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Investigaciones Mastozoológicas

VOLUME 3

INTRODUCED INVASIVE MAMMALS OF ARGENTINA

MAMÍFEROS INTRODUCIDOS INVASORES DE ARGENTINA



Alejandro E. J. Valenzuela, Christopher B. Anderson, Sebastián A. Ballari and Ricardo A. Ojeda, EDITORS

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Introduced invasive species are a major driver of local to global environmental change, including important negative impacts on biodiversity, ecosystem processes, economies, health and other social values. At the same time, however, different social actors can hold diverse representations of these species, particularly of introduced invasive mammals (IIMs). Such divergent values and perceptions can lead to conflicts regarding the management of IIMs, but also invite researchers and managers to be reflexive regarding their own work at a more fundamental level. Therefore, it is key that we advance towards a holistic understanding of IIMs and develop strategies to manage them based on solid technical information and plural perspectives regarding their multiple values. Despite a rich history of initiatives in Argentina to study and manage IIMs, until now there has not been an opportunity to assess the state-of-the-art knowledge in our country. This book seeks to provide rigorous, relevant and legitimate information to support research, policymaking and management decisions regarding IIMs in Argentina. With this objective in mind, the book presents a series of chapters selected to highlight priority topics concerning the conceptualization and implementation of IIM research and management. Then, fact sheets are provided for the different IIMs found in Argentina. Finally, beyond the realm of academic inquiry, the timing of this publication is ideal to re-enforce policy and decision-making, such as the recently approved National Invasive Exotic Species Strategy, which seeks to implement actions and enhance institutional capacities related to invasive species management in Argentina, and the Convention on Biological Diversity's new Global Biodiversity Framework, which also addresses biological invasions as part of broader efforts to attain the 2050 Vision for Living in Harmony with Nature.

Dr. Alejandro E.J. Valenzuela
Dr. Christopher B. Anderson
Editors, Vol. III SAREM Series A

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FOREWORD

Biological invasions by introduced species are one of the great changes rapidly transforming the globe today, with innumerable impacts on economics, human health, ecosystem services, and biodiversity. Mammals are among the most impactful of invasive species, transmitting diseases to humans, livestock, and native animals, trampling native grasslands, voraciously devouring vegetation from groundcover to saplings of forest trees, fouling water, causing erosion, and preying on and outcompeting native animals. They were among the first species humans introduced worldwide and in Argentina, both deliberately (*e.g.*, livestock) and inadvertently (*e.g.*, rats and mice). They have been introduced for sport (*e.g.*, deer, boar) and companionship (*e.g.*, cats, dogs), or simply as attractive ornamentals (*e.g.*, squirrels). Some that are meant to be kept in captivity, such as cats, dogs, and squirrels, escape and establish feral populations.

Argentina looms large in the history of biological invasions by introduced mammals. The earliest permanent European settlers of Buenos Aires in 1580 discovered huge herds of feral horses already on the pampas, and soon after, Vázquez de Espinoza described feral horses in Tucumán that were “in such numbers that they cover the face of the earth...”. Many sheep were in Tucumán as well at that time, and of course later sheep were enormously numerous in Patagonia, effecting huge changes in the vegetation and driving land degradation and desertification to this day. When Charles Darwin visited the La Plata region in 1832 during the voyage of the *Beagle*, he reported that “...countless herds of horses, cattle, and sheep, not only have altered the whole aspect of the vegetation, but they have almost banished the guanaco, deer and ostrich. Numberless other changes must likewise have taken place; the wild pig in some parts probably replaces the peccari; packs of wild dogs may be heard howling on the wooded banks of the less-frequented streams; and the common cat, altered into a large and fierce animal, inhabits rocky hills.”

