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THE EXTIRPATION AND CURRENT STATUS OF WILD CHINCHILLAS *Chinchilla lanigera* AND *C. brevicaudata*

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Abstract

The short-tailed chinchilla Chinchilla brevicaudata *and the long-tailed chinchilla* C. lanigera *were once widely distributed along the central Andes and adjacent mountains. The high quality of their fur motivated the harvesting of chinchillas for the fur market. Commercial hunting, beginning in 1828, became a common and widespread activity in northern Chile. As market prices and the demand for skins increased in Europe and the United States, the number of pelts exported rose steadily. During 1900–09, the number of skins officially exported exceeded half a million per year. The continuous and intense harvesting rate, however, was not sustainable and the number of chinchillas hunted declined until the resource was considered economically extinct by 1917. Concurrently, market prices for the skins increased exponentially over time. A ban against chinchilla hunting in 1929 only increased the demand for skins. The last record for a short-tailed chinchilla sighting in the wild was c. 1953. The long-tailed chinchilla was also considered extinct in the wild, but was "re-discovered" in 1975. Currently, in two separate localities in north-central Chile a few scattered colonies of long-tailed chinchillas remain. Although chinchilla protection laws were enacted in 1929, they were not strictly enforced until 1983, with the establishment of the Chinchilla National Reserve. Chinchilla numbers continue to decline and possible causes are considered. Copyright © 1996 Elsevier Science Ltd*

Keywords: chinchilla, furbearer, over-exploitation, extinction, Chile.

INTRODUCTION

The biology of wild chinchillas is poorly known. Chinchillas are strictly nocturnal rodents and live in colonies which range in size from a few individuals to several hundred (Mohlis, 1983). Several colonies form an archipelago-like aggregate whose spatio-temporal dynamics appear to behave as a metapopulation (Jiménez, in press). Chinchillas are about the size of a small rabbit (adult weight 400–500 g) and have long soft fur (Grau, 1986). Although economically important for their fur for more than a century, little is known about chinchilla ecology. For example, their past distribution, population dynamics and taxonomic status are still unclear (Mann, 1978; Pine *et al.*, 1979). Once widespread along the central Andes and adjacent mountains, chinchillas are now restricted to a few localities in northern Chile (Jiménez, 1990).

Like many other Chilean mammals, wild chinchillas have been intensely hunted for their fur (Iriarte & Jaksić, 1986) which is considered one of the most valuable in the world. Exploitation of this species has been more extensive than that of other valuable species such as guanacos *Lama guanicoe*, river *Lutra provocax* and sea otters *L. felina*, fur seals *Arctocephalus* spp., spotted cats *Felis* spp.), and foxes *Dusicyon* spp. (Bowman, 1924; Cabrera & Yepes, 1960; Jiménez, 1994).

In this study I review the history and decline of chinchilla harvesting. I use export statistics from Chile and propose that harvesting, fueled by high market prices, almost drove the chinchilla to extinction. This review should be of interest to wildlife managers in other South American countries where many wild vertebrates such as foxes, otters, turtles, parrots, caimans, and lizards are heavily harvested and could easily suffer the same fate as chinchillas (Mares & Ojeda, 1984; Ginsberg & Macdonald, 1990; Robinson & Redford, 1991).

TAXONOMY AND DISTRIBUTION

The term chinchilla is a generic one that refers indistinctly to two species of hystricomorph rodents: short-tailed chinchilla *Chinchilla brevicaudata*, also called the Bolivian, Peruvian, and Royal chinchilla, and the long-tailed or Chilean chinchilla *Chinchilla lanigera*. Chinchillas have been bred in captivity for commercial purposes worldwide since 1923. The captive stock is distinct from both wild species, and is a cross-breeding of the two taxa (Grau, 1986). In the past only a single chinchilla species was recognized (Albert, 1901; Sage, 1913; Bowman, 1924; Bidlingmaier, 1937), but some authors recognized color and size differences among localities (Albert, 1901; Bidlingmaier, 1937; Osgood, 1943). Although two species are currently recognized (Cabrera & Yepes, 1960; Thornback & Jenkins, 1982;

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Miller *et al.*, 1983), some authors persist in considering them as subspecies (of *C. lanigera* by Walker, 1968; Pine et al., 1979, and of *C. chinchilla* by Mann, 1978). This taxonomic issue may never be resolved because there are no wild populations of *C. brevicaudata* (Miller *et al.*, 1983).

