Historia. vol.4 no.se Santiago 2008

EUROPEAN RABBITS IN CHILE: THE HISTORY OF A BIOLOGICAL INVASION

PABLO CAMUS[*] SERGIO CASTRO[**] FABIÁN JAKSIC[***]

[*]

Centro de Estudios Avanzados en Ecología y Biodiversidad (CASEB). email: pcamusg@uc.cl

[**]

Departamento de Biología, Facultad de Química y Biología; Universidad de Santiago de Chile. Centro de Estudios Avanzados en Ecología y Biodiversidad (CASEB). email: scastro@usach.cl

[***]

Departamento de Ecología, Pontificia Universidad Católica de Chile. Centro de Estudios Avanzados en Ecología y Biodiversidad (CASEB). email: fjaksic@bio.puc.cl

ABSTRACT

This work analyses the relationship between human beings and their environment taking into consideration the adjustment and eventual invasion of rabbits in Chile. It argues that in the long run, human actions have unsuspected effects upon the environment. In fact rabbits were seen initially as an opportunity for economic development because of the exploitation of their meat and skin. Later, rabbits became a plague in different areas of Central Chile, Tierra del Fuego and Juan Fernández islands, which was difficult to control. Over the years rabbits became unwelcome guests in Chile.

Key words: Environmental History, biological invasions, European rabbit, ecology and environment.

RESUMEN

Este trabajo analiza las relaciones entre los seres humanos y su ambiente, a partir de la historia de la aclimatación y posterior invasión de conejos en Chile, constatando que, en el largo plazo, las acciones humanas tienen efectos e impactos insospechados sobre el medio natural. En efecto, si bien inicialmente los conejos fueron vistos como una oportunidad de desarrollo económico a partir del aprovechamiento de su piel y su carne, pronto esta especie se convirtió en una plaga difícil de controlar en diversas regiones del país, como Chile central, Tierra del Fuego e islas Juan Fernández. Así, con el paso del tiempo, el conejo se ha terminado por transformar en nuestro país en un verdadero "convidado de piedra".

Palabras clave: Historia ambiental, invasiones biológicas, conejo europeo, ecología y medio ambiente.

Fecha de recepción: octubre 2007
Fecha de aceptación: abril 2008

INTRODUCTION[1]

Globalization has caused modifications not only in cultural and economical patterns around the globe, but also in the biological heritage of the countries involved[2]. The increment in commercial connection and transport between remote regions of the planet has favored an unprecedented exchange of flora, fauna and microorganisms[3]. In many occasions, the introduction of species is done intentionally, as in those with economical and productive importance. However, in other situations, this introduction is involuntary and in many cases undesired, as is the case with weeds or plagues.

The invading species have awoken a renewed and growing interest in our society[4]. On one side, they admittedly affect the natural (biological) heritage of the recipient geopolitical units, due to the fact that they can alter the existence of native species, and in some cases cause extinction. On the other, the invading species negatively affect the productive areas, as they can behave as weeds or plagues to crops. Finally, the arrival of new species can imply effects to human health, introducing pathogens or deleterious substances.

Though the biological dimension of these *invasions* is beginning to be understood from the point of view of ecological theory, its human dimension is clearly less studied[5]. This is particularly true if one considers that global connectivity (i.e. globalization) is sustained by relationships between specific geopolitical units (i.e. countries), and that these have been profoundly modified in the last 500 years. In this way, the study of the human dimension of biological invasions constitutes an aspect that helps to understand how the introduction of species has been supported historically, socially and politically, and what lessons are to be learned from these experiences to apply in the future, because new events of this sort will probably occur again.

In continental Chile, the introduction of invading species began early on. The commercial exchange between the native peoples probably contributed to the expansion of numerous species and crops (quinua, pepper, camelids, etc.). However, the Spanish colonization changed this dynamic in quality and quantity, by introducing species from a far away continent, with very remote evolutionary and bio geographical links to local biota[6].

[1] We thank Rodrigo Torres for the recompiling of antecedents for this work.

[2] Peter M. Vitousek, Carla M. D'Antonio, Lloyd L. Loope y Randy Westbrooks, "Biological invasions as global environmental change", in *American Scientist*, Vol. 84, Nº 5, Washington, 1996.

[3] Richard N. Mack, Daniel Simberloff, Mark Lonsdale, Harry Evans, Michael Clout and Fakhri A. Bazzaz, "Biotic invasions: causes, epidemiology, global consequences, and control", en *Ecological Applications*, Vol. 10, Nº 3, Washington, 2000.

[4] D. Pimentel, L. Lach, R. Zuniga and D. Morrison, *Environmental and economic costs associated with non-indigenous species in the United States*, Ithaca, NY, College of Agriculture and Life Sciences, Cornell University, 1999.

[5] J.A. McNeely, *The great reshuffling: how alien species help feed the global economy*, Gland, Suiza, IUCN, 2001.

With the founding of the Republic there was an active stimulation of commercial liberalization and internal stockbreeding, forestry and farming, and it was possible to introduce new breeding and crops. As a result of this, Chile has 24 species of vertebrates and 800 species of invading plants with a largely unknown history, in terms of the social and biological context of their introduction in the country.

The European rabbit (*Oryctolagus cuniculus L.*) has an important place among the invading fauna of Chile[7]. As an introduced species – apparently with commercial purposes – the breeding of rabbits in central Chile led to their escape or liberation in natural environments. With the new status of wild species, they not only managed to expand their geographical distribution, but also reached considerable amounts of population, to the point of causing economical damage to forestry and farming and becoming, in the process, a plague species: an uninvited guest[8]. Nowadays the presence of European rabbits in Chile can be seen not only in the central area of the territory, but also in the archipelago of Jan Fernández, Tierra del Fuego and part of Chilean-Argentinean Patagonia.

In this article we look through and analyze the available historical antecedents that demonstrate the introduction of rabbits in Chile. Specifically, we intend to cover two aspects of this issue: on one hand,

reconstruct the history of this invasion, focusing on the available documentary evidence; on the other, analyze the political and social context that triggered the introduction and savaging of one of the most worrying species for Chilean forestry and farming. With these antecedents, we will try to reach some relevant lessons about the introduction of species in Chile and the need for a virtuous dialogue between scientific investigation and policy making, which have accompanied and will accompany the multilateral connection of our country in the face of globalization.

THE EUROPEAN RABBIT

The European rabbit is a native species of the Iberia peninsula. Its distribution was originally restricted by glaciations that affected the European continent. This determined the apparition of two subspecies: *O. cuniculus*

[6] Sergio A. Castro, Javier A. Figueroa, Mélica Muñoz-Schick and F.M. Jaksic, "Minimum residence time, biogeographical origin, and life cycle as determinants of the geographical extent of naturalized plants in continental Chile", in *Diversity & Distributions*, Vol. 11, Nº 3, Stellenbosch, South Africa, 2005.

[7] Fabián M. Jaksic, "Vertebrate invaders and their ecological impacts in Chile", in *Biodiversity & Conservation*, Vol. 7, Nº 11, Springer, Netherlands, 1998.

[8] Fabián M. Jaksic and Eduardo Fuentes, "El conejo español: ¿un convidado de piedra?", in E. Fuentes y S. Prenafeta (eds.), *Ecología del paisaje en Chile central: estudios sobre sus espacios montañosos*, Santiago, Ediciones Universidad Católica, 1988.

cuniculus and *O. cuniculus algirus*[9]. The first subspecies is distributed in the northeast region of the peninsula and southeast France, while the second is located in southwest Spain and Portugal. The great fertility of this species, as well as its important supply of skins and food, probably motivated its introduction in different regions of the world (i.e. Asia, Africa, New Zealand and America), including numerous oceanic islands. So, in this last case, rabbits were a resource that provided food to the first oceanic travelers from the 15th and 16th centuries onward. In many of these places, rabbits ended up becoming a wild, unwanted species. This is the case of Australia, where there were no rabbits until the sailing boat *Lightning* brought two dozens of them in 1859, ordered by the landowner Thomas Austin, who did not wish to be deprived of the traditional rabbit hunt. The rabbits liberated by Austin had no natural predators, so they multiplied with abysmal speed. In a few years they became millions and occupied the Australian continent progressively with nothing to stop them. Foxes were imported from England as a palliative, buy they preferred to depredate the native marsupial fauna and almost exterminated it. Later on, a wire fence of 11000 kilometers was placed all along the country, with no result. In ten years Australia exported 700 millions rabbit skins and 160 million frozen rabbits. All the measures to eliminate rabbits were useless, until in 1950 scientists started to inject rabbits with the virus *mixoma*. Mosquitoes transmitted the disease, until the propagation of *mixoma* had reached its maximum point in 1951[10].

In practically all countries where rabbits were introduced, they have been successful colonizers and have shown to be potentially destructive of ecosystems, crops and livestock. That is why the rabbit has become one of the classic examples that are used to characterize the impact caused by biological invasions. At the same time, paradoxically, in many countries the rabbit has been introduced deliberately with the aim to practice hunting, obtain meat and skins, and even to be adopted as family pets. In Europe and other continents, the rabbit has been the object of arguments and rivalries for centuries between the "tenants" and the "great proprietors" who disputed the hunting rights of their game. Consequently the juridical status of the rabbit was the object of long deliberations, private prosecutions and legislations. In the second half of the 20th century, scientific investigation programs have established costly laboratories for medical experimentation and control of the species, under the protection of national governments. In short, the rabbit is a species of economic importance, that adapts effectively and quickly, and at the same time a certain and successful colonizer[11].

[9] Christophe Biju-Duval, Hajer Ennafaa, Nicole Dennebouy, Monique Monnerot, Françoise Mignotte, Ramon C. Soriguer, Amel El Gaaïed, Ali El Hili y Jean-Claude Mounolou, "Mitochondrial DNA evolution in lagomorphs: origin of systematic heteroplasmy and organization of diversity in European rabbits", en *Journal of Molecular Evolution*, Vol. 33, Nº 1, New York, 1991.

Monique Monnerot, Jean-Denis Vigne, Christophe Biju-Duval, Didier Casane, Cécile Callou, Florence Mougel, Ramon C. Soriguer, Nicole Dennebouy y Jean-Claude Mounolou, "Rabbit and man: genetic and historic approach", in *Genetics Selection Evolution*, Nº 26, Supl. 1, París, 1994.

[10] J. Voigt, *La destrucción de equilibrio biológico*, Madrid, Alianza, 1987, 146-150.

