in contrast to males of a troop, the male of a displaced band is not entirely

submissive. He runs back and forth behind his retreating females, and he may kick at his pursuer or even turn and chase him a short distance. The fact that two displaced bands on the territory of a third are only mildly hostile toward each other indicates that it is the territory, rather than the females, which the male defends. In addition, solitary males often defend large territories. When all the vicuñas in an area are highly alarmed, normally hostile bands may join each other, or even troops of males, in flight.

On the chief study site, 18 territories were situated along four miles of a clear stream which ran through a narrow grassy valley to sandy flats bordering a shallow lake. These territories ranged from 20 to 115 acres in extent, with an average of 32 acres. The larger territories were located near the lower end of the study area where vegetation was sparse, while the smaller territories were located near the head of the valley where forage was abundant. That is, territorial size varied with the abundance of food. Apparently each territory contained enough food for a band of vicuñas, with a maximum of one animal to five acres. Although changes in the size of bands were not accompanied by changes in territorial size, extremely large bands, of 18 to 26 members, were found only on territories exceeding 60 acres in area. Perhaps large bands occurred there because disturbance by other vicuñas and by livestock was infrequent where forage was scant. Where territories were situated in the narrow grassy bottom of the valley, they were elongated in the direction of the stream. Segments of many boundaries lay near the stream, where the continuity of lush forage was broken. Nearly all of the territories observed included moderately steep slopes which were used as retreats in alarm and for resting at night; all included water suitable for drinking.

During a period of six months there were few notable changes in territorial boundaries. One territory changed when a lake, swollen by rains, rose and covered 50 acres of it. The band moved to an adjacent area. In another, a resident male became sick and was unable to defend his territory. During this period, two neighbouring males each annexed about two acres of his territory, and when the sick male recovered the new boundaries were maintained. This observation suggested that the size and shape of territories depends much on characteristics of the resident male. The chief advantages of territoriality in the vicuña appear to be that it reduces strife among adult males, it protects a feeding area for the females and young, and it prevents range damage from over-grazing.

## RELATIONS WITH OTHER VERTEBRATES

The chief enemy of vicuñas, apart from man, is the domestic dog. Ranchers told me that dogs are used by Indians to capture hundreds of infant vicuñas each year. Wherever there are native herdsmen there are savage, poorly fed dogs which run free and chase vicuñas. Adult vicuñas are seldom caught for they can outrun dogs and, at close quarters, they can fight well with their feet. Yet, at a distance of half a mile, a single dog may startle a vicuña band into flight, and within half an hour a dog can drive off all the vicuñas from dozens of territories. Thus, dogs disrupt normal territorial relations, cause waste of energy and loss of feeding time, and increase the danger of injury from dashing over rough ground.

The only common large native carnivore in the vicuña range is the Andean fox (*Dusicyon culpaerus*), the ecological equivalent of the North American coyote. These large foxes, up to 25 pounds in weight, are mainly scavengers, but possibly they attack vicuñas at night. By day they show no tendency to attack, and the reaction of vicuñas to foxes seems to be inquisitive rather than fearful. When a fox approaches a band of vicuñas, they walk towards it and follow at a distance of about 30 yards staring intently. They behave in a similar way towards a man stalking them. If he is but partly hidden, the vicuñas move toward him, staring and trilling, and they may approach as close as 20 yards. Pumas (*Felis concolor*) and long-tailed wildcats (*F. colocolo* and *F. jacobita*) live close to vicuñas and may attack them on occasions.

Although condors are said to kill infant alpacas and lambs, I have found no reliable account of this occurrence. Nevertheless, in one observation I saw five adult condors land 10 yards from an infant vicuña within a minute after it was born. The mother and two other females of the band remained close to the infant and made short charges at the birds, driving them back. Other condors arrived, and finally 14 of them stood on the ground. Some approached the infant to a point only two yards distant. But one by one the condors flew off and all had gone by the time the infant could stand up, half an hour after birth. In view of this observation, I think that condors often kill vicuñas at the time of birth.

Livestock affects vicuñas directly, by disturbing them while feeding, and indirectly, through eating forage that is suitable for vicuñas. At the end of summer, when grass becomes green and vicuñas give birth, Indians from lower valleys drive flocks of sheep up to the vicuña pastures. Inasmuch as the sheep are



corralled at night, they seldom disturb vicuñas during the early morning and late afternoon. But when sheep do approach a vicuña band it departs for another feeding area. Late in the day, after the sheep have left, the band returns to its territory. This disturbance may be repeated every day for a period of weeks. Sheep and vicuñas compete for the annual crop of forage to an unknown degree. In addition, sheep may have long-term effects on the food supply. During the past four centuries, intensive grazing of succulent grasses by sheep may have altered the composition of puna vegetation and brought about an increase of coarse bunch grasses, which are poor forage. Probably, too, vicuñas have abandoned many grasslands below their present range because of constant disturbance by sheep or other livestock.