The past distribution of chinchillas is unclear. Grau (1986) and Housse (1953) reported that chinchillas were found from Talca, Chile (35°30'S), north to Peru, and longitudinally from the Chilean coastal hills to the Andes and puna of Argentina, Bolivia and Peru (Fig. 1; but see Osgood, 1943). Gay (cited in Osgood, 1943) concurred with Albert (1901) and Opazo (1911) that chinchillas were not found south of the Choapa river (32°S). Recently, Jiménez (1990) came to the same conclusion. Walker (1968) mistakenly reported that chinchillas occurred as far south as 52°S. Because only one chinchilla species was recognized in the past, there is no evidence of whether the two species coexisted in sympatry in some parts of their past distribution. However, Grau (1986) suggests that both species may have coexisted in sympatry around Potrerillos (Fig. 1). This region would have corresponded to the northern limit of the long-tailed chinchilla distribution and to the southern limit of the short-tailed chinchilla (but see Grau, 1986).

Currently the long-tailed chinchilla exists only near Illapel (31°38'S, 71°06'W; probably the southern range of their past distribution) in the Reserva Nacional Las Chinchillas, and in an isolated population about 100 km north of Coquimbo (29°33'S, 71°04'W, Jiménez, 1990, 1993; Fig. 1).

HARVESTING BY HUMANS

Because chinchillas have one of the softest, longest and finest furs of any wild mammal (Sage, 1913; Walker, 1968; Mann, 1978), people have harvested these rodents since ancient times (Burton, 1987). In pre-Columbian times, Inca noblemen used the fur to make coats (Housse, 1953; Garcilaso in Cabrera & Yepes, 1960) and ate chinchilla meat (MacClintosh, 1966; Walker, 1968; Grau, 1986). Indians from San Pedro de Atacama, Chile (23°S, 68°W) also used chinchilla skins for garments (Bowman, 1924; MacClintosh, 1966). The Spaniards quickly recognized the high quality of chinchilla fur and began to export pelts to Spain in the 18th century (Housse, 1953), but the commercial exploitation of chinchillas started in 1828 (Gigoux, 1928). The demise of the species was thereafter accelerated by the use of shotguns and more efficient trapping methods (Housse, 1953). Chinchilla hunting was such a widespread and common activity that the local chinchilla trapper ("chinchillero") became a well-known character throughout northern Chile (Bowman, 1924; Gigoux, 1928).

Chinchilleros used a variety of trapping methods: trained grisons *Galictis cuya*, small dogs, and smoke to drive chinchillas out of their burrows; actual excavation of the burrow; stone, leghold and cage traps; snares; poles with hooks; fences made of fabric along