ORIGINS OF THE RABBIT IN CHILE

In 1892, Lataste pointed out that he first specimens of *O. cuniculus* were imported to Chile in 1884. They were supposedly freed on an island in the lake of Cauquenes (in what is now the 6th region), from which they expanded along the territory of central Chile. Despite the fact that Lataste's version was vastly accepted, the recent exam of available historical evidence suggests a different interpretation. In fact, after investigating in the first chronicles and other sources, like the acts of the municipal council, accounts of travelers and the impressions of different actors that describe the elements of the natural environment in Chile, we can say that the first one to show the presence of rabbits in the country was Juan Ignacio Molina, more than a century before Lataste. In this way, historical records indicate that there were rabbits in Chile before the time conventionally accepted in existing literature. In any case, some questions remain that the consulted texts don't answer. For example, when were rabbits introduced? And when did they become naturalized?

As was pointed out, the first references to the presence of rabbits in Chile, although indirectly, were written by the Jesuit Juan Ignacio Molina, who on describing the guinea pig pointed out that, despite all its semblance with rabbits, it "flees from their company and these animals have never been seen in relation or together"[12]. In his *Essay about natural history of Chile,* Molina states that both the guinea pigs and the rabbits "are very afraid of cats and moles, who are their enemies and predators"[13]. At the same time, when he refers to viscachas, Molina points out that "those peoples [peasants] prefer the meat of this animal that is white and very tender, to that of rabbits and hares"[14]. Considering that Molina was expelled in 1768 at the age of 28, these observations indicate that towards the middle of the 18th century rabbits had already been introduced in Chile, because the author mentions them to compare their habits in national context and to clarify and represent his descriptions of guinea pigs and viscachas to European readers, for whom his oeuvre about Chile's natural history is meant.

[11] H. Thompson y C. King (eds), *The European Rabitt. The history and biology of a sucessful colonizer*, Oxford, Oxford Science Publications, 2004.

[12] Juan Ignacio Molina, *Compendio de la historia civil del Reyno de Chile*, Madrid, Imprenta de Sancha, 1788-1795, tomo I, LXXXVIII, 348.

[13] Juan Ignacio Molina, *Ensayo sobre la historia natural de Chile*, Santiago, Ediciones Maule, 1987, 288.

[14] Molina, *Compendio..., op. cit.*, tomo I, LXXXVIII, 289.

However, at least until the mid 19th century, rabbits were not seen as an invading species or a problem in Chile. This was deemed so by Claudio Gay, who pointed out that this species was "unfortunately little abundant in relation to the numerous services its meat offers as food and its hairs as felt for hats"[15]. In his treaty of Zoology, Claudio Gay indicated that the rabbit that lived in Chile was "of a grey hue mixed with amber in wild state, with reddish blond in the nape of the neck; its throat and stomach are whitish. The ears almost as long as the head. The tail not as long as the thigh and brown op top; but in domesticity the colors vary a lot". This shows us that in his perception there were wild or savage rabbits in Chile before the mid 19th century, but not in the required abundance for a Frenchman accustomed to them, to be perceived as a plague. Consequently, Gay points out that in Chile "it would doubtless be useful to try to propagate them in the wild, especially in the large regions next to the mountain ranges where the lands are not being farmed yet, because they would offer a much tastier and healthier meat than that of domestic rabbits, a large quantity of furs, that the art of hat industry employs so frequently and to so much advantage"[16].

We have, in any case, more news of the existence of rabbits in the mid 19th century and also the first signs

of its potential as environmental plague, thanks to the references we have about a rabbit farm established before 1849. Nathan Miers remembers this, when he points out that that year Manuel Ruiz Tagle told him that "in his estate La Calera he had a rabbit farm of about four blocks**,** with many rabbits. After inquiring about it, I deduce that after his death, his heirs did not take care of the rabbits, and it is likely, according to the explanation I was given, that as they were locked up inside walls of lime and bricks, receiving no food, most of them perished. Some must have escaped. Because somebody told me a few days ago that one can see rabbits in territories next to Calera"[17].

In short, from the statements of Juan Ignacio Molina, Claudio Gay and Nathan Miers one can deduce that, as opposed to what Fernand Lataste stated originally, there were rabbits in Chile before 1884. Although these were probably kept locked up, to use their meat and skins, it is not clear if the populations of wild rabbits in the central territory of Chile consisted of freed animals or of those that had escaped from breeding. On the other hand, with the evidence at hand it is not possible to determine if the introduction of rabbits in the country was done once or in more opportunities, or if their escapes or liberations took place in more than one occasion. Truth is, at the end of the 19th century, rabbits were already being bred in captivity, and there were also wild rabbits in central Chile.

[15] Claudio Gay, *Agricultura Chilena*, Santiago, ICIRA, 1973, 477.
[16] Claudio Gay, *Historia física y política de Chile. Zoología*, tomo I, Santiago, Museo de Historia Natural de Santiago, 1847, 126.
[17] Nathan Miers, "Invasión de los conejos", in *Boletín de la Sociedad Nacional de Agricultura*, Vol. XXI, Nº 22, Santiago, May 28th 1900, 453 y 454.

ADJUSTMENT OF THE RABBIT IN CHILE

Towards the last third of the 19th century an interesting controversy began about the adjustment of the rabbit in Chile and the benefits that the breeding of this species could have in the development of national economy, especially for the groups with less resources. For some it was a highly profitable species, that, for its capacity to multiply quickly, would provide meat and fur abundantly and at low cost for consumption for the families of the countryside; while for others, like Rodulfo A. Philippi, it was a species that could cause enormous damage to agriculture if it escaped from its cages, just as had happened in other regions of the world. In any case, most authors stressed the importance of closing the them firmly, so these animals would not be able to attain freedom.

That is how in 1870 the *Boletín de la Sociedad Nacional de Agricultura (Bulletin of the Nacional Society of Agriculture)* published an article called "Breeding of Rabbits", that emphasized the importance of the rabbit in the fields, noting that up until then this vertebrate played "a secondary role in our farmyards", but that in other latitudes it was acknowledged for "its white meat, clean and of an always agreeable taste, it doesn't cloy and can be stewed in thousand different ways. But it is not the exquisiteness of its taste that makes us enhance it in this brief study we dedicate to it; it is an even superior consideration that touches the domestic economy of the poor: it is the importance it has for peasant families". Consequently, the article concluded "recommending to our landowner its diffusion among peasants". In any case it stated that the rabbit farm had to be "constructed with a material that prevents the fleeing of the rabbit, who is skillful and hard-working in making large caves where he hides first and through which he attains freedom at last"[18].

In that period Santos Tornero also encouraged the presence of rabbits in Chile. In 1875 he emphasized the benefits of the breeding of this species, while pointing out that it was useful "when the domestic breed is multiplied in appropriate conditions. Its assistance is not costly, and besides of the products, it gives an excellent meat, its skin and hair have a high price and as it is suitable to be bred by poor families, they are a great resource for domestic economy "[19]. However, at the same time, he warned about how "damaging rabbits can be when in freedom"[20].

That same year, the *Boletín de la Sociedad Nacional de Agricultura* published again an article about the breeding of rabbits "to manifest the great utility farmers in other countries obtain from this field that is highly neglected in the Republic", in which he pointed out that "as for the rabbit hutches in open air it is important to bear in mind that the larger the extension, the more they will prosper. Each rabbit hutch must be closed from each side with securely shut walls of about ten feet high and with deep enough foundations so the rabbits can not pass underneath […]. Hopefully one of our compatriots who are in Europe will go to Flanders to acquire

some pairs of these pretty and profitable animals"[21]. This text can be interpreted as a preoccupation with the possible invasion of rabbits, given their already known fecundity, or as a concern for the loss of productivity of rabbit farms after the escape of some animals.

[18] "Cría del conejo", in *Boletín de la Sociedad Nacional de Agricultura*, Vol. I, Nº 1, Santiago, 1870, 168.
[19] Santos Tornero, *De la cría y propagación de animales domésticos*, Valparaíso, Librería del Mercurio, 1875, 175.
[20] *Idem.*

Ten years later, the naturalist Rodulfo Amando Philippi thought that, according to his observations, "rabbits have not become wild for the reason of happiness, though some Frenchmen have tried to place them in one or another farmyard to have the pleasure to hunt them and to eat their meat, highly esteemed in France. The large damage they do was soon to be seen and they have been exterminated before they could become savage. The Englishmen, great rabbit hunters, have transported them to Australia, where they have multiplied in some places in such excess that it became a plague; in such a way that the settlers do not know how to get rid of these animals, that threaten to devastate the whole plantation"[22]. It is interesting to analyze this comment of Rodulfo Philippi; since it is the first reference we have about the rabbit plague in Australia, a topic that will be more than recurrent to explain the harm by rabbits in the documentation available in the following decades. On the other hand, it points out some actions undertaken to exterminate them before they became savage, and, speculating, we think that in some way it questions the statements of the Frenchman Claudio Gay we have already referred to, about the convenience of freeing rabbit into wild life.

For his part, René Le Feuvre, director of Quinta Normal de Agricultura, stated that the breeding of rabbits was convenient "especially for the poor of the countryside; both because it allows them to vary their alimentation and because it can be done in a very economic matter having children – who normally have very little to do – pick up the herbs and weeds that these animals feed on"[23]. Consequent with Le Feuvre´s lessons, who was the director of the most important center of agricultural experimentation in the country, in 1900 the Escuela Práctica de Agricultura de Chillán (Practical School of Agriculture of Chillán) informed that in its establishment rabbits "have multiplied enough to form a good basis for their exploitation on a bigger scale"[24].

On the other hand, Nathan Miers, a frequent collaborator for the *Boletín de la Sociedad Nacional de Agricultura* feared the effects of propagation of rabbits in Chile, due to their amazing fertility. So, on discussing the visions that praised the economical virtues of rabbits, he pointed out that:

[21] "Cría del conejo", in *Boletín de la Sociedad Nacional de Agricultura*, Vol. VI, Nº 13, Santiago, 1875, 346.
[22] Rodulfo Philippi, "Sobre los animales introducidos en Chile desde su conquista por los españoles", in *Anales de la Universidad de Chile*, LXVIII, Santiago, junio de 1885, 323 and 324.
[23] René Le Feuvre, *Lecciones teórico-prácticas de Agricultura y Zootecnia: dadas a los alumnos de la Escuela Normal de Preceptores*, Valparaíso, Imprenta Excelsior, 1885, 345.
[24] *Memoria del Ministerio de Industria y Obras Públicas*, Santiago, 1900, 18.

> "Last year I made the following observations regarding a pair of rabbits I had: the male was white and the female black. She bore eight little ones on October 26th; seven on November 27th, and nine on January 2nd. So, in 68 days one pair multiplied to 27. If we calculate that the first pair procreate during seven months of the year; and that their offspring only from six months onwards, one can establish that in a year we could count on 570. This estimation is not fantastic, it is in fact still very limited, when one considers that the natural state of pure freedom and enough food is always more favorable for procreation than the artificial state of confinement"[25].

