**VICUÑA CONSERVATION IN CHILE**

**INTRODUCTION**

The vicuña is a medium-sized ungulate and is the smallest representative of the South American Camelids (infra-order Tylopoda: family Camelidae). The vicuña inhabits the altiplano or puna region of the Southern Andes of South America, from latitudes South 9º 30' to 29º 00' and between 18º 45' to 27º 30' South in Chile. Vicuña inhabit an ecosystem that is characterised by extreme daily temperature variations, intense wind, and high solar radiation. Current knowledge about the vicuña is summarised in Table 1. Their survival in this habitat is due in part to their highly territorial social organisation and patterns of habitat use, and also to their physiological and anatomical adaptation to survival in high altitudes and cold weather.

Two geographic sub-species of vicuña have been described in Chile, the Northern vicuña, Vicugna vicugna mensalis (18º 45' S to 19º 00' S) and the Southern vicuña, Vicugna vicugna vicugna (19º 00' S to 27º 30' S). The Northern vicuña is out of danger of extinction and the Southern vicuña is endangered of extinction. The distribution between both subspecies correspond to a continuum of scattered and fragmented groups that are less frequent from North to South.

**MANAGEMENT**

The vicuña, along with other South American Camelids, is one member of a group of animals that produces rare fibres. Current management policies for vicuña include:

- capture and shearing of wild animals,
- captivity and farming,
- translocation and reintroduction

The vicuña has a double-coated fleece and is one of the most valuable and highly prized sources of animal fibre. The fine fibres are the commercially important part of the fleece and, since only 2% of the fleece is made up of the coarser primary hairs, it is highly prized. Currently Chile is auctioning the first 20 kilos of fibre collected from animals captured for farming. It is estimated that a total yield of 250 g of fibre could be obtained from Vicugna vicugna by shearing every two years. Considering a life span of 8 years in the wild, a potential total of 1 kg of fibre could be harvested from an adult vicuña.

**PROTECTION**

Vicuña have been protected by the International Convention for the Trade of Endangered Species (CITES) since 1973 and by the Vicuña Convention signed by Argentina, Bolivia, Chile and Perú since 1979. This agreement initially signed by Perú and Bolivia in 1969 and followed by Chile and Argentina in 1974, ensured the protection of the species in national parks and private lands for future sustainable use by requiring animals to be sheared alive and returned to the wild. The successful partnership between Government agencies, local communities and international conservation agencies resulted in a fast population recovery and the vicuña population is now classified as 'out of danger of extinction' in the northern range of distribution (Parinacota Province). However, the southern populations are still in danger of extinction and little progress has been made to effectively protect them from poaching. The estimated current population size is 17-22,000 animals in Chile (99% of which is in the northern range) and more than 220,000 in the Andean region (Bonacic et al., In Press). The ban on trade of their fibre has been lifted to allow shearing, and a programme of sustainable use has been promoted. Since it was stated in the Vicuña Convention that protection would be followed by sustainable use for the local people's benefit, vicuña conservation is now inextricably linked to sustainable use.

**SUSTAINABLE USE AND CONSERVATION**

The Vicuña Convention originally identified three main issues that needed to be considered for the protection and sustainable use of the species: i) population recovery, ii) ecosystem conservation and, iii) social benefits from the use of the species.

The current trend in Chile is to promote capture and captive breeding farms in the altiplano or Andean puna for commercial use. It is not known the consequences of captive breeding and artificial selection in Chile. Three main aspects should be studied to evaluate the conservation value of in situ captive breeding programmes:

- The genetic impact of artificial selection on the captive vicuñas and the positive/negative effects that this practice may cause on wild populations.

- The risk of disease transmission between livestock and enclosed wild vicuñas and the likelihood of cross species disease transference to wild populations from accidental escapes of captive vicuñas.
- The impact of habitat use restriction caused by captive farming considering that vicuñas are adapted to move and select habitats in a very fragile ecosystem.