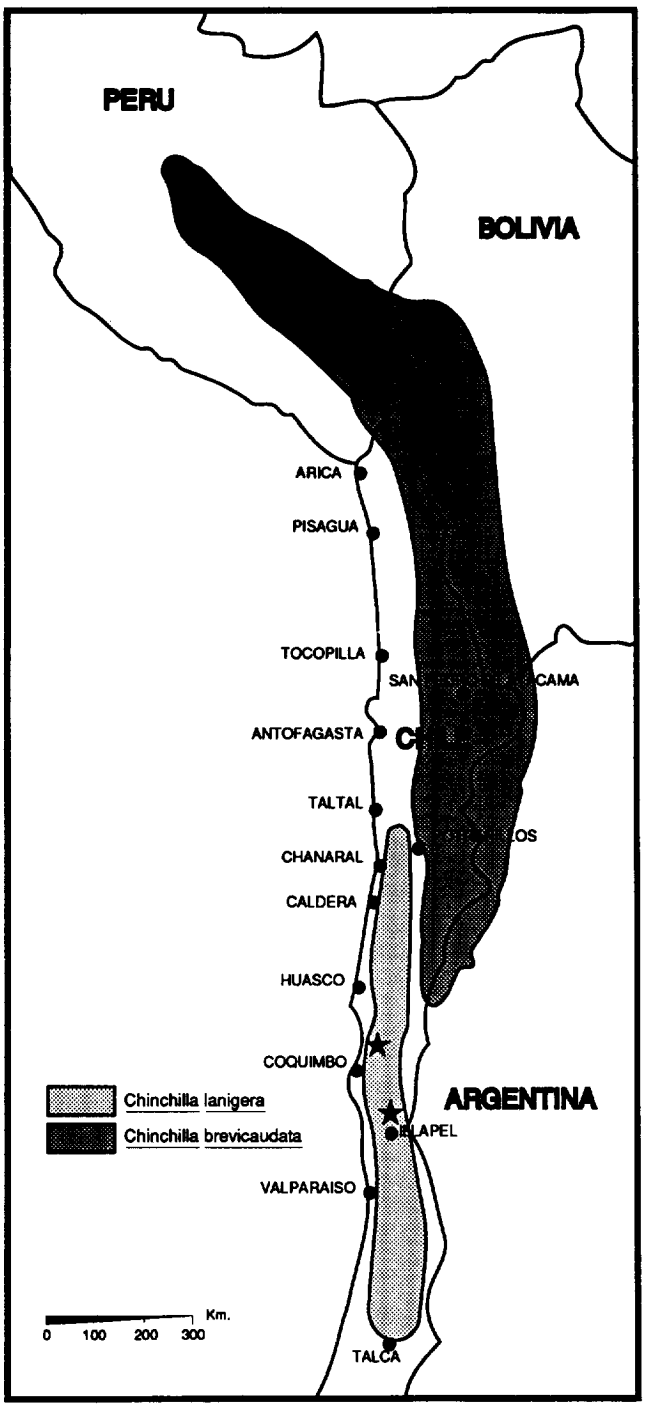

Fig. 1. Past distribution of *Chinchilla lanigera* and *C. brevicaudata* (modified according to Grau, 1986). The stars indicate the current location of the wild populations (according to Jiménez, 1990).

which chinchillas were driven; poisonous baits; and even dynamite (Albert, 1901; Opazo, 1911; Nazarit 1913; Sage, 1913; Bowman, 1924; Wolffsohn, 1927 Bidlingmaier, 1937; Housse, 1953; MacClintosh, 1966 Grau, 1986). In addition to devastating chinchilla populations, chinchilleros burned the vegetation to reach the animals (Opazo, 1911; B. Peña, pers. comm.). The widespread destruction of the shrub algarrobilla *Balsamocarpon brevifolium*, now endangered, was attributed

in part to the actions of chinchilleros (Gigoux, 1928; Bidlingmaier, 1937; Miller *et al.*, 1983), who also harvested algarrobilla pods cached by chinchillas in their burrows (Nazarit, 1913; Bowman, 1924; Miller, 1980).

The commercial use of chinchilla pelts was minor until after Chilean Independence in 1810 (Miller, 1980; Jiménez, 1994). Intense persecution first extirpated chinchillas from their lower ranges (MacClintosh, 1966). Over time, the chinchilleros moved toward progressively higher and more inaccessible regions (Bidlingmaier, 1937). Twenty-five years (1885–1910) of intensive exploitation reduced the two chinchilla species to near extinction (Miller, 1980). Mann (1978) considered both chinchillas as extinct during the 1960s, but later withdrew this opinion (Mann, 1978). Osgood (1943) stated that isolated colonies of the long-tailed chinchilla still remained, but that the short-tailed chinchilla could become extinct anytime. The last record of wild, short-tailed chinchillas dates to about 1953 (Rudolph, 1955). Long-tailed chinchillas were still captured for their fur as late as 1968 near the Choapa river (Jiménez, unpublished data; B. Peña & J. Grau, pers. comm.). Wild chinchillas were also livetrapped in order to improve the genetic quality of captive chinchillas (Miller, 1980; L. Bou, J. Grau & A. Kauer, pers. comm.).

As the chinchilla populations decreased, chinchilleros improved their capture techniques (Opazo, 1911; Bidlingmaier, 1937). During the early 1900s, they could obtain up to eight chinchillas nightly, but this rate decreased steadily from 1910 onwards (Z. Rivadeneira & J. Tapia, old chinchilleros from Illapel and Combarbalá, respectively, pers. comm.). As a consequence fur market prices increased (see below) and thus chinchilleros profited even if they captured only a few individuals per month (Albert, 1901; Nazarit, 1913). Chinchilla hunting became more profitable than working in the local mines (Miller, 1980).