Later on, in 1900, Miers warned again in the *Bulletin of the National Society of Agriculture* about the "astonishing fertility of the rabbit". In this opportunity he pointed out that this fact had to be known, because it was stressed in all the "little treaties" used about the breeding of rabbits. He also cited the case about New Wales in South Australia, about which he wrote "anyone can measure the extent of what the invasion of rabbits can become with the data supplied by Mr. F. A. Coghlan, a government statistician, in his work *La riqueza y el progreso de Nueva Gales del Sur (Wealth and progress in New South Wales)*"[26]. In this way, Miers pointed out that the exposed arguments were enough, in his opinion, to "know what to expect when throwing the rabbits to the fields"[27].

Also warning about the dangers of the spreading of the rabbit, in 1912 Luis Castillo wrote that

"in Chile, especially in the central zone, which is similar to the original habitat of the rabbit, this rodent has found a suitable ground to undermine and an abundance of living fences to protect itself from the prosecution it is subject to for the damages it causes. It finds itself so well here, so much to its taste that it multiplies prodigiously invading the farming lands with astonishing speed, for which it relies on the valuable resource of the blackberry bush, an invading plant that serves as an inviolable den, only violable by fire"[28].

Likewise, Castillo pointed out that

"like many other organic beings adjusted to places outside of their country of origin, rabbits have found conditions in other regions of the earth that are so suitable to prosper that they have acquired a degree of rusticity completely unforeseen by their importers. This has also happened in Chile with the apple tree and the dolphin-fish, the goat's rue and blackberries, three calamities. In Chile those plants, like the dolphin-fish, have found in the weather, the quality of the soil and the lack of all those natural agents that in one way or another hinder their propagation and spreading, such favorable conditions for their rusticity that from useful beings they have turned into damaging ones"[29].

[25] *Boletín de la Sociedad Nacional de Agricultura*, Vol. XXIV, Nº 15, Santiago, August 5 1893, 445.
[26] Miers, "Invasión de los conejos", *op. cit.*, 453-454.
[27] *Idem.*
[28] Luis Castillo, "El conejo en libertad", in *Boletín de bosques, pesca y caza*, Vol. I, Nº 4, Santiago, October 1912, 253.
[29] *Ibid*., 261.

In another article, Castillo points out that "the rabbit and blackberry have not only found an easy adjustment in Chile but they have also become wild in an unforeseen manner, to the point of becoming highly damaging to agriculture"[30].

The next year, the *Bulletin of the National Society of Agriculture* pointed out, in an article about plagues and problems of agriculture, that

"in the fields next to the coast of the provinces of Santiago, Colchagua and O´Higgins there is a large amount of wild rabbits of unknown origin, since while some maintain that they were freed on purpose for sports and hunting, others say they descend from rabbits that have escaped from the cages they were held in. The plague has already passed south of the Maipo and reached the lake of Aculeo. For now the best solution is to hunt them in any way and as they are appreciated for their meat, they will be chased more every day. It is convenient to destroy the spots of blackberry bushes with fire, which is where it pleases them most to hide. The most practical means is the use of special lasso's made with thin wire, which are placed in the areas most trafficked by rabbits. When they pass, they put their heads in the lasso and are strangled. In this way, large quantities of rabbits are hunted every day"[31].

Despite the danger of rabbits as an invading species, the economic benefits expected from the exploitation of their skins and meat made them to be considered as an opportunity for the country's development, especially for the proprietors of smaller agricultural lands. In fact, especially from the 1920´s onwards, there is a persistent campaign in the available documentation to introduce the breeding of rabbits as a good alternative of economic development. In 1921, for example, Carlos Echeverría published a manual for rabbit breeding in which he stated that

"the rabbit industry is one of the few that could easily and in the short term become a real source of wealth for our country and nowadays it is more appropriate for development as it doesn't require a large investment and it would strongly contribute to solve many items in the supply of meat for food… the unemployed or those disabled to do forced labor, women that live in the countryside and rural villages can easily take care of one or two domestic rabbits and provide themselves a very nutritious food at a lower price".

In any case, Echeverría warned that

"Most of the rabbits sold in our markets are those that live in freedom and that some people have freed to propagate and then use for hunting, without thinking of the large damage they cause to our agriculture, rending the crops useless and undermining the fields and even the houses when they build their warrens"[32].

[30] Luis Castillo, "Migraciones observadas en la fauna y flora de Chile", in *Boletín de bosques, pesca y caza*, Vol. II, Nº 4, Santiago, October 1913, 251.

[31] "Cartilla práctica sobre las enfermedades de árboles y cultivos, causadas por insectos y animales. Remedios", in *Boletín de la Sociedad Nacional de Agricultura*, Vol. XLV, Nº 9, Santiago, September 15th 1914, 528.

In march 1928, the National Society of Agriculture published an article called "The breeding of the rabbit", that stressed that "between the small agricultural industries, one of the most lucrative is perhaps the breeding of rabbits, both for their fine and delicate meat, as for their skins, that has more commercial importance each day"[33]. A few months later, in June 1928, the Bulletin of the Society published "Advice for the production of skins", where it said that "the furrier industry has reached such perfection that it transforms the fur of the prolific rabbits in luxurious coats of ermine, badger, beaver and other imitations that because of their elegance and economy have become generally adopted in female fashion". Because of this, the article considered that "with good reason the Ministry is preoccupied with boosting this very simple exploitation, typical of modest homes and capable of providing notable utilities". Finally, it emphasized that

> "rabbit fur has triumphed now and there is no need to disguise it under other names to receive the appraisal it deserves. Our ladies will not have to consider the confections with these furs as less, since the most recent fashion, in the countries that impose fashion, are in favor of them and even royalty accepts to wear furs of this origin"[34].

The Bulletin of that month also stressed "the exhibition of rabbits in the shop windows of *Gath y Chaves*" and the pamphlet that was handed out there about the possible benefits of the breeding of rabbits to obtain their skins. The editors of the Bulletin stated as well that these initiatives of the Department of Lands and Colonization, within the Ministry of Public Works, were proof of the interest to promote the birth of the lucrative furrier industry. Consequently, they exclaimed: "Let's congratulate ourselves that the hour has come to take into account one resource of the country that until now had not been taken seriously". However, they warned that it was not enough "to have the small industry that is easily established in farms or plots of land close to cities, but it is necessary to go towards the industrialization of large scale exploitations, established with help from the State, at least regarding to the delivery of certain portions of territory that could be used exclusively to this end". They also stated that the government should eliminate custom taxes for the living specimens introduced in the country, and taking the example of the United States and Canada, grant the lease of islands along the Chilean coast, where there are large quantities of completely abandoned islands that have no use for the treasury nor the national economy and that would offer a splendid land for all kinds of breeding for furrier purposes"[35].

[32] Carlos Echeverría, *Conejos y conejeras. Lecciones prácticas sobre los medios de manejar esta industria*, 1921, 2-4.

[33] "La cría del conejo", in *Boletín de la Sociedad Nacional de Agricultura*, Vol. LX, Nº 3, Santiago, March 1928, 172.

[34] "Consejos para la producción de piel", in *Boletín de la Sociedad Nacional de Agricultura*, Vol. LX, Nº 6, Santiago, June 1928, 381 and 382.

The next month, July 1928, the director of the Department of Lands and Colonization sent "a note to the president of the National Society of Agriculture inviting him to cooperate on the campaign that department had set out to embark on to intensify the exploitation of furrier animals, especially in the field of rabbit breeding". In the note, he attests the good quality of the Chilean furs that are exported and that, "despite the deficient conditions in which they are prepared, they are esteemed of the best quality abroad". Besides, he added that "our hat factories have an annual demand of rabbit hair valued at two million pesos, raw material they currently have to import"[36]. In response to the request of the Department of Lands and Colonization, the president of the National Society of Agriculture stated that "his institution had always tried to encourage in our lands all those small exploitations and inspired on those purposes has never neglected to publish any useful information about this matter in its bulletin. Lately our publication has created a special section about rabbit breeding"[37].

Indeed, from then onwards, a series of publications followed, both in the *Bulletin of the National Society of Agriculture* as in pamphlets, official documents, articles and books, that stated the need to implement rabbit breeding as a possibility of development of small scale agricultural industries. For example, between April

1928 and September 1929, the *Bulletin of the National Society of Agriculture* published: "Precepts of hygiene and diet for rabbits", "Rabbits for fur production", "Exploitation of the angora rabbit", "Lucrative exploitation of the angora rabbit", "Depilation of the angora", "The castorex rabbit", "Castorex robust and rustic", "Coccidiosis in rabbits" and "Catarrhs in rabbits". In this same context, the *Magazine of Stockbreeding and Veterinary Agriculture* published an article called "The breeding of rabbits and their reproduction", that stated that "it is a known fact that in Chile the breeding of rabbits has reached considerable development lately"[38].

Therefore, it is not surprising that given the fertility of rabbits, soon new preoccupations, warnings and also some measures to control the growth of this species population in the country soon came up. In sum, in the last decades of the 19th century and first decades of the 20th, a debate began about the benefits or harms of the adjustment of the rabbit and the establishment of rabbit breeding, especially as a business opportunity for the small landowners.

[35] "Medida indispensable que el Gobierno debe adoptar a favor de la industria peletera nacional", in *Boletín de la Sociedad Nacional de Agricultura*, Vol. LX, Nº 6, Santiago, June 1928, 385.
[36] "Cunicultura. La explotación del conejo de Angora", *Boletín de la Sociedad Nacional de Agricultura*, Vol. LX, Nº 7, Santiago, July 1928, 457.
[37] *Idem.*
[38] "La cría de conejos y su reproducción", in *Revista de Ganadería y Agricultura Veterinaria*, Año V, Nº 53, Santiago, 1930, 692.

The rabbit was valued for its quick multiplication, easy breeding and the benefits obtained by the exploitation of skins and meat. However, many saw a danger in the rabbit, because the chances that some would escape and form wild colonies were very high. In fact, the promoters of rabbit breeding report this when they differentiate wild rabbits from the bred ones. The first categorical warnings about damages by rabbits are from Philippi, in 1885, Miers, in 1900, and Castillo, in 1912, who already sees the first signs of a rabbit plague in central Chile. This is how, together with the development of rabbit breeding promoted by government institutions like the Department of Lands and Colonization and guild organizations like the National Society of Agriculture, at the end of the 1920s the existence of a rabbit plague was more and more evident in Chile.

RABBITS IN CENTRAL CHILE

At the end of the 1920s there were rabbits all over the central valley. In 1929, for example, Camacho recognized as

> "an undeniable fact that we have established the rabbit plague in some parts of the country, causing important damage in plantations, sown fields and grasslands. […] According to information I have, this plague keeps spreading and possibly in a not far away future it may be necessary to take measures to stop the invading area from growing and to control the situation in the already invaded areas"[39].