Alpacas dominate much of the grassland immediately below the vicuña zone. When they approach vicuñas, the latter retire to poorer sites. One morning I watched a single alpaca charge again and again at two large bands of vicuñas and finally drive them from their territories to adjacent sandhills. Llamas, grazing freely or in pack trains, pass within sight of most vicuña bands nearly every day, and vicuñas retreat from them. In many parts of their range vicuñas are outnumbered by llamas. During Inca times llamas were even more numerous. All of the other lamoids compete with vicuñas for food; alpacas on the wetter sites, llamas on the drier sites, and guanacos in some of the most arid places. No scientific studies have been made of the degree of competition between vicuñas and domestic stock.

#### UTILIZATION

For hundreds of years, men have hunted vicuñas for their wool and meat. Spanish chronicles of the sixteenth century tell of royal Inca hunts, or "chacos" in which about 20,000 Indians afoot surrounded a huge area and then converged toward the centre, driving the game before them and capturing thousands of animals. Many were slain, but often vicuñas and guanacos were merely shorn, and set free. Moreover, in each district, hunts were held only at intervals of about three years, so that the animal population had time to recover. Under this system of controlled hunting, the vicuña population apparently was not depleted; but by the beginning of the seventeenth century, men hunted with dogs and guns, and vicuñas became rare in some areas. They continued to be taken in chacos on a small scale, until the middle of the last century. In the present century,

thousands of vicuñas were killed each year for export of their wool and hides, until protective laws curtailed the slaughter.

Simon Bolivar prohibited the killing of vicuñas in Peru as early as 1825, but effective laws were not passed until a century later. Modern Peruvian law prohibits not only killing but all commerce in and manufacture of vicuña products, except those of ranch raised animals. Chile, Argentina, and Bolivia have similar laws, except that in Bolivia the manufacture and sale of products made from "imported" vicuña fleece is permitted. There a tourist can buy legally a robe made from the fleece of the necks or legs of dozens of infant vicuñas. Presumably, much of this fleece is taken illegally, and much is smuggled across borders. Because law enforcement is difficult in the sparsely inhabited puna, illegal shooting of vicuñas is common. Shooting by rural Indians probably does little harm, for few of them have guns, their weapons are poor, and they waste neither shot nor meat. On the other hand, hunting from automobiles by urban dwellers with repeating rifles is often wanton.

#### RECOMMENDATIONS

The Incas succeeded in domesticating the llama and alpaca but not the vicuña. At various times during the past century, flocks of several hundred vicuñas have been built up. One ranch in Peru has more than 400 vicuñas in walled pastures. But the animals have proved to be too highly strung for efficient handling and they fight each other when confined. Further, they produce so little wool, about half a pound per year, that even with cheap labour, it is unprofitable to raise vicuñas in the manner of sheep or cattle.

On the other hand, vicuñas can be profitably managed as a wild animal resource. To accomplish this end, the following measures are recommended :—

1. *Increased protection.*—Uniform protective laws should be established and enforced in the four countries having vicuñas. Game protective agencies could be strengthened by means of funds derived from regulated utilization of wild vicuñas. Dogs should be restrained from running free in the vicuña zone. A great deal could be accomplished, at least among the literate population, through education that would instil pride in native wild life and a protective attitude toward it.
2. *Improved vicuña habitat.*—Food supply for both livestock and vicuñas could be improved by the regulation, not

necessarily the reduction, of livestock grazing. But first, detailed studies must be made of puna grasslands and the food habits of vicuñas and competing livestock. On the drier sites, the increase or stabilization of the water supply, through construction of rock and earth dams, would enlarge the area habitable by vicuñas. These improvements could be made on both public and private lands. Because there is much good vicuña range in private ownership, land owners should be encouraged to increase vicuña herds on their property. They could do this with economic profit if they were allowed to harvest a portion of the animals and to sell the products, under permit but without restrictive taxation.

3. *Making use of the natural production of wild vicuñas.*—Inasmuch as the number of young males is far in excess of those required for reproduction, a large proportion could be taken annually from male troops. Reduction of troops would lessen disturbance and increase the food supply of family bands. This harvest of animals should be conducted by men trained to distinguish sex and age classes and to avoid disrupting family bands. Such a programme would require continuous research to determine the condition of the populations and ranges, and the proper harvest. Research would also show whether removal of some females from large bands would increase the reproductive rate of the population. On favourable sites, such as the study area, probably more than 10 vicuñas per square mile could be taken annually without decreasing production of young. Because vicuñas live in an open and relatively simple environment, and because they have survived three centuries of careless use, they should respond well to modern wild life management.

#### FOOTNOTE

This report is based largely on the following publication : KOFORD, CARL B., 1957. The Vicuña and the Puna. *Ecological Monographs*, 27 : 153–219. The Ecological Society of America. It was also submitted to the I.U.C.N. conference at Warsaw in 1960 and will appear in their proceedings.

For further information about the vicuña and the guanaco, readers are referred to *Oryx II* 273–279 and 347–352.