At the beginning of this century some entrepreneurs attempted to start chinchilla farms, but met with little success (Bowman, 1924; Osgood, 1943). Chinchilla farmers raised primarily the long-tailed species, although it had a less valuable fur than the short-tailed chinchilla (Mann, 1978; Grau, 1986). The captive chinchilla stock derives from a few chinchillas captured near Potrerillos in 1923 (Grau, 1986; Fig. 1). Currently chinchilla farms are found throughout the world, and most are doing well (J. Grau, pers. comm.). Restoration of captive long-tailed chinchillas to the wild was attempted once in Chile, but failed (Mohlis, 1983). Chinchilla introductions were attempted in California (Voris *et al.*, 1955) and in Tajikistan (former Soviet Union; Grau, 1986), but without success.

EXPORTS AND FUR TRADE

Records on legal exports of chinchilla fur were obtained from the Chilean National Bureau of Statistics (Iriarte & Jaksić, 1986), and from published works (e.g. Opazo, 1911; Echegoyen, 1917; Gigoux, 1928; Bidlingmaier, 1937). However, only about one-third of the actual exports (legal+illegal) were reported (Albert, 1900), and the exact number of skins sold in Chile is unknown (Albert, 1901; Iriarte & Jaksić, 1986). Further, because some skins were damaged during capture, the number of chinchillas killed was greater than the number of pelts reported (Sage, 1913). Thus, the export records underrepresent the harvest mortality.

Fur export records combine both chinchilla taxa. However, locations of captures and of export ports suggested that the taxa corresponded initially to the short-tailed, and subsequently to the long-tailed, chinchilla (see below).

Skins were bought at low prices from chinchilleros by field buyers (Bidlingmaier, 1937), then brought to local markets such as San Pedro de Atacama, Vallenar (28°35'S, 70°46'W) and Combarbalá (31°11'S, 71°02'W; Bowman, 1924), where they were exported in packs of 12 through the ports of Arica, Pisagua, Tocopilla, Antofagasta, Taltal, Chañaral, Caldera, Carrizal, Huasco, Coquimbo (Albert, 1901; Fig. 1), and even as far south as Valparaíso (Bidlingmaier, 1937). At the beginning of the 20th century Coquimbo became the most important port for chinchilla fur exports (Opazo, 1911). Few furs were exported through Huasco during 1911, and exports ended by 1912 or 1913 (Nazarit, 1913), as was also the case at Arica and Tocopilla (Sage, 1913). This north-south trend probably reflects a wave of local extinctions of the stock from north to south, indicating that the short-tailed chinchilla populations were decimated first. As the short-tailed chinchilla became extirpated from northernmost Chile around 1912, the hunting pressure on the long-tailed chinchilla increased.

Chinchilla fur exports increased steadily from the 1830s (2800 skins/year) to the decade of 1900–09 (254,000 skins/year; Fig. 2) and then declined sharply with almost no exports at all during 1917 (356 skins/year). At the same time the market price of furs increased exponentially over time, from 0.088 to 50 Chilean pesos per skin (an increase of 568 times over the 84 years reported, corrected for inflation). On a finer temporal scale, the decline is even more dramatic (Fig. 3). The harvesting rate peaked during 1900, when about 700,000 pelts were exported, and declined sharply to 218,000 in 1905 and 24,600 in 1910, a decline of 96.5% in only 10 years. Simultaneously, the market price of chinchilla fur increased 15-fold during 8 years. Between 1840 and 1916 over 7 millon chinchilla pelts were exported from Chile (Miller, 1980). According to Albert (1900) this represents more than 21 million chinchillas that were actually killed. Until 1914, the major component of the Chilean fur trade was chinchilla (Iriarte & Jaksić, 1986).