On the other hand, during the parliamentary discussion on the Law of Hunting of 1929, an article was included to allow the President of the Republic to authorize the hunting of detrimental or harmful animals without the warrant referred to in article 2, at any moment, even during close season. Likewise, recognizing the plague characteristics rabbits were having in Chile in those years, the honorable García Henríquez pointed out in the Chamber of Deputies that the project taxed "the hunting of the rabbit, while in other countries people are being paid to hunt them". It was alarming that "editorials in *La Nación* and *El Mercurio* have asked for a hit to the rabbits that constitute a plague. However, those who kill them are charged here"[40]. In turn, senator Yrarrázaval pointed out the need to encourage the rabbit hunt, not only reducing taxes for exportation proposed by the project, but "instead establishing a disposition according to which a bonus will be paid for the export of rabbit skins as this animal has expanded considerably and has become a plague in rural fields, like the region of Melipilla"[41].

[39] C. Camacho, "El conejo Silvestre", en *Boletín del Departamento de Agricultura*, Año I, Nº 10/ 12, Santiago, October/December 1929, 3.
[40] Chile. Congreso Nacional, Cámara de Diputados, *Diario de Sesiones. Publicación Oficial de la Cámara de Diputados*, 41ª sesión ordinaria September 10th 1928, 1.246.

In 1930, Ismael Vicuña, Chilean consul in Bremen, sent a note to the Ministry of International Relations and Commerce in which he "delivered important antecedents about the way that could be used in our country to attack the large rabbit invasion that is causing such considerable damage to agriculture". To this end, he made "a study of the systems used in Germany to combat wild rabbits that have become a plague to agriculture"[42]. According to Vicuña, in Chile there was "a grave danger to agriculture due to the damages caused by rabbits, and the worst thing is that farmers have had to agree that it is indispensable to stop hunting foxes, the animals that eat rabbits. But one has to keep present that they are mortal enemies of lambs and fowls". At the same time, Vicuña sent models of rabbit traps to the National Society of Agriculture, with their prizes and also other catalogues with appliances to use carbon sulfide gas, with the prices of appliances and gas. Finally, he justified the extent of his report "in the understanding that I state a matter that will serve farmers, who are alarmed with the immense damages they receive from rabbits"[43].
The plague was acknowledged on March 8th 1932 in the official note Nº 300 by the General Board of Fishing and Hunting, and asked the Minister of Public Works to postpone for five years the prohibition to hunt different fox species, some of them native species, to control the rabbit population[44]. A few months later, on June 23 1932, decree Nº 1.046 was enacted which caused numerous complaints by the farmers of the central zone, because they considered that it authorized the hunting of foxes under certain conditions, which would cause "a grave danger for agriculture. […] The extinction or reduction of that species would neutralize one of the most efficient natural means to put an end to the rabbit and hare plague that invade the fields with grave harm to national economy". Besides, they considered that, even if in decree 1.046 there were norms to compensate the effects of the partial opening of the fox hunt, for example commerce and export of fox skins with the obligation to export at the same time large quantities of rabbit and hare skins, "this compensation does not respond to the magnitude of the damages that could occur"[45]. In fact, the Agricultural Society of Chile had stated ten years before, on July 13th, the need to maintain absolute close season on fox hunt, reasoning that "the simple fact that the fox is a powerful enemy of one of the most harmful plagues that is taking effect on our agriculture, would suffice to try to protect its existence by all means possible"[46].

[41] Chile. Congreso Nacional. Senado, *Sesiones de la Cámara de Senadores*, February 7 1929, 2.748.
[42] "Animales dañinos. Procedimientos para exterminar la plaga de los conejos", in Boletín de la Sociedad Nacional de Agricultura, Vol. LXII, Nº 4, Santiago, April 1930, 198.
[43] *Ibid*., 202.
[44] AN.FMF, Vol. 653. Expediente Decreto Nº 1.253, June 30 1932.
[45] *Ibid*., Vol. 654. Decreto Nº 1.205, July 21th 1932.

In these circumstances, the Department of Fishing and Hunting of the Ministry of Public Works chose to revoke decree Nº 1.046, maintaining "in full rigor the precepts of law Nº 4.601, about the close season of the hunting of foxes and other protected animals"[47]. A few days later, the Ministry of Public Works approved decree Nº 1.253, with which it deferred "for three years from the first of December of the current year onwards, the prohibition established in letter b) of the second article of law 4.601"[48].

However, in 1934 the rabbit plague did not cease in the central valley. That year Carlos Reed published a pamphlet called *Let us make the most of the meat and skin of the wild rabbit and contribute to national well being*, in which he pointed out that

> "in the last 20 years the wild rabbit has multiplied extraordinarily in the countryside of Chile, and is already reaching the south […] agriculture laments the large damages this rodent causes to crops […] I ascribe an extraordinary power to the adjustment of wild rabbits in the fields of Chile, from the point of view of our people […] previously, farmers did not eat meat […] now, with the multiplication of rabbits, meat is part of the farmers´ daily diet and also of that of

city dwellers"[49].

Reed had been able to ascertain that "more than one hundred thousand dead rabbits, hunted with traps or dogs, reach the city of Santiago, usually during the winter months, to be sold in different markets. As I found out, in only one day in 1933, more than five thousand dead rabbits were brought to Santiago". That is why "rabbit meat is sold cheaply in Santiago". Then he recommended a series of rabbit recipes, to conclude that

> "the Chilean people would do a patriotic deed if they would consume more rabbit meat and tried to replace with it, to a certain degree, that of cows, lambs and chickens […] that its consumption increase in all the homes of Chile and with this the rabbit plague would diminish in the country and the population would be better nourished, there will be less consumption of imported cow's meat and besides the properly tried rabbit skins could be better used by the national furrier industry and also as an important export item"[50].

On June 8th 1934, furrier workers of Santiago requested formally to allow the hunting of foxes in the north zone, from June 15th to August 31, and of foxes, coypu and Southern river otters in the south zone, from August first to 31st , allowing its export until September 31st, claiming that

[46] *Ibid*., Vol. 653. Expediente Decreto Nº 1.253, July 30 1932.
[47] *Ibid*., Vol. 654. Decreto Nº 1.205, July 21 1932.
[48] *Ibid*., Vol. 653. Expediente Decreto Nº 1.253, July 30 1932.
[49] Carlos Reed, *Aprovechemos la carne y la piel del conejo silvestre y con esto contribuiremos al bienestar nacional*, Santiago, Imprenta y Litografía La Ilustración, 1934, 3.
[50] *Ibid*., 36.

> "it would contribute strongly to awaken interest among rabbit and hare hunters, saving agriculture from this plague and at the same time releasing numerous fox, coypus and Southern river otters´ skins kept by landowners and foremen of country estates. One can understand that rabbit and hare hunters will hunt foxes and other harmful animal species when they cross their path. So it is no wonder a large quantity of skins have accumulated, and their value must be properly used, with a manifest benefit for the treasury, since commerce and export of them signify a considerable income of taxes and customs duties, and their use in the country would boost the national furrier industry. Besides, we have seen that the law of close season and prohibition, which has lasted four years, have not exterminated the rabbit and hare plague, and perhaps, on the contrary, have increased them. Because when the hunting of foxes, coypus, etc was allowed, almost 4 million rabbit and hare skins were exported annually, but since the law of prohibition came into force, the export of rabbit and hares has been almost inexistent. There is no proof more eloquent to show that the killing of rabbits is boosted when there is a release of skins as well. Therefore, if rabbit and hare hunters are allowed to release the skins of foxes and coypus, etc that fall into their hands the rabbit and hare plague will be exterminated in rural areas […] in this manner, clandestine hunting would be avoided, as well as the illegal export of these skins, which occurs despite the surveillance in customs, benefiting criminals who use smugglers to do this, evading the payment of custom taxes"[51].

Some days later, the fur merchants and exporters from Talca requested the Ministry of Public Works to open up the hunting of coypus, Southern river otters and foxes. They argued the economic benefit to the country of jobs and income by taxes and customs this economic activity would generate. Besides, during the six years of close season, these species had been largely conserved, as was the objective of the Law Nº 4601 about hunting, from June 18th 1929. At the same time, they stated that "allowing the hunting of those animals will be an effective aid to many homes of our farmers stricken by the crisis, since hunters will be able to obtain good profits for the high prizes they receive for these animals skins"[52].

Regarding this, Luis Lagos, general director of the Office of Woods, Fishing and Hunting, stated that the hunting law responded to the need to

[51] AN.FMF, Vol 885. Expediente Decreto Ley Nº 2.436 of August 11th 1934.
[52] *Idem.*

"protect these animals from the persistent persecution they are subject to and avoid the extinction of those species that conveniently propagated could become a great economic wealth for the country; and concerning the foxes, they are an element of natural defense from the rabbit and hare invasion in the center and south of our territory. The close season established by the law and subsequent decrees has been maintained to this day with slight exceptions. This has caused that every year, fur merchants have recurred to your honorable ministry, asking for the temporary suspension of it in this season, that is to say in winter, the time in which the animals in question reach their highest value in terms of the quality of their skin. Regarding this, and if there are no hare and rabbit plagues to combat in the provinces of Coquimbo and Atacama, and the fox really constitutes a danger for the offspring of sheep and goats and even for the chinchilla, the species most in danger of extinction, this Office is of the opinion that there would be no inconvenient to give this permission until August 31st, prior to the inscription of the hunters and payment of corresponding license in the regions they come from [...] as for the hunting of foxes in the area from the Aconcagua provinces to the south, and despite what the solicitants state that the hunting of this animal would serve as a stimulus to simultaneously beat the rodents (hares and rabbits) that invade the fields, I consider this matter worthy of a larger study, and to solve it, it would be necessary to consult the Ministry of Agriculture first"[53].

The report of the Service of Vegetal Health of the Ministry of Agriculture picked up the point of view of the director of Fishing and Hunting when he stated that:

"the fox was a valuable element for the natural defense against the invasion of hares and rabbits in the agricultural lands of the center en south of our territory. Rabbits and hares are a plague from the province of Aconcagua to Cautín, so from this point of view everything done to preserve foxes will only benefit our agriculture. I don't believe the damages these animals may cause have to be taken into account, as they do not match the harm done by the rodents; besides farmers can easily take precautions to avoid the damage foxes can do. My opinion regarding foxes is therefore that from the province of Aconcagua to Cautín, hunting them must be prohibited, making the close season more strict, as to avoid all clandestine commerce of fox skins. I take the liberty to imply that all skins stored in the country estates, of animals hunted during the close season that are awaiting permit for export and sale, must be confiscated. If this precaution is not taken, the close seasons will be completely useless because the foremen and other employees of the estates keep on hunting foxes and store the skins until their sale is allowed. As for the provinces of Coquimbo and Atacama and south of Cautín where the rabbit problem is practically inexistent, I see no inconvenient to give the requested authorization"[54].