Approximately 40 mammals have been introduced to South America, of which 25–30 have established populations; most of these are in the Southern Cone. In Argentina, I count 23 successfully introduced mammal species, including feral cats, dogs, and cows. Many, such as rats, rabbits, boar, and goats, are widely distributed around the world. By contrast, the hairy armadillo has been introduced nowhere else but from the mainland of Patagonia to Tierra del Fuego Island. Strikingly, except for the rats and house mouse, all these mammals were brought to Argentina deliberately; this is very different from, say, introduced insects. A few of these invasive mammals, like the squirrel, were not intended to be released, but I hesitate to term such invaders truly “accidental,” because the people who brought them should have realized that escapes or later releases were almost inevitable. Of course, almost all of these mammals were introduced before the late twentieth century, which was when most scientists and the public began to recognize the extent and importance of impacts of introduced species. However, the squirrel and armadillo introductions were recent enough that potential impacts should have been foreseen. Things could be worse, of course—mammals deliberately brought to Argentina that either were released, but did not establish persistent populations or have not yet escaped from hunting preserves include reindeer, silver fox, mule deer, African buffalo, white-tailed deer, Père David’s deer, thar, barbary sheep, wisent, mouflon, chamois, and ibex.

The technology of eradicating introduced invasive mammals has made enormous strides in the last thirty years—at least 31 mammal species have been eradicated from islands worldwide, including relatively large islands like South Georgia. Both Norway and ship rats have been eradicated hundreds of times, and house mice about 100 times. Most large mammals, such as deer and horses, are technologically easier eradication targets—many can simply be tracked and shot, for instance. However, mammals more than any other introduced species pose the complication that many people—especially hunters—simply do not want to eradicate them, and many animal welfare advocates, even those recognizing the damage some invaders cause, object to eradicating them by the only currently feasible means—killing them, humanely if possible. Even rat eradication has been impeded on animal rights/animal welfare grounds, and free-ranging dog and cat populations frequently are seen more as animal welfare issues than as conservation problems to broad sectors of some societies. In Argentina, the problem of implementing feasible eradication programs for invasive mammals is epitomized by the rather schizophrenic attitude taken by the National Parks Administration (Administración de Parques Nacionales—APN) towards red deer. The APN's conservation imperative is supported by the section of Law #22,351 that forbids propagating introduced animals, yet red deer, known to damage native species and ecosystems, are managed in Lanín National Park to foster ongoing hunting, and even to improve the size and quality of the deer for better hunting trophies. Additionally, there is often inconsistent and inadequate funding for managing and eradicating invasive mammals in protected areas, almost always constituting a supervening impediment even when a rational and effective goal is stated.

Argentine scientists have participated heavily in the rapid growth of modern invasion science since its inception in the 1980s, and they and overseas colleagues have conducted substantial research on the biology and impacts of many of the introduced invasive mammals in Argentina, as well as other invasive species. Some of the threats posed by these mammals have even become widely known to the general public in Argentina and beyond—the spread of the beaver from Tierra del Fuego to the mainland has been an international news story. *Introduced Invasive Mammals of Argentina* is therefore an exciting and timely addition to the literature on invasions in southern South America for both the Argentine public (and its political representatives and environmental managers) and scientists worldwide. The many authors assembled for this book explore how these biological invasions happened in the first place, how they spread, what they do to biodiversity, ecosystems, and human enterprises, what has been done about them so far, what can be done about them now, and what might be done with them in the future. The editors and authors are to be congratulated for an excellent exposition of the Argentine part of a growing global phenomenon.

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Axis axis
chital, ciervo axis

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Resumen. El ciervo axis o chital es nativo del subcontinente indio. Es una especie generalista de hábitat que evita ambientes extremos. Su sistema digestivo es de un consumidor intermedio y se alimenta de gran variedad de plantas, principalmente pasturas. Puede formar grupos de más de 150 individuos y alcanzar altas densidades en áreas protegidas libres de ganado y depredadores. Fue introducido en Uruguay con fines cinegéticos y desde allí se translocaron individuos a la provincia de Buenos Aires, donde se expandió asociado a montes de tala (*Celtis ehrenbergiana*) próximos a la Bahía Samborombón. Desde Uruguay habrían cruzado a Entre Ríos (Argentina), y se expandieron por prácticamente toda de la provincia llegando a la provincia de Corrientes y al bajo delta bonaerense del Río Paraná. También se translocaron individuos a la provincia de Santa Fe y a los Esteros del Iberá en Corrientes, desde donde se han expandido y formado poblaciones silvestres. En Argentina se ha observado que producen daño sobre la flora nativa y plantaciones forestales. Puede competir con el ganado, tanto de forma comportamental como por el uso de recursos alimenticios. A su vez es vector de enfermedades bovinas como la Diarrea Viral Bovina. Posee además parásitos que podrían afectar a la fauna nativa y a la salud humana. Las medidas de control han sido escasas hasta el momento y focalizadas en áreas protegidas, principalmente en el Parque Nacional El Palmar.