**Table 1. Current knowledge about the vicuña (*Vicugna vicugna*): Conservation status, biological traits and some productive parameters based on research conducted mainly in Chile.**

| Variable | Value | Comments | Reference |
|---|---|---|---|
| | | **Conservation status** | |
| Chile | Vulnerable | Out of danger (Parinacota Province). Endangered (southern Parinacota). | (Glade 1993) |
| | | **Body measurements** | |
| Body weight | 32.7 kilos (SD 9.43) (n=68) | Measured in captured animals in March 1995. | (Bonacic 1996) |
| Length | 137.8 cm (SD 11.4) (n=68) | Measured in captured animals in March 1995. | (Bonacic 1996) |
| Girth | 86.7 cm (SD 10.85) (n=68) | Measured in captured animals in March 1995. | (Bonacic 1996) |
| Growth curve | $Y(b.w.)= 16.25+7.2^{t}-0.24*t^{2}$ (n=68) | The equation was fitted to the mean body weight of each class (1year-5 years). $R^2=0.81$; $F_{1,65}=278.3$, $p<0.001$ | (Bonacic 1996) |
| Body weight estimation | Body weight= -33.3+0.758 girth size x) | $R^2= 0.74$; $F_{1,68}=198.1$; $p<0.001$). | (Bonacic 1996) |
| | | **Social organisation** | |
| Sex ratio | 33 males:100 females | Typical sex ratio in Lauca National Park when population size reached 50% of available carrying capacity. | (Glade 1982) |
| Group composition | 1 leader, 3 females and 1.6 calves | Typical family group composition in Lauca National Park when population size reached 50% of available carrying capacity. | (Glade 1982) |
| Mean group size | 5.7 (n=11) | Typical family group composition in Lauca National Park when population size reached 50% of available carrying capacity. | (Glade 1982) |
| Habitat preferences | Flushing meadows and steppe | Animal follows a daily routine from resting sites to feeding sites. | (Galaz 1998) |
| Daily budget | 90% feeding | Flushing meadows are preferred habitat. | (Glade 1982) |
| | | **Population dynamics** | |
| Population density | 5.3 animals/km$^2$ | Highest density recorded in Chile when total population size reached 26,000 animals. | (Bonacic 1996) |
| Current population size | 25-30,000 | Northern puna of Chile. | (Galaz 1998) |
| Birth rate | 65-68% of population (n=70) | Births occurred between mid-February and late March. | (Glade 1982) |
| Mortality rate | 17.6% | Calf up to 1 year old. | (Glade 1982) |
| Life span | 10 year | Not clearly defined. In captivity even longer. | (Hoffmann, Otte et al. 1983) |
| Calf/Mother weight | 14-16% | Suggests extremely adaptable animal to harsh conditions. | (Cueto, Ponce et al. 1985) |

**Table 1. Continuation.**

| Variable | Value | Comment | References |
|---|---|---|---|
| **Productive parameters** | | | |
| Fleece yield | 263±23 g/animal (n=8) | Fleece yield can be variable according to system of shearing (manual or mechanical), expertise and extent of shearing (fully or partially shorn). This figure represents the best compromise between quantity and quality of the final product. | (Bonacic 1996) |
| Fibre diameter | 15.1 microns (SD 1.01) (n=45) | Current figures are suggesting a range between 12-15 microns. Age could have an effect. | (Bonacic 1996) |
| Medulla percentage | 1.9%(SD 2.9) (n=45) | Low percentage of medulla is required in textile Industry to facilitate dying if required. | (Bonacic 1996) |
| Hair proportion | 1.9% (SD 1.3) (n=45) | Vicuña has the lowest hair proportion of South American Camelids. This facilitates textile processing. | (Bonacic 1996) |
| Fleece proportion | 68% fleece region (n=16) | Fibre from the fleece region has the highest quality. | (Bonacic 1996) |