[53] *Idem.*
[54] *Idem.*

In confirmation of this, the Inspection of Provincial Services of the Ministry of Agriculture pointed out that foxes caused considerable damages to the breeding of sheep and goats and that "the plague of those rodents does not exist", therefore it would be convenient to enact a law to "exempt the provinces of Atacama and Coquimbo of the general enforcement of Law Nº 4.601, that prohibits the hunting of foxes"[55]. In this context, decree 2.436 from August 11th 1934 excluded the provinces of Coquimbo and Atacama from the close season and established the prohibition to "capture foxes in the provinces from Aconcagua to Cautín"[56]. We know as well that on August 17th 1942, the General Office of Fishing and Hunting gathered diverse information that confirmed the assertions by private individuals who pointed out that in the area between the Mapocho and Maipo rivers a rodent plague had developed and produced considerable damage. Consequently, on August 21st 1942 the decree 1.745 established the complete close season for the hunting of foxes during five years in the area affected by the rodent plague[57].

One year later, July 9th 1943, some proprietors from the Maule province stated that "the prohibition of the fox hunt had brought about an abundance of that damaging animal in the Maule province, causing real havoc among the herds of the region. The damages produced among sheep by the fox plague had reached such proportions that farmers were justly alarmed, and some of them even put an end to the breeding of these animals out of fear of greater losses". Considering "the exposed matter, and attending the greater interests of national industry, we would like to ask that you kindly authorize the precautionary measures that are needed, with the precedent that the main motive to prohibit the fox hunt has disappeared with the considerable increment in the hunting of hares and rabbits, given the high prize these animals furs have reached"[58]. In that

sense, on July 31st 1943, the general director of the Office of Fishing and Hunting pointed out that the decree Nº 2.436 had effectively given the expected results. Ten years later, the Office of Fishing and Hunting of the Ministry of Public Works stated that

> "foxes multiplied in such abundance, that, while it's true the rabbit plague has been reduced, the foxes don't find enough food, so they have launched themselves on the hunting of sheep, as affirmed by the report of the Ministry of Agriculture. The time has therefore come to free the fox hunt, as established by the Law of Hunting in its first article, maintaining only the total close season established for five years by decree 1.745 of August 21st 1942, in the small area between the Mapocho and Maipo rivers"[59].

[55] *Idem.*
[56] *Idem.*
[57] *Ibid.*, Vol. 1968. Decreto Ley 1.745, August 21 1934.
[58] *Ibid.*, Vol. 15. Expediente Decreto Ley Nº 618, August 16 1943.
[59] *Idem.*

Given these antecedents, the Ministry of Public Works dictated decree Nº 618 on August 16th 1943, that derogated decree Nº 2.436, but maintaining "the ordinary close season considered by the first article of the law of hunting and extraordinary close season established by decree Nº 1.745, of August 21st 1942, for the area between the Maipo and Mapocho rivers"[60]. This shows us that rabbits were still considered a plague for agriculture in the current metropolitan area of Santiago.

However, Carlos Schneider made a different diagnosis for the Biobío region, when he pointed out that while the first rabbits had adjusted to Concepción around 1907 and caused damage towards 1909, later on they had completely disappeared, "perhaps controlled by some carnivore or bird of prey, and reappeared in the last years as a really serious plague"[61], contradicting, in that sense, the statements of the Department of Fishing and Hunting of the Ministry of Public Works.

Despite the evidence of the developments concerning rabbits in central Chile, on June 26th 1940, the Office of Fishing and Hunting presented a project to CORFO to inhabit the austral islands with rabbits, hares and goats, and then release silver, blue, grey and red foxes and so as to form "an inexhaustible source of wealth from animals of fine furs"[62]. In March 1943, *Fishing and Hunting* magazine published an article called "Six ineluctable points in hunting and fishing of Chile", which insisted on the project of including the innumerable austral islands to national economy, populating them with hares, rabbits and goats, and then after some years, after those animals had multiplied, free

> "silver, blue and grey foxes and other fine furred animals, one species on every island, where they would find the necessary food for their sustenance, in hares, rabbits and goats. Once these furrier animals have multiplied, man could begin to hunt. From the first day on, he would find animals from which he could obtain valuable furs and immediate earnings"[63].

On the other hand, Rafael Housse pointed out that the Patagonian Fox fed on "small mammals that are incapable of resisting them: all the species of rats, hares, and rabbits of any age, viscacha rats, goats, lambs, pudus and sometimes domestic cats". According to Housse, the possible damages the Patagonian Fox could cause on the domestic animals he devours:

> "are really not that bad, because this species ordinarily lives in isolated and wild places, not frequented by small cattle, far away from human homes.

[60] *Idem.*
[61] Carlos Schneider, "Catálogo de los mamíferos de la provincia de Concepción", in *Boletín de la Sociedad de Biología de Concepción*, tomo XXI, Concepción, 1946, 76.
[62] AN.FMF, Vol. 1976. "Repoblación de las islas australes".

[63] "Detengamos el exterminio de nuestras especies", in *Pesca y Caza*, Año II, Nº 2, Santiago, March 1943, 28.

> These damages are very inferior to the benefits the Patagonian Fox gives to man for the enormous amount of hares and rabbits, both litter and adults, he destroys, preserving the fields from havoc. Experience shows this is so: where inconsiderate people have diminished or exterminated Patagonian foxes, there were so many rabbits and hares that they rendered the sowing useless and put an end to the crops. This happened in the basin of the Claro River, east of Molina, from 1928 to 1930. Mountain dwellers killed the Patagonian foxes because they coveted the commercial value of the furs, and as a result of this aberration rabbits multiplied in such a way that they invaded the mountainsides and gullies of the mountain range and overtook the central valley, becoming an uncontrollable fatal plague"[64].

Never Bonino and Reinaldo Gader point out that rabbits were first seen in Argentina between 1945 and 1950, in the province of Neuquén, specifically in the town of Andacollo. The authors state that these rabbits "came almost certainly from Chile, since on the same latitude at the Chilean side there were populations of this species, and in that area there are many passages across the mountain range of an altitude that is no impediment for the advance of rabbits"[65]. For his part, John Keever Greer observed mammals in the province of Malleco between 1960 and 1962 and estimated that the rabbit was located "all along the province of Malleco, except in the high parts of the Andes"[66].

On the other hand, statistics on rabbit and fox skins exported by Chile show us that the number of fox furs sent abroad effectively decreased, which is proof of a smaller hunting, a result of the restrictions imposed by the hunting law of 1929. However, the number of exported rabbit skins increased notably, at least until the 1960s, with a maximum of 479.031 skins exported from 1950 to 1954. In this sense, the numbers indicate that there would be no direct correlation between the increment in the fox population and the reduction in the rabbit population, because despite the decrease in the fox skins export, the export of rabbit skins increased. According to the antecedents available towards 1960, this would respond to two factors indicated in this work. On one hand, the mentioned boosting of rabbit breeding for that period, and on the other the expansion of the presence of the wild rabbit in central Chile.

[64] Rafael Housse, *Animales Salvajes de Chile en su clasificación moderna*, Santiago, Universidad de Chile. 1953, 150-153.
[65] Never Bonino y Reinaldo Gader, "Expansión del conejo silvestre europeo (*Oryctolagus cuniculus L.*) en la República Argentina y perspectivas futuras", en *Anales del Museo de Historia Natural de Valparaíso*, Nº 18, Valparaíso, 1987, 157.
[66] John Keever Greer, *Mamíferos de la provincia de Malleco*, Angol, Museo Dillman S. Bullock, 68 y 69.

TABLE 1 NUMBER OF EXPORTED SKINS, 1910-1980[67]

Years	Rabbits	Foxes
1910 - 1914	0	96.524
1915 - 1919	0	14.418
1920 - 1924	0	19.176
1925 - 1929	453.775	53.367
1930 - 1934	68.315	24.059
1935 - 1939	75.989	21.827
1940 - 1944	151.739	25.904
1945 - 1949	159.655	9.692

1950 - 1954	479.031	2.404
1955 - 1959	255.621	2.845
1960 - 1964	273.719	17.893
1965 - 1969	120.270	14.704
1970 - 1974	37.000	11.100
1975 - 1979	51.645	1.746
1980 - 1984	14.600	0
Total	2.141.359	315.659

Surprising about this story is that, approximately thirty years later Jaksic and Yáñez calculated for the first time the impact of rabbits in the diet of Chilean foxes, with an analysis of droppings and stomachs of carnivores and regurgitations of birds of prey, and they concluded that rabbits constituted a minority fraction of the preys hunted by the most common predators in the country. As an explanation of this phenomenon, they stated that Chilean predators were not efficient in the hunting of rabbits, because they had not developed the "adaptations of conduct needed to hunt a recently introduced species, as is the rabbit. In any case, whatever the explanation, it is apparent that predators had no important role in the abundance of rabbits in Chile"[68]. With this, they annihilated many years of public policies in the matter and posed a new challenge: how to control the rabbit plague? What to do to avoid damages to agriculture?

[67] José A. Iriarte y Fabián M. Jaksic, "The fur trade in Chile: an overview of seventy years of export data (1910-1984)", in *Biological Conservation*, Vol. 38, Barking, 1986, 247.

[68] Fabián M. Jaksic y José Yáñez, "¿Quién controla las poblaciones de conejos introducidos?", in *Medio Ambiente*, Nº 4, Valdivia, 1980, 43.

From another point of view, we can only state that despite this fallacious and repeated analogical reasoning, that gave the same role Spanish foxes had in controlling the rabbit population of Spain to the intrinsic capacity of Chilean foxes to control the plague of that species - which was exotic to this country – the national fox species were possibly protected by State institutions. This at least allowed diminishing the extinction process they were in before the law of fishing and hunting of 1929. In fact, as we can see from the demands of the hunters of the central valley, with this law there was a series of restrictions to the export of fox skins, which diminished considerable as can be seen in Table 1. So, the myth that Chilean foxes were voracious rabbit eaters was built based on suppositions and not on a scientific platform with quantified data about the effective diet of these predators. In any case, fortunately this supposition and myth allowed a fiercer application of a group of laws that regulated the hunting of foxes and other species in the country and that tried to prevent or hinder the export of their skins because of the supposed ecological role they fulfilled.

RABBITS IN TIERRA DEL FUEGO

Another rabbit plague known in Chile occurred in the region of Magallanes, in Tierra del Fuego. Pedro Arentsen points out that the first rabbits were freed towards 1874 on Isla Grande of Tierra del Fuego by protestant missionaries that settled on the Argentinean part of the island, in front of the Beagle canal. Supposedly, these first specimens had multiplied freely in a completely wild life, but after a little while they

were decimated by a very harsh winter, with strong frosts and snowfall. In 1913, rabbits were again liberated in the Chilean sector of Baquedano and a little later in the proximities of Porvenir, but due to the harsh winters none of these attempts prospered, luckily for the local livestock of the time. The plague of 1950 came from two pairs of rabbits of European origin freed in the surroundings of Porvenir around 1936, or perhaps two or three years before. These rabbits had "multiplied swiftly and no special importance was given to this, since both farmers and workers saw the increment of their population as a new source of wealth for the province"[69].