As chinchillas became scarcer the market prices rose, stimulating increased efforts to capture chinchillas (Sage, 1912; Gigoux, 1928). Chinchilla furs were exported primarily to the United States, England,

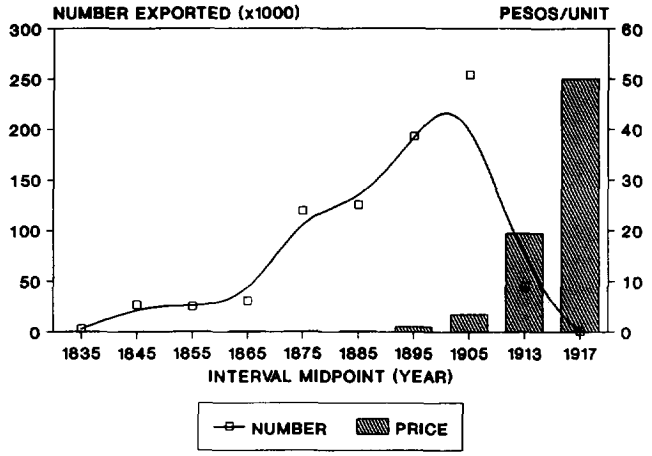

Fig. 2. Chinchilla pelts exported from Chile and prices paid in the Chilean market. The figures are means by decade (due to missing information, the 1913 and 1917 values are means for 5 and 3 years, respectively; according to Echegoyen, 1917 and Chilean Bureau of Statistics). The currency value corresponds to the gold peso, which is of constant value and is equivalent to US$ 0·206.

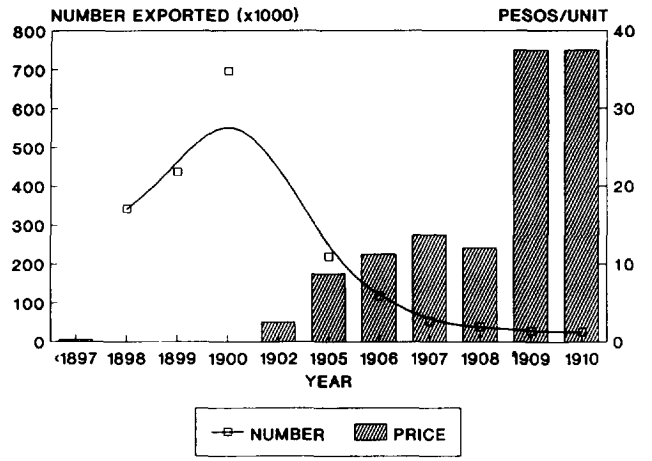

Fig. 3. Yearly chinchilla pelts exported from Chile and prices paid in the Chilean market (no information was available for 1901, 1903 or 1904 so these years are not shown; according to Albert, 1901 and Opazo, 1911).

France and Germany (Albert, 1901). As chinchillas became more scarce, "... fur buyers from European markets give instructions to their agents to purchase skins at any price..." (Opazo, 1911; Bidlingmaier, 1937). Prices as high as US$ 170 per pelt were paid in St Louis in 1920 (Gigoux, 1928). Miller (1980) states that this was "... a classic illustration of reduced supply resulting from overexploitation". This was because the reward for harvesting was higher each time (Opazo, 1911), and thus the risks were comparatively lower (see below). After several years of heavy and wide-ranging persecution, the capture per unit effort declined markedly, indicating that chinchilla populations were not able to withstand the high harvesting rate (MacClintosh, 1966). The steep decrease in the fur exports after 1900 is a reflection of chinchillas nearing extinction (Iriarte & Jaksić, 1986).

LEGISLATION AND CONSERVATION

The extinction of the chinchillas was foreseen as early as the 1890s and conservation measures were proposed to prevent it (Albert, 1901). Previous hunting and trapping of these furbearers were unregulated. Hunting regulations for chinchillas were implemented in 1898 (Miller, 1980). These measures were applied in only two departments of Chile (Ovalle and La Serena), but neither these nor subsequent regulations were enforced (Albert, 1900). The treaty of 1910 between Chile, Bolivia, Argentina and Peru, the main exporters of chinchilla fur, was the first international effort to protect the species (Grau, 1986). It banned the hunting and commercialization of chinchillas. Unfortunately, the treaty "... resulted in an enormous increase in the price per pelt to 14 times that before the ban, and contributed to the demise of the remaining populations" (Iriarte & Jaksić, 1986). In Chile, the first law for the protection of furbearers was passed as late as 1929. Since then no hunting or commercialization of wild chinchillas has been permitted (Iriarte & Jaksić, 1986).