General description of the species

Chital, axis deer or spotted deer is one of the most common and widely distributed native cervid in the Indian subcontinent. It originally inhabits India, Nepal, Bhutan, Bangladesh and Sri Lanka (Duckworth *et al.*, 2015). It is a medium-sized deer. Males are usually larger, reaching a weight of up to 113 kg; nevertheless, the average adult males weigh 75 kg and the females 45 kg (Long, 2003). Their coat is reddish brown, darker at the top, with well-defined white spots on the back and flanks; a black stripe runs down the spine from the nape to the tip of the tail (Fig. 1). The abdomen, chest, throat, insides of legs and ears, and

underside of tail are white. The head is brown and the muzzle blackish. Only males have antlers, which usually have three ends, with a brow tine (found just above the base) and a forked main beam. Chital is a habitat generalist species. In its natural environment it avoids extremes, such as dense moist (evergreen) forests and open semi-deserts or deserts. Moist and dry deciduous forest areas, especially adjoining dry thorn scrub or grasslands, appear to be optimal for it, and highest densities of chital are reported from these habitats (Duckworth *et al.*, 2015). It eats a wide variety of plants. Being an intermediate feeder, the gastrointestinal system is similar in morphological characteristics to both types of ruminants: browsers and grazers (Pérez *et al.*, 2015). It usually feeds on grasses, but it also consumes leaves, flowers and fruits, mainly in seasons where forage quality decreases (Johnsingh and Sankar, 1991). Groups may number up to 150 or more individuals, with a composition that changes frequently during feeding periods and in flight from potential predators (Dinerstein, 1980). In their natural distribution they can be found at densities ranging up to 200 animals per km² in protected areas practically free of predators and livestock (Raman *et al.*, 1996). In a day, the periods when they are most active are usually during dawn and dusk, which are characterized by peaks in feeding activity (Álvarez-Romero *et al.*, 2008). Reproductive patterns in India show a clear seasonality; however, deer with hardened antlers and in rutting condition may be found throughout the year. Only one fawn (rarely two) is produced per pregnancy after a gestation period of 210–238 days (Mishra, 1982).



Figure 1. *Axis axis* in Argentina. Photo: Horacio Patrone.

History of the invasion

The first specimens in South America were introduced for hunting purposes by Aarón de Anchorena, in his farm in Barra de San Juan in Colonia department, Uruguay (González and Lanfranco, 2010). As for Argentina, chital were introduced sometime between 1928 and 1930, sent by Anchorena from Uruguay to Punta Indio, Buenos Aires province (Navas, 1987). Specimens from this region were later introduced to the mountain range systems of Ventania and Tandilia, and to central provinces such as La Pampa, Córdoba and Santa Fe (Abba *et al.*, 2009). The Santa Fe introduction in particular is reported to have been at least 30 years ago, in the vicinity of San Javier (Pautasso, 2008). Chital specimens were also taken to the provinces of Neuquén and Río Negro (Navas, 1987). In 1973, they are thought to have been introduced in Tucumán, in the Yastay hunting club (Grau *et al.*, 1995). In the early 1980s, 12 specimens were released in the area of Sayuque Viejo, San Luis province (Jackson, 1986). From Uruguay, crossing the homonym river, the species would have entered to Entre Ríos province (Muzzachiodi, 2007). In Corrientes province, chital would have entered from the south, coming from Entre Ríos; and also, it would have been introduced in the Esteros del Iberá (Fabri *et al.*, 2003). It has been observed in the Buenos Aires portion of the lower delta of the Paraná River since 2008 (Fracassi *et al.*, 2010).

An earlier introduction of chital in Argentina is proposed by Novillo and Ojeda (2008), following Lever (1985). It would have been introduced in 1906, in La Pampa province, at about the same time when red deer specimens (*Cervus elaphus*) were introduced in the farm San Huberto (future nature reserve Parque Luro). However, a close examination of the data from the reserve does not support this proposal: the introduction of chital on that date is not mentioned in the reserve's history, neither is its presence when the farm was bought in 1939 (Amieva, 1992), and no specimens have been recorded in that location up to the present.