[69] Pedro Arentsen, "Control Biológico del Conejo", in *Boletín Ganadero*, Nº 43, Punta Arenas, 1954, 4.

TABLE 2

LOADING OF RABBIT SKINS TO THE NORTH OF THE COUNTRY, FROM THE PROVINCE OF MAGALLANES[70]

Year	Amount	Value $
1939	4.171	15.732
1940	4.318	13.564
1941	10.624	64.877
1942	51.121	422.074
1943	148.289	1.216.495
1944	120.045	1.464.811
1945	89.793	772.961
1946	185.337	2.564.440
1947	318.031	4.159.150
1948	433.340	3.504.286
1949	379.490	3.203.472

As can be seen on Table 2, together with the rabbit plague in the fields of Tierra del Fuego, the commerce of this species grew from 1942 onwards, producing generous earning, especially for those involved in the commerce of skins. However, Arentsen pointed out

> "much has been said and written about the convenience of taking measures aiming to project the free multiplication of rabbits arguing the benefits this rodent contributes to a country's economy, both for its meat as for the skins that are a source of work, for hunters and the development of industries these areas exploit [...] These apparent benefits for a country are indisputably relative in comparison with the enormous damages rabbits cause"[71].

Since the beginning of 1947, the rabbit plague in the province started to seriously worry the directive of the Union of Small Farmers of Magallanes. They adressed the Ministry of Agriculture for the first time "presenting the seriousness of this plague and the immediate threat it already is for the livestock of Magallanes"[72]. H. B. de Bruyne was one of the first private persons who warned farmers and the authorities of the real economic scope of this terrible plague, when he commented in *La Prensa Austral* of June 19th 1948 an article called "A warning to Chile" written by Jorge Mulgrue published in the magazine *Imperial Review.*

[70] "Exterminación total de la plaga de conejos", in *Boletín Ganadero*, Año I, Nº 8, Punta Arenas, September 1950, 3.
[71] Arentsen, *op. cit*., 8.
[72] Daniel Claro, "Instituciones ganaderas aúnan sus esfuerzos para extirpar la plaga de conejos en la región", in *Boletín Ganadero*, Año I, Nº 3, Punta Arenas, January 1950, 24.

In this article Mulgrue stated that:

> "the rabbit does not only consume the superficial vegetation used for grazing, but he also eats the heart of the plant, so it dies, turning green fields into wastelands. Besides, the rabbit does not eat any plant; it feeds only on the best grasses of each region, leaving weeds that end up extirpating the usable grass rabbits didn't eat. On the other hand, rabbit droppings poison and kill the pasturelands, and transform the devastated lands in dry soil that, lacking trees to evaporate humidity, can give way to disastrous droughts. The lack of vegetation caused by these rodents and the inevitable drought that comes with it lead to the erosion of the territory, so that in a short time the lands full of rabbits become patches of loose sand. It is necessary to seriously draw attention on what this can signify in a region of strong winds, like Chilean Patagonia. The food needed for one sheep is only enough for 16 rabbits. If we consider that a pair of rabbits, with a normal number of kindling – at least four per year – become millions after one year, we will see that the danger of not having enough grasslands for sheep can become a sad reality in a relatively short time"[73].

For his part, Manuel Chaparro, president of the Union of Small Stockbreeders of Magallanes, stated that if "this malady continues, the pasture capacity of Tierra del Fuego will be over in five or ten years up to the roots, giving way to the erosion of the soil that will make a great dessert of the whole province"[74]. Likewise, he pointed out that Carlos Strauss, of renowned experience in zoological matters, had expressed that "the rabbit plague originates in an imbalance produced in nature by the uncontrolled hunting of fine furred animals […] he said we have to move towards a protection of our fauna as a way to avoid the disappearance of the species that feed on rabbits and prevent a disproportionate increment of the species"[75]. Following the same lead, another author pointed out that

> "since many years and because of the relentless, uncontrolled hunting and the free trade of skins, feathers, furs of foxes, Andes skunks, lesser Grisons, Andean mountain cats and Pampas cats, eagles, red-backed hawk, etc, these species have disappeared and others have multiplied excessively. This is the case of rabbits who have an astonishing reproduction, and consequently this leads to an imbalance in nature, causing the rabbit plague that is cutting down all the fields destined to the breeding of sheep"[76].

[73] Jorge Mulgrue, "Una advertencia a Chile", in *La Prensa Austral*, Punta Arenas, June 19 1948.
[74] "Plaga de Conejos invade Tierra del Fuego", en *Boletín Ganadero*, Año I, Nº 5, Punta Arenas, April 1950, 2.
[75] *Idem.*
[76] "Campaña nacional contra plaga de conejos", en *Boletín Ganadero*, Año I, Nº 7, Punta Arenas, July 1950, 21.

With these arguments, the Union of Small Stockbreeders of Magallanes agreed to "negotiate with official organisms the enactment of a decree to consider the close season of Andean skunks, grey foxes, wild cats, Andean mountain cats and Pampas cats, species that have run out in the province and that could contribute to the extermination of rabbits"[77].

In Santiago, through the official letter Nº 255, of May 24th 1950, the Ministry of Agriculture, through the National Commission of Protection of Wildlife, requested the Ministry of Economy to attend "a suggestion of the Local Committee of Magallanes to enact a decree to prohibit, for a period not shorter than five years, the hunting and commerce of skins, hairs and feathers of various animal species that are enemies of the rabbit"[78]. The minister of Economy referred the letter to the Department of Fishing and Hunting. On June 6th 1950, Exequiel Rodríguez, the director of that department, requested the minister of Public Works a decree to prohibit the hunting of all the species that were enemies of rabbits, aiming to "combat the plague of those animals, that are causing such serious damage to the livestock in the regions of Magallanes and Aysén due to the biological imbalance caused by the uncontrolled persecution, especially of foxes and Andean mountain cats". At the same time, to combat the rabbit plague he recommended to use their frozen meat in the cold stores of that area, sending it to the central zone, which would considerably increase the hunting of that species. He also entrusted the representative of the Stockbreeders Association of Magallanes to acquire foxes

to free in Tierra del Fuego in the area between Concepción and Puerto Montt with the funds for that campaign[79].

Accepting the request of the Union of Small Stockbreeders of Magallanes and the technical report of the Department of Fishing and Hunting on June 23rd 1950, the minister of Economy considered the rabbit plague had caused important damages to the livestock of that area and that the hunting and extermination of some enemy species of the rabbit caused the increment in the number of them. Consequently, he agreed to prohibit for five years "the hunting and commerce of skins, hairs and feathers or eggs of the following species considered as enemies of the fox, in the provinces of Aysén and Magallanes: eagle, red-backed hawk, Rhea, Common Kestrel, Patagonian fox, Andean skunk, Andean mountain cat, kodkod, guanaco, lesser Grison, Harris's hawk"[80]. Likewise, on August 7th 1952, the Ministry of Agriculture dictated Supreme Decree Nº 811 that declared the rabbit a plague for agriculture in Magallanes, forced to combat, and on August 24th the Decreto Supremo N º 1.379, that established the use of wire medals as an effective means[81].

[77] "Labor Directiva", en *Boletín Ganadero,* Año I, Nº 6, Punta Arenas, May 1950, 23. [78] AN.FMF, Vol. 280, Expediente Law Decree Nº 757, July 13 1950.
[79] *Idem.*
[80] *Ibid.,* June 23 1950.
[81] Arentsen, *op. cit.,* 6.

In December 1953 the biological combat of the rabbit began with the use of the virus of a disease that had proven to be specific of rabbits: myxomatosis. A campaign was planned to inject the virus in 100.000 rabbits towards 1954. Then all the isolated focus that might remain would be exterminated with all kinds of elements, like fats, poisons, gasses, dogs, predators, fire guns, etc.[82]. To this end, in 1954 the Department of Stockbreeding and Animal Health of Magallanes, under the direction of the veterinary Elías Sabat, began an energetic campaign against the rabbit plague. Vaccination brigades of the virus myxomatosis, radio programs dedicated to the disastrous plague and the support of Carlos Aracena, director of the newspaper *La Prensa Austral*[83]. In any case, Sabat expressed his apprehensions and doubts about the process, warning that the myxomatosis:

> "was not an infallible panacea since there were studies by bacteriologists and immunologists that proved that the animals could develop a pretty notable resistance to the virus and once we come to that state of things we must recur to all possible means like dogs, fire arms, poisons, etc and establish the natural equilibrium of the island with the predators that attack rabbits and the acts of men to obtain an effective control of the plague. In current circumstances it seems imperatively necessary to place screens to defend the eradicated fields and continue the fight in smaller areas, making the infestation and mortality of rabbits more effective"[84].

Arentsen thought the same. He had been able to

> "observe while covering the fields of the farm "Sarita" of the stockbreeding society Gente Grande where epizootia had practically swept away numerous rodents in a few months, that many specimens kept on quietly living in the area of the disease, surrounded by animals that were sick or had died of myxomatosis. These observations make one think that the rabbits of Tierra del Fuego are already starting an immunization process"[85].

In April 1954, there was a public forum in the region to analyze the situation of the rabbit plague that threatened to "put an end in the short term to the fertile fields on the Isla Grande of Tierra del Fuego"[86]. Concerning this, Otway Falkiner, sheep breeder of Australia, vigorously pointed out: "I would advise to all who sees rabbits in his fields or neighborhood to chase them strenuously and to destroy them with no mercy"[87].

[82] *Ibid*., 22.
[83] "Campaña enérgica contra la plaga de conejos", in *Boletín Ganadero*, Año IV, Nº 44, Punta Arenas, December 1954, 10.

[84] Elías Sabat, "La mixomatosis no es una panacea infalible", in *Boletín Ganadero*, Nº 45, Punta Arenas, 1955, 23.
[85] Arentsen, *op. cit.*, 14.
[86] "Foro público contra la plaga del conejo", in *Boletín Ganadero*, Año IV, Nº 40, Punta Arenas, April 1954, 8.

On the other hand, Marco Davisón, director of the Union of Small Stockbreeders of Magallanes, remembered that the rabbit had arrived some years ago and it was only owing to "the adventurous spirit and liking to exotic sports" of one man, that

> "looking for the distraction of easy and abundant hunting, it occurred to him to bring some pairs of rabbits to this region, freeing them in the fields. Now we find ourselves in front of the scary fact that they can be estimated in millions, that is to say, 10 rabbits for each sheep. Next year there will already be 20 rabbits for each sheep and from then on between 20 and 40, so if we don't immediately take charge of the matter we can predict that Tierra del Fuego will soon look like a billiards ball"[88].