Although the 1929 law was very strict, enforcement was poor (Bidlingmaier, 1937; Osgood, 1943; Iriarte & Jaksić, 1986; Jiménez, 1990). Poaching has only been successfully stopped during the last two decades (but see Burton, 1987). Presently, both short-tailed and long-tailed chinchillas are listed under Appendix I of CITES (Honacki *et al.*, 1982; Burton, 1987). They are categorized as "endangered" in Chile (Glade, 1988) and as "threatened" by the IUCN (Thornback & Jenkins, 1982).

It is likely that the flourishing of chinchilla farms, the improvement of the captive chinchilla stocks (e.g. hair color and quality), and their higher commercial value, have reduced pressures to harvest the remaining wild populations. However, it is also likely that commercial breeding activities have stimulated the demand for live wild chinchillas to improve the genetic variability of captive stocks (Burton, 1987).

The re-discovery of a wild chinchilla population by Connie Mohlis and Baldomero Peña (a past chinchillero) in 1975 was an important moment for the conservation of this species. Mohlis (1983) subsequently started the first scientific study of the species in the wild. Since 1975, the Corporación Nacional Forestal (CONAF; the Chilean Forest Service), in conjunction with different Chilean universities and supported by the World Wildlife Fund (WWF), has undertaken efforts to study and protect this chinchilla population (Jiménez, 1990). The 4229-ha National Chinchilla Reserve was created in 1983 in the locality of Auco (31°31'S, 71°06'W; Fig. 1), 17 km north of Illapel. In recent years, CONAF and WWF have also surveyed potential sites for the presence of wild populations of the short-tailed chinchilla in northern Chile (M. Parada & A. Santoro, pers. comm.).

The remaining colonies of long-tailed chinchillas in the Chinchilla National Reserve are currently well protected

from human activities, including poaching, hunting, grazing by cattle and goats, mining, and firewood extraction. Despite statements by MacClintosh (1966), Walker (1968) and Grau (1986) that populations of wild chinchillas are recovering well, the species is still declining for unknown reasons (Jiménez, 1990). Some hypotheses are that (1) current numbers are lower than the minimum viable population size for long-term survival; (2) predation by foxes upon chinchillas has increased during the past decades; (3) the later decline is caused by long-term abiotic and/or biotic changes; and (4) the trend might represent the decreasing phase of a long-term natural cycle of chinchilla populations (Jiménez et al., 1992; Jiménez, 1993). Jiménez (1993) found no evidence to support the second hypothesis and further research is needed to test the others.

SUPPLY AND DEMAND IN THE MARKET

The export figures for chinchilla pelts follow a typical supply-demand situation (Figs 4 and 5). The line in the figures reflects the yearly willingness-to-pay (or demand) of consumers in the North American and European markets. The demand remains more or less constant over time, especially at high supply levels. Because the yearly supply of chinchilla fur changes constantly, a different "supply line" should pass over each point in the figures, from the higher-right to the lower-left. This implies that the supply and demand relationships changed quickly over short periods of time. As expected from economic theory (Pearce & Turner, 1990), the price per skin unit decreases with increasing supply (Figs 4 and 5).

The apparent anomaly of the curve in the lower part of Fig. 4 (at low prices) can be interpreted as the time required (about 60 years, Fig. 2) for new fashions to be accepted. As consumers recognized the high quality of the pelts, and as wearing chinchilla coats became fashionable, the prices started to increase slowly, and so did the number of skins harvested motivated by better revenues. This pattern is apparent up to the point when chinchilla populations, and hence the harvest, began to decline (Opazo, 1911). With the decrease in supply after 1900 the prices rapidly skyrocketed (15-fold during 1902-1909; Fig. 3). This motivated a frantic hunting of the wild chinchilla populations that already had been decimated. In addition, the potential for being apprehended by game wardens was low (Miller, 1980). Because chinchilleros were very poor, the income they received for one or two chinchilla skins was sufficient to cover living expenses for at least two months.

These data suggest that the fur trade, motivated by economic interest, has forced the short-tailed and long-tailed chinchillas to the brink of extinction.