**Table 2. Vicuña response to different management practices (From Bonacic, 2000).**

| Factor | Response | Observations |
|---|---|---|
| **Captivity** | Initial period of significant changes in physical and blood parameters followed by a trend toward baseline levels. | Male juvenile vicuña were habituated to a short period of captivity (39 days).<br><br>Physiological values and clinical examination showed no apparent signs of disease, decreased food intake or weight.<br><br>Behavioural time budgets significantly changed from wild conditions with a reduction in feeding time and an increase in inactivity.<br><br>Long-term consequences of captivity are unknown.<br><br>The effects of captivity on wild-caught adult animals are unknown, particularly in pregnant females. |
| **Capture** | Increased cortisol, TEMP, HR, RR, CK, AST, PCV, GLU, N:L ratio. Mortality by neck fracture. | Vicuña could cope with short-burst chases and a short time in captivity for shearing.<br><br>Prolonged restraint caused more changes than faster chases. |
| **Transport** | Hyperthermia, contusions. | Short journeys caused minor injuries.<br><br>The physical and physiological consequences of longer journeys were not evaluated. |
| **Shearing** | Total shearing caused hypothermia, increased cortisol, N:L ratio with lymphopenia, respiratory disease and mortality.<br><br>Partial shearing: Mild | Total shearing proved inadequate.<br><br>Total and partial shearing should be discarded during autumn.<br><br>Partial shearing caused minor changes in juvenile males during spring. |

increase of cortisol and CK. The consequences of shearing pregnant females are unknown.

Note: TEMP (rectal temperature), HR (heart rate), RR (respiratory rate), CK (creatin kinase), AST (aspartate aminotransferase), PCV (packed cell volume), GLU (blood glucose), N:L ratio (neutrophils:lymphocytes ratio).

## Table 3. Levels of individual response to management (From Bonacic, 2000).

| Behavioural response | Physiological response/signs | Welfare consequences/ Frequency |
|---|---|---|
| **Acute stress.** Vocalisations and attempts to escape. | **Acute stress.** Increase TEMP, HR and RR. Short CORT and GLU increase. | **Minimal.** Short-lived response to human stressor. Ceases after the animals are released back to the wild. Very frequent, almost every animal showed signs of stress during capture. |
| **Prolonged stress.** Aggression, vocalisations or inactivity, prostration and lack of responsiveness to the environment. | **Prolonged stress.** Increase in CK and AST by body traumas, moderate dehydration with increase in PCV, regurgitation. | **Low.** The animals are showing an active response to the physical and psychological stimuli of chase, handling and capture by humans. Ceases after the animals are released back to the wild. **Low frequency or less than 5-10%** |
| **Pre-pathological.** Postration, walking difficulties, vocalisations. | **Pre-pathological** Lip lacerations and bleeding, body contusions, leg soft tissue trauma, deep skin lacerations during shearing, regurgitation during restraint. Sustained increase in CK, AST, CORT and TEMP and lymphopenia. Inflammatory processes. | **Medium.** Physical injuries trigger physiological responses to repair damage such as inflammation. Pain is present and the consequences of the injuries can persist after they are released back to the wild. **Low frequency or less than 5-10%** |
| **Pathological.** Respiration altered, lack of responsiveness to environment, inactive, postration, dehydration, altered feeding patterns. | **Pathological** Acute hypothermia, respiratory infections, leg fractures, internal trauma and inflammation. | **High.** Pain is present. Physical injuries cause long-lasting effects with a risk of death.<br><br>**Variable**. Only total shearing and capture with vehicles caused pathological problems. |
| **Life threatening.** Lack of mobility, vocalisations, and postration. | **Life threatening.** Neck fracture, massive concussion, abortion, hypothermia. | **Very high.** Pain is present. Loss of natural ability to respond to stress. Inability to be released back to the wild. Pain and distress if euthanasia is not applied promptly.<br><br>**Variable**. Only total shearing and capture with vehicles caused pathological problems. |

**Table 4. Potential effects of management on vicuña population viability (From Bonacic, 2000).**

| Response | Example | Consequences |
|---|---|---|
| **Behavioural** | Transient changes in patterns of habitat use, changes in daily budget to compensate for increased energy demands for thermoregulation. | Minimal. The animals can cope with a short imposition of a human stressor. |
| **Social organisation** | Group disruption, calves separated from mothers. Increased competition between male leaders for territory, emigration from preferred habitats. | Moderate. The effect of management affects the social structure dynamics by causing significant changes in group composition after the stressor is applied. |
| **Reproductive** | Abortions during or after capture. Calves mortality because of mother-calve separation. Disruption of reproductive cycle because of increased energy demand to cope with the effect of shearing. | High. Management effects have significant long-lasting effect s on the population dynamics of the species. |
| **Population density** | Mortality during capture and emigration | Very high. Changes in population density by human induced mortality could drive the population into a declining stage. |

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