The situation was considered to be extremely serious by the stockbreeders of Tierra del Fuego. Rabbits had affected the fields, that showed "clear signs of erosion, in some cases, and though this erosion is just beginning, they will be definitively eroded if things go on in this manner" On the other hand, the rabbit had also affected the sheep population, since

> "in the biological struggle between sheep and rabbits, the latter always wins, because he has a large list of advantages, like his great proliferation, rusticity, health and even vivacity. In this manner he has affected the sheep population, decreasing their number, production, zootechnical quality in 20, 30, 40 and more percent, according to the case".

Besides, it had affected cattle farming, decreasing all farm work: shearing, branding, herding, freezing, embarking, etc. He concluded that "the damage caused by the rabbit plague is hard to establish and what is worse: it is difficult to repair. In 1935 there were no rabbits on the island, in less than 20 years things have reached such extremes, that cattle farming is about to disappear "[89]. Among the factors that favored the development of the plague were the hunting habits. The rabbit furs with commercial value were those of winter, so between May and September many were interested in hunting rabbits; their skins moved large amounts of money. From October onwards and during the summer, their skins ceased to have the commercial value they had during winter and therefore no one was interested in hunting them, so the plague grew fast[90]. The situation was more desperate each time, because all measures were ineffective. Between 1953 and 1954 the wool production of the region had diminished to 1.898.593 kilos, the slaughtering of animals from one season to another had diminished to 112.003 animals and the decrease in kilos of meat was 1.947.776 kilos of frozen meat[91].

[87] "Opiniones de Mr. Falkiner y un llamado de atención sobre la plaga de conejos", in *Boletín Ganadero*, Año IV, Nº 40, Punta Arenas, April 1954, 25.
[88] *Ibid.*, 26.
[89] "Interesante exposición sobre la plaga de conejos", in *Boletín Ganadero*, Año IV, Nº 41, Punta Arenas, April 1954, 5.
[90] *Idem.*

However, from 1955 onwards, the rabbit plague abated in Magallanes and from then on ceased to be a problem for local stockbreeders. With the passing of time and from a scientific viewpoint, Jaksic and Yáñez state that the introduction of the myxomatosis virus was the most effective agent in the biological control of rabbits in Tierra del Fuego[92]. However, there is a dissident opinion by Ojeda, González and Araya, who estimated that the myxomatosis did not achieve eradication, as rabbits developed a genetic resistance and recovered their population density and became a plague again[93]. All in all, according to Jaksic´s personal observations, this is not so, and that is why myxomatosis persists as the most effective means of rabbit control in Tierra del Fuego.

The 9.290 hectares of the archipelago of Juan Fernández were declared national parks in 1935, under the administrative protection of the Corporación Nacional Forestal (National Forest Corporation, CONAF). In 1977, the archipelago was declared World Biosphere Reserve by UNESCO, acknowledging in this manner this valuable ecosystem that is characterized by the high degree of endemic qualities of its vegetable species. Through it is protected and under the administration of CONAF, Francisco Sáiz and Patricio Ojeda point out that the island of Robinson Crusoe "has received the most implausible introductions of species, many of which have become serious plagues and have profoundly transformed the environment of the island, like domestic livestock, blueberries, maqui berry**,** trun, thrush, goat, coatis, rabbits, etc."[94]. Among these invasions in the island, Sáiz and Ojeda emphasized rabbits, which helped significantly in the deteriorating actions of the livestock, as well as other factors like the construction of roads, felling of trees and the introduction of other animal and vegetable species.

The available data indicate that the European rabbit (*Oryctolagus cuniculus*), was introduced in the island of Robinson Crusoe in the decade between 1930 and 1940, more exactly in 1935[95] or 1936[96], with the aim to breed this species in captivity and use it as a dietary supplement for the local population.

[91] "Campaña enérgica contra la plaga del conejo", *op. cit.*, 11.

[92] Fabián M. Jaksic and José Yáñez, "Rabbit and fox introductios in Tierra del Fuego: History and assessement of the attemps at biological control of the rabbit infestation", en *Biological Conservation*, Vol. 26, Barking, 1983, 374.

[93] CONAF, "El conejo silvestre en Chile", in *Boletín Técnico* Nº 8, Santiago, 1973.

[94] Francisco Sáiz y Patricio Ojeda, "*Oryctolagus cuniculus L.* in Juan Fernández. Problema y control", en *Anales del Museo de Historia Natural de Valparaíso*, Valparaíso, Vol. 19, 1988, 91.

[95] Walter Kahler, "La isla Juan Fernández", in *En Viaje*, Nº 238, Santiago, 1953, 15.

[96] Maura Brescia, *Mares de leyenda*, Santiago, s/l, 1979, 95.

However, some specimens escaped and their distribution expanded through the islands of Robinson Crusoe and Santa Clara[97]. Towards 1970 the situation did not seem serious yet. At least it seemed that way from the observations made in the beginning of 1970 by Daniel Torres and Anelio Aguayo who stated that:

> "this *lagomorpha* devastates the vegetation that covers the grounds of some places of Robinson Crusoe, like "Puerto Inglés", "Puerto Francés", "Villagra" and "Plazoleta del Yunque". In Alejandro Selkirk the islanders assure they have seen some of them some years ago. We are trying to ascertain the possible presence of these animals covering the larger part of the island, and have found none of them. On the other hand, we confirmed the presence of domestic cats in wild state, so we consider it difficult to find rabbits now. However, Mann assures to have seen some specimens close to the "Quebrada de las Casas"; these were animals recently introduced by the islanders to use for hunting. Currently there is a large rabbit population in the island of Santa Clara that is controlled naturally by the "nuco" (Asio flammeus suinda)"[98].

However, five years later, in 1975, Guillermo Mann´s perception was radically different when the stated that the rabbit:

> "is currently represented by many thousands of specimens in the island of Robinson Crusoe. Because of its continuum growth, it represents one of the most serious problems for the biological equilibrium of this island, because it largely contributes to the continuum decrease of the herbal stratum and the consequent increment of erosion. Besides, it contributes to the extermination of diverse native vegetable species and even endemic ones. The intense hunting of the islanders does not seem to cause a significant decrease of their population"[99].

In turn, in 1976, the *Plan of Management National Park Juan Fernández* indicated that the rabbit "is forming large populations that contribute significantly to the detriment of the vegetation cover on the islands of Robinson Crusoe and Santa Clara and in a smaller amount on Alejandro Selkirk"[100]. In any case, at the end of the 1970s, the situation was each time more unsustainable. In 1981, Guillermo Mann pointed out that

> "in the islands of Santa Clara and Robinson Crusoe, their population is very large, approximately 7.000 specimens on average and fluctuates greatly from year to year, and represents important plagues when it reaches their maximum population number. In the competition with livestock over the vegetation cover and because of the construction of tunnels that constantly collapse under the feet of livestock, they facilitate the erosion of the soil; their destructive

action is boosted"[101].

[97] Patricio Ojeda, Hernán González and Guillermo Araya, "Erradicación del conejo europeo (*Oryctolagus cuniculus Linnaeus*, 1758) desde la Isla Santa Clara, Archipiélago de Juan Fernández", *Informe Técnico* N°48, CONAF, December 2003.
[98] D. Torres and A. Aguayo, "Algunas observaciones sobre la fauna del archipiélago de Juan Fernández", en *Boletín de la Universidad de Chile*, Nº 112, Santiago, June 1971, 34.
[99] Guillermo Mann, "Observaciones sobre el estado actual de algunos representantes de flora y fauna en el Parque Nacional Juan Fernández", in *Boletín del Museo Nacional de Historia Natural*, Nº 34, Santiago, 1975, 211.
[100] CONAF, *Plan de Manejo Parque Nacional Juan Fernández*, CONAF, 1976.

Progressively, rabbits started to compete for food with the sheep on the island of Santa Clara, so the islanders requested the intervention of the authorities to solve the problem. In this framework, the National Forest Corporation (CONAF) summoned the scientific community to do a study to evaluate the scope of the problem and propose an integral plan for its control[102]. As a result of this study, during 1982 CONAF received the document "Proposal of a method for integrated control of rabbits in the archipelago of Juan Fernández" written by an interdisciplinary team of the Universidad Católica de Valparaíso. The proposal was partially implemented during the period 1983-1985 through a program of permanent hunting with traps and lasso's. For this the project included the hiring of an experienced hunter who became a valuable element, capacitating various generations of hunters, who remained on the island until his death in 2002.

Evaluations towards the end of the 1980s showed a clear recovery of the herbal stratum in areas where the rabbits had diminished and a permanence or decrease in those areas where rabbits had increased in number. While in global terms one could not affirm that there was a decrease in density of rabbits, it was possible to state that there was an important decrease in size and weight. The larger specimens, who have a bigger reproduction rate, disappeared. Consequently, the rabbit population has in fact been hit by the hunting it has been subject to", which, according to Sáiz and Ojeda, attested the effectiveness of hunting as a means to control the rabbit population, with no need to introduce myxomatosis, "if the method is applied in a rigorous and intense manner on the whole island for a proper lapse of time"[103].

However, one decade later, in December 1997, a project financed by the Kingdom of the Netherlands was approved that included the control of the rabbit plague, among other things. This is how, from 1998 onwards, the Program of Rabbit Control was initiated in the islands Robinson Crusoe and Santa Clara. A little later, in 2002, an integrated system of rabbit control was put into practice to eradicate this animal from the island of Santa Clara that considered all those methods of control used in the world, with legally and ecologically accepted characteristics[104]. In that period CONAF paid the hunters of Juan Fernández 500 pesos for every rabbit tail brought to their offices, as the rabbit plague severely damaged the native species of the islands, destroying saplings and tender sprouts[105].

[101] Guillermo Mann, "Análisis del Plan de Manejo y situación actual del Parque Nacional Juan Fernández", Informe CONAF, 1981, 34.
[102] Sáiz y Ojeda, *op. cit.*, 91.
[103] *Idem*.
[104] Ojeda, González y Araya, *op. cit.*

In 2005, CONAF looked for financiering of the Global Environment Facility of the United Nations to do the investigation for 1,6 million dollars, to establish stocks to conserve the native endangered flora and fauna of the island and eradicate the animals the threatened local biodiversity. As explained by the director of CONAF of the fifth region, Mario Gálvez, the first part of the initiative consisted in doing an evaluation of the state of conservation of the terrestrial and marine species and ecosystems of the archipelago. On the other hand, the idea was to propose a model to eradicate these species, capturing them at a higher rate than their ability to reproduce[106]. In October 2005, Aarón Caviedes and Guillermo Araya pointed out the importance of this Project, because the archipelago housed a high percentage of endemic species that made the place one of the richest in biodiversity of the planet. One of the main preoccupations was the presence of the rabbit, which had even reached the highest parts of the islands, that is to say the parts that were best conserved. In that sense the

forest ranger of the CONAF Guillermo Araya pointed out that "in places that are hard to reach like El Yunque, droppings have been found, an indicator of their presence"[107].