WHY EXTINCTION? AN ECONOMIC APPROACH

Given that different species respond in different ways to excessive harvesting (for some Argentine and Chilean species see Mares & Ojeda, 1984; Iriarte & Jaksić, 1986, respectively), one might ask what conditions prompted the extinction, or quasi-extinction of chinchillas? The most direct answer is that wild populations were harvested over a prolonged period of time at a higher rate than the species' reproduction and recruitment rate. Chinchillas produce one or two litters a year, but unlike most other rodents their litter size is only one or two (Jiménez, 1990). Undoubtedly, the chinchilla harvested during many years was over 1.5 million per year, high considering the low reproductive rate and the relatively low population densities of 27–118 individuals/km^2 (Jiménez, 1990, 1994). It is important to note that the human-caused mortality is added to the natural mortality factors for the species (predation, parasitism, weather conditions, etc.).

In summary, the proximate cause of decline seems fairly clear, but the ultimate cause derives from three main factors:

(1) The effort invested in harvesting chinchillas was almost nil at high population levels, and prices remained high as long as there was a demand.

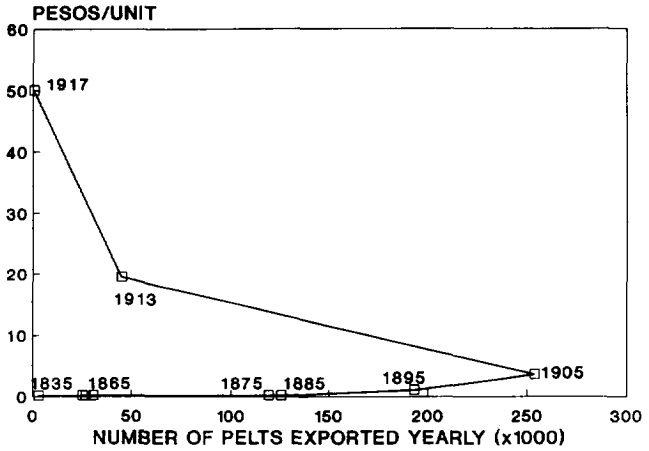

Fig. 4. Demand curve for chinchilla pelts exported yearly from Chile between 1835 and 1917. The figures are means by decade (sources as in Fig. 2).

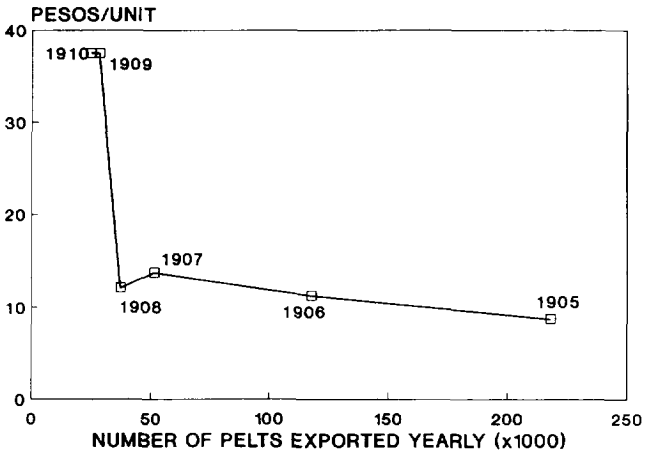

Fig. 5. Demand curve for chinchilla pelts exported yearly from Chile between 1905 and 1910 (no information was available for 1901, 1903 or 1904 so these years are not shown; sources as in Fig. 3).

(2) For chinchilleros, the discount rate (or the lowering of the importance that is attached to gains and losses in the future) of wild chinchillas was high, i.e. the current value of the chinchillas in the wild was higher than its estimated value in the future. They simply had no incentives to curb their harvesting rate to preserve the species for future exploitation.

(3) Common property and open access increased the likelihood of extinction —the tragedy of the commons— (Pearce & Turner, 1990). Since no one owned the chinchilla resource, individuals stood only to gain, at least in the short term, by increasing exploitation rather than conservation.

As stated by Pearce and Turner (1990), ... open-access solution will carry high risks of resource extinction if there is a critical minimum size to the population, and especially if cost of harvesting is low.

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