Patterns of expansion and current distribution

In Argentine territory, chital specimens have undergone numerous translocations because of their hunting importance. Subsequently, this species has expanded from the hunting grounds and formed wild populations (Fig. 2). However, not all the sites where the species is reported to have been introduced correspond to areas where wild population can be found in the present: for some of them, the number of individuals has declined or even disappeared; for others, they remain restricted to farms or hunting grounds; lastly, there are some specific sites where they may have not been introduced.

In Buenos Aires province they have proliferated in association with natural tala (*Celtis ehrenbergiana*) forests close to Bahía Samborombón (Navas, 1987), extending in General Lavalle, Magdalena, Tordillo, Punta Indio, Chascomús, Berisso and Castelli departments. Wild populations have also been recorded in Gral. Madariaga and Gral. Pueyrredón. Individuals have been registered in Tornquist, Bahía Blanca, Balcarce, Guaminí, Gral. Belgrano and Coronel Suárez (Carpinetti and Merino, 2000); however, we cannot ensure that wild populations exist in those departments. In the Buenos Aires portion of the lower delta of

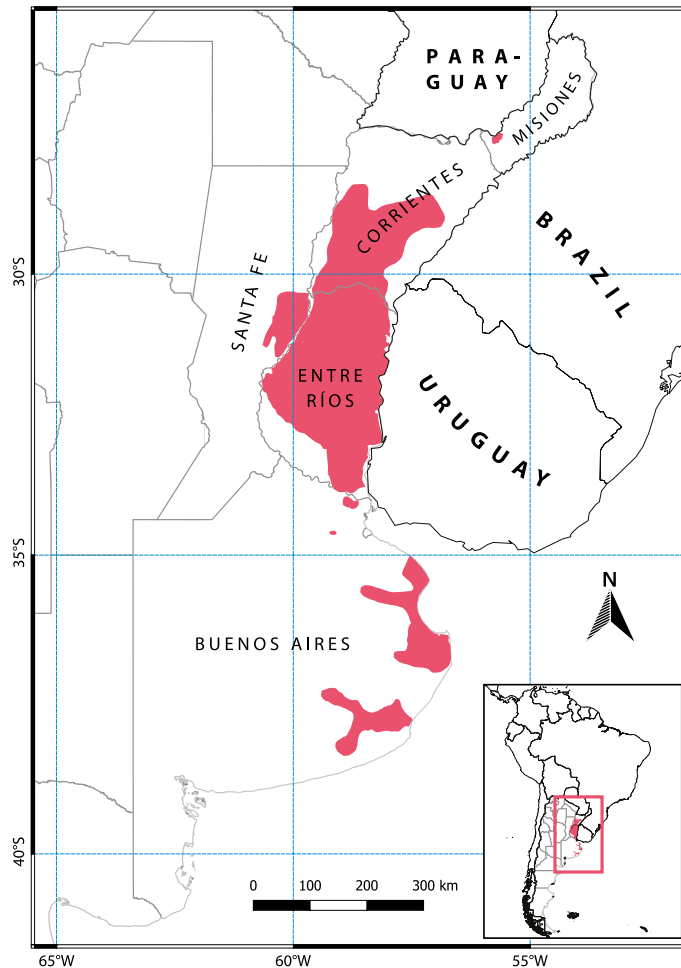


Figure 2. Distribution of *Axis axis* in Argentina. Modified from Tellarini *et al.* (2019). (Mapping: Ian Barbe and Alfredo Claverie).

the Paraná River, chital is found on a reduced area, due to the recent nature of the invasion, but records from the last few years suggest that it is expanding (Tellarini, pers. obs.).