After more than seventy years since their introduction, rabbits still devastate the archipelago and cause serious damage to the ecosystems of the islands, with their various ranges of endemic species. Evidently, hunting has proven to be insufficient as a means to control the rabbits in the islands of Juan Fernández.

RABBITS IN FOREST PLANTATIONS

In 1968, an investigation by experts of the Universidad de Chile on the basis of an inquest to associations and clubs of the Fishing and Hunting Federation stated that rabbits had extended from Coquimbo to the south, except in the provinces of Osorno, Chiloé and Aysén. The authors warned that this expansion had grave characteristics because of the high rate of births and high biotic potential of the species. The invaded areas had to endure a large overpopulation of rabbits, with grave consequences for livestock farming and agriculture. The phenomenon of the rabbit plague in Chile had been particularly notorious in the provinces of Magallanes and Malleco, even causing an increment of erosion[108].

[105] E. Bellido, "Plagas devoran Juan Fernández. Animales y vegetales exóticos amenazan equilibrio ecológico del archipiélago", en *La Nación*, Santiago, June 4 2004.

[106] "Controlarán especies dañinas de archipiélago Juan Fernández", in *La Tercera*, Santiago, July 8 de 2005. En sección noticias de web CONAF.

[107] "Inician estudio para salvar biodiversidad del archipiélago de Juan Fernández", in *La Nación*, Santiago, October 23 2005.

In this context, the forest industry was also complicated by the presence of rabbits. Specifically by the alimentary habits of this species, that is in the habit of eating the tip of growth of pines, which hampers the vertical development of the tree and produces a stocky growth, because of the sideward sprouting of leaf buds. Rabbits could damage up to 100% of plantations, and replanting, besides the cost of new investments, meant a loss in State bonus and a year delay in the final exploitation of the affected stand[109]. In this sense, Jaksic and Fuentes pointed out that "rabbits are fearsome in forest plantations, and their negative effect on pine plantations are more than known"[110].

In 1974, CONAF published the bulletin "The wild rabbit in Chile" that stated that the

> "enormous damage caused by the wild rabbit in reforestation has been one of the main causes to dedicate resources and efforts by the National Forest Corporation to study and apply advanced techniques of rational control of this animal [...] after fifty or more years the wild rabbit is occupying practically all environments where in one way or another he has been able y to come and acclimatize, except some regions in the high Andes, north area of the province of Magallanes and province of Aysén"[111].

According to the antecedents they had, they pointed out that the wild rabbit had the most presence between the provinces of Los Andes, to the north, and Malleco to the south, and supposed that "the north limit is the valley of Limarí. It is not known if this is an ecological or merely physical border".

According to the authors of the study, the most adequate method of eradication in continental Chile consisted in the application of sodium *monofluoracetato 1.080*, "despite its high danger for men and domestic animals"[112].

Given this, in February 1977 *El Celarauco* magazine of the company Celulosa Arauco pointed out that "one of the most implacable enemies is the feared wild rabbit, capable of destroying up to 100% of a Monterey Pine plantation". Further on it stated that "it is estimated that the stable population exceeds five millions and that in some periods of the year surpasses 30 million specimens [...] in the affected areas there can be between 4 to 15 rabbits per hectare"[113].

[108] Jaime Péafur *et al.*, "Estudio preliminar de mamíferos silvestres chilenos: su distribución, valor económico e importancia zoonótica", in *Revista de la Sociedad de Medicina Veterinaria de Chile*, Vol. 18, Santiago, January-December 1968, 6.
[109] Jaime Rodríguez, "Alternativas de control de lagomorfos en plantaciones forestales", en *Ciencia e Investigación Forestal*, Nº 4, August 1988.
[110] Jaksic y Fuentes, *op. cit.*, 94.
[111] CONAF, "El conejo silvestre en Chile", *op. cit.*, 1.
[112] *Ibid*., 3.

To control the rabbits, compound 1.080 was used; a powerful toxin that could exterminate 90% of the rabbits but that, at the same time could kill a man at a low concentration. The massive treatment against rabbits was initiated by CONAF at the beginning of the 1960s. In 1975 this service passed "to private companies founded that same year. Currently there are two of them: TECFA Ltda. (society of the technical management of fauna) and EXCO (rabbit exploitation). In the last season they treated thirty thousand hectare"[114].

The resolution of November 25th 1982 of the *Servicio Agrícola Ganadero* (Agricultural Stockbreeding Service) had to consider these risks. It prohibited the import, manufacturing and use of *Sodium monofluoracetato 1.080*, considering it a "pesticide of high toxicity to man" and that remained "in the bodies of the animals that have ingested it without diminishing toxicity so that it can cause poisoning both of people and useful animals. This situation is very serious because there are no antidotes for the treatment of those that are poisoned"[115]. Cruz and Rivera, of the *Grupo de Investigaciones Agrarias* (Group of Agrarian Investigations) agreed with this diagnosis. They pointed out that "the pesticides of high toxicity that were used to eliminate wild rabbits also affect farmers, their domestic animals and game"[116]. For Aarón Caviedes and Antonio Lara using poisons to kill rabbits was another of the negative impacts of forest plantations, because it led to the death of birds and wild mammals. There was also an ecological impact, because the poisons caused a serious decrease of the fauna, especially of carnivores that regulate the herbivore populations, which caused "an alteration of the natural equilibrium that facilitates the increment of rabbits"[117].

Despite the warnings of the environmental impact of the use of this poison, Jaime Rodríguez, professor of Ecology and Wild Fauna of the Universidad de Chile, specified that years after the resolution of the Agricultural Stockbreeding Service, compound 1.080 was still being used, since "because of the lack of substitute products in the market, this resolution was extended for a year. This has happened every year until now (1988)"[118]. As an alternative of rabbit control, Rodríguez rejected introducing the *myxoma* virus, because of the risk of infection to farm rabbits and also the methods of capture and depredation because they had been inefficient in Chile.

[113] "Se le acabó la suerte al conejo: Se le acusa de destructor de plantas de pino", in *El Celarauco*, Año IV, Nº 29, Arauco, February 1977, 8.
[114] *Idem*.
[115] Servicio Agrícola Ganadero, "Prohíbe la importación, fabricación y uso del Monofluoracetato de Sodio 1.080", Santiago, November 25 1982.
[116] María Elena Cruz and Rigoberto Rivera, *Cambios ecológicos y de poblamiento en el sector forestal chileno*, Santiago, GIA, 1983.
[117] Aarón Caviedes and Antonio Lara, *La destrucción de bosque nativo para ser reemplazado por plantaciones de pino insigne: evaluación y proposiciones*, Santiago, CODEFF, 1983.
[118] J. Rodríguez, "Alternativas de control de lagomorfos en plantaciones forestales", en *Ciencia e Investigación Forestal*, Nº 4, Santiago, August 1988.

As for the chemical methods, he pointed out that diverse control tests of *Lagomorpha* in forest plantations, with second generation anticoagulants had given very good results, even better than sodium monofluoracetato 1.080. According to his tests, he recommended using blocks with kerosene and brodifacoum, also known as klerat, as they were well accepted among rabbits and hares and were efficient in damage control and of small risk, both for men and beneficial animals, as there was an antidote and it is only lethal in high doses[119].

In 2002, Ovalle, Ojeda and Skewes pointed out that Tagasaste (*Chamaecytisus proliferus palmensis*) was introduced in Chile in 1988 by the Instituto de Investigaciones Agropecuarias (INIA, Institute of Agricultural Investigations) as part of a project to search and select shrubs and fodder trees that contribute to the betterment of stockbreeding production in dry areas. However, "one of the most important limitations in the establishment of tagasaste is the damage caused by rabbits and hares in the period between plantation and the

first year of the plant's life"[120]. This shows us that in the 21st century rabbits are still a plague in central Chile, and a problem for forestry and men, and the difficulties to control their excessive population growth persist.

CONCLUSIONS

The European rabbit was introduced in Chile on an uncertain date. The first references about the existence of rabbits in the country are from the mid 18th century and were registered by father Molina to describe to Europeans some Chilean species like guinea pigs and viscachas. In the 19th century, several authors refer to the existence of rabbits and rabbit hutches in central Chile. Some recommend the breeding of this animal for its economic benefits, while others warn about the dangers the adjustment of this species could mean to agriculture. It is not possible to ascertain if it was intentional or casual that rabbits became wild. Did they escape from the rabbit farms or were they intentionally liberated to the fields to hunt them and obtain meat and skins? The written sources have left no signs about these questions.

Truth is, at the beginning of the 20th century, many observers began to warn about the dangers of the "rabbit in the wild". It is possible to suppose that many rabbit hutches were not built under strict security norms, and that this was especially noticeable in the second half of the 1920s.

[119] *Idem*.

[120] C. Ovalle, F. Ojeda and O. Skewes, "Evaluación de distintos métodos de prevención de daño causado por lagomorfos en plantaciones de tagasaste (*Chamaecytisus proliferus ssp. palmensis*)", en *Agricultura Técnica*, Vol. 62, Nº 3, Santiago, julio 2002, 396.

Since then, the presence of the rabbit as a plague is described, sometimes dramatically, in central Chile, Tierra el Fuego and the archipelago
Juan Fernández. Given this situation, the State responded formulating public policies that have tried to stop the rabbit plague. In the 1930s, the hunting of foxes was banned, which permitted the protection of that species and dismantling of the national furrier industry. However, it was discovered decades later that Chilean foxes only fed sporadically on rabbits, since they are better adapted to depredate other native animals. This shows us that this policy was based on mistaken suppositions and could not have had results. Later on, the forestry industry had to recur to a powerful and dangerous poison that has no antidote in case of human poisoning. So the difficulties to control this invading species in central Chile persist.

Currently there is evidence that the problem of the "rabbit in the wild" has not been definitely resolved in central Chile. In the case of Tierra del Fuego, after a widespread alarm that included the arrival of hunters, traps, poisons and depredators, the State successfully implemented the introduction of the *myxoma* virus, at the time widely acknowledged worldwide for its efficiency to control the excessive growth of the rabbit population. On the archipelago of Juan Fernández, after years of international financing and national efforts, rabbits remain a species difficult to control.

Translated by Cristina Labarca Cortés
Translation from Historia (Santiago), Santiago, v.41, n.2, p. 79-98, julio-diciembre. 2008.