In Entre Ríos, it has expanded practically all over the province, and presence has been documented for the protected areas of Parque Nacional El Palmar, Parque Nacional Pre-delta and the El Potrero private reserve (Muzzachiodi, 2007). In Santa Fe, the species seems to be scattered over a large area that includes the entire zone between Saladillo Dulce and Saladillo Amargo streams and the surroundings of the provincial route 39 (San Javier and San Justo departments), it has also been recorded a little north of Fortín Olmos in Vera department (Pautasso, 2008). In Corrientes, it is distributed mainly in the center and south of the province, and in the south-east area of the Iberá reserve, occupying mainly the Espinal environments; even though it seems to be beginning to expand into patches of hygrophilous forests surrounded by grasslands (Cirignoli, pers. comm.). In Neuquén there are no

wild populations; it is confined to private farms (Guichón *et al.*, 2016). The same may have occurred in Córdoba and Río Negro: in the latter, the wild population of Victoria Island could not prosper due to the cold weather and the competition with red deer and fallow deer (*Dama dama*) (Navas, 1987). In Tucumán, it may have never been introduced (Juliá, pers. comm.), and the notion of chital in that province could be attributed to a misidentification of red deer presence. In San Luis, the only available report is of an individual that was found dead on Route 27, 80 km south to Villa Mercedes. In Misiones, there are recent records in the south of the province as well as in the center-east, in El Soberbio locality. In La Pampa province, it is present in numerous hunting grounds, where it probably remains confined.

Impacts

No studies on the impacts of chital on native and implanted flora have been performed in Argentina. Nevertheless, damage to trees has already been observed in native trees in Parque Nacional El Palmar (Sobral Zotta, pers. comm.), as well as in forest production in Entre Ríos (Tellarini, pers. obs.) and ornamental trees in Uruguay (González and Seal, 1997). These effects are greatest during the reproductive season, when bucks rub their antlers on bark.

It has been shown that chital compete with other deer species such as white-tailed deer in Texas, USA (Faas and Weckerly, 2010). In Argentina, it shares territory and could compete with the pampas deer (*Ozotoceros bezoarticus*) in Bahía Samborombón and Corrientes, with marsh deer (*Blastocerus dichotomus*) in Paraná River delta and Corrientes, and with gray brocket (*Mazama gouazoubira*) in Corrientes, Santa Fe and Entre Ríos; agonistic behaviors towards the latter have been observed in Iberá (Cirignoli, pers. comm.).

Chital presence can also be linked to an increase in parasites and illnesses affecting local mammals. Research from Iberá marshlands shows that chital and native fauna are both infected with the same tick species, resulting in a population increase of ticks and their associated parasites (Debárbora, 2012). Bovine Viral Diarrhea antibodies have been detected in blood tests performed on chital individuals hunted in Iberá (Sciocia *et al.*, 2011). In Parque Nacional El Palmar, 22% of the analyzed individuals showed positive seroprevalence for leptospirosis (Tammone *et al.*, 2018). The presence of *Mycobacterium bovis*, the main agent of tuberculosis in cattle, was observed in deer from Buenos Aires, Entre Ríos and Corrientes (Barandiaran, pers. comm.).

A known effect of chital in its native distribution is the competition with livestock, both behavioral and through the use of food resources (Madhusudan, 2004). A survey of field enclosures with winter pastures for cattle performed in Gral. Lavalle (Buenos Aires) showed that chital consumed 60% of the greenery (Mc Loughlin, pers. comm.).

Management

Chital is included in the introduced invasive species management plan of Parque Nacional Campos del Tuyú. Although the species is not established within the park, isolated individuals are occasionally hunted in it (Beade, pers. comm.). In Parque Nacional

Iberá, in Estancia El Socorro, individuals have been hunted as part of a control program in order to reduce its quantity and mitigate its possible impacts (Cirignoli, pers. comm.). In Parque Nacional El Palmar, chital hunting began in 1996. Since 2006, a formal introduced invasive mammal control plan has been applied. Several methods of hunting are used, the most common being the elevated hunting platforms with firearms using salt baiting. From 2006 to 2015, the number of deer hunted per year has grown, reaching 513 deer hunted in 2015 (Gürtler *et al.*, 2018).

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INTRODUCED INVASIVE MAMMALS OF ARGENTINA

Introduced Invasive Mammals (IIMs) are a major driver of global and local environmental change, including negative impacts on biodiversity, ecosystem processes, economies, health and other social values. However, as complex social-ecological systems, invasive species cannot be conceived solely as “negative,” nor merely as “biological” invasions. This book presents conceptual and practical perspectives from 49 authors with expertise in communication, ecology, education, genetics, history, philosophy, social sciences and veterinary medicine to better understand and manage IIMs in Argentina. It concludes by providing updated information on Argentina's IIM assemblage, which includes 23 species.

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and Ricardo A. Ojeda, EDITORS**



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