



SAREM Series A
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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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SAREM Series A
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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
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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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Ondatra zibethicus muskrat, rata almizclera

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Resumen. *Ondatra zibethicus*, comúnmente conocida como «rata almizclera» o *muskrat* en su región de origen, es un roedor semiacuático que fue introducido desde Canadá a la Isla Grande de Tierra del Fuego en la década de 1940 para el aprovechamiento de su piel, considerada valiosa en el mercado comercial de pilíferos. En líneas generales, las especies introducidas son en su mayoría especies generalistas y oportunistas que se adaptan más fácilmente y llegan a incrementar rápidamente su población y uso de hábitats. En ese sentido, la ausencia de predadores y de un régimen de caza permitió a la especie colonizar tanto ambientes lóticos como lénticos en la isla, ocupando actualmente la totalidad de los cursos de agua, y tolerando una amplia diversidad de ambientes. La colonización de rata almizclera está asociada a la sucesión de ambientes inundados, incluyendo a aquellos generados por castor (*Castor canadensis*), en donde son importantes los cambios en la profundidad del agua y la heterogeneidad de la vegetación emergente, ya que influyen particularmente en la supervivencia de invierno, cuando el acceso al alimento y la presencia de predadores son críticas. El análisis de su historia de vida demostró que la rata almizclera es 100% herbívora, consumiendo preferentemente plantas acuáticas y terrestres, con las cuales también construye sus casas y madrigueras. La especie no es explotada ni se han presentado planes de manejo históricamente. Su impacto no ha sido mayormente evaluado, aunque es considerado bajo.

General description of the species

Ondatra zibethicus, known as muskrat or *rata almizclera*, is a semi-aquatic rodent of the Arvicolinae subfamily that was introduced into Tierra del Fuego Island (TDF) in the 1940s for its fur. It is the largest species of the Cricetidae family (Fig. 1), reaching a total length of approximately 55 cm and an adult weight between 700 and 1800 g (Willner, 1980).

One of muskrats' main adaptations to semi-aquatic habits are lips that close behind the incisor teeth, allowing them to gnaw while submerged. The small forelegs are used to handle food and burrow-building material, while the hind legs present an interdigital membrane to swim. Muskrats can stay underwater up to 20 minutes, and their coat retains air between hairs, favoring impermeability and increasing thermal insulation.

Muskrats live for 3 to 4 years. Both sexes possess functional musk glands in a perianal position. Females commonly have three pairs of breasts (1 pectoral and 2 inguinal) and sometimes 4 or 5 pairs. Muskrats are considered monogamous (Messier and Virgl, 1992), with a gestation period that varies between 25–30 days.

In general, the reproductive period on TDF extends practically from the end of winter to the beginning of autumn, with a peak of births during the summer. More than one successive calving can occur, with a litter size of 5–6 animals (Deferrari, 1996).



Figure 1. *Ondatra zibethicus* in Tierra del Fuego province, Argentina. (Photo: Guillermo Deferrari).

The environments invaded by the muskrat in TDF are characterized, as in the Northern Hemisphere, by two main types of construction, depending on the environment if the muskrats build houses or dig burrows in the substrate (Messier and Virgl, 1992). The houses have the shape of a dome or conical elevation built with remnants of aquatic vegetation, while the burrows are underground cavities connected by tunnels or channels in peatland or riverside areas. These constructions serve as a protective structure after spring and as a shelter during winter. Houses are built above the water level and connected by underwater tunnels, and in general, construction generally begins using local floating vegetation (Willner, 1980).

Vegetation density, water level and plant phenology influence the degree to which certain plants are used in diet, with the root and base of various hydrophytes being the most important portion of what is consumed in North America and Europe (Danell, 1978).

Despite bibliographic data indicating the consumption of a significant percentage of animal material in the species' native range (Danell, 1978; Convey *et al.*, 1989; Neves, 1989; Parmalee, 1989) its diet in TDF appears to only be vegetarian.

History of the invasion

Muskrat is native to North America, where it occupies almost the entire territory. This species was introduced for the economic value of its pelt. Current areas with introduced populations of *Ondatra* include western Europe, Scandinavia, Japan, Russia (Willner, 1980), and southern South America.

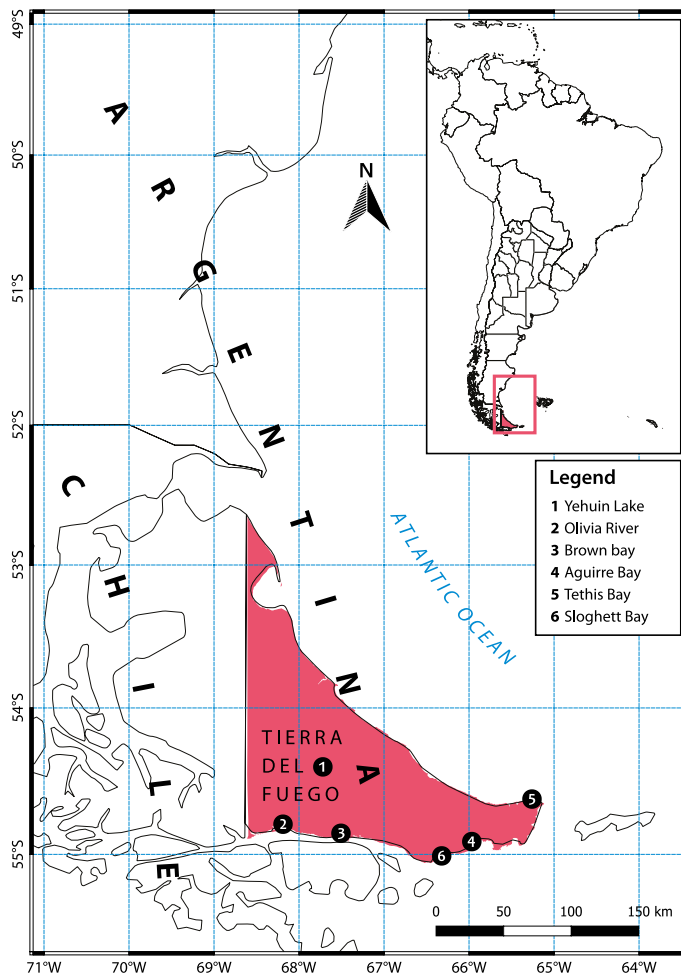


Figure 2. Distribution of *Ondatra zibethicus* in Argentina. Modified from Deferrari (2019). (Mapping: Ian Barbe and Alfredo Claverie).

Between 1940 and 1950, the Argentine Ministerio de Marina decided to introduce several fur-bearing species to TDF to enhance natural resources, and released North American beavers (*Castor canadensis*; Anderson and Roulier, this volume) and muskrats brought from Canada. Daciuk (1978) indicates that 225 individuals (75 males and 150 females) were released in different sites in the island: Yehuin Lake (14 males and 15 females), Olivia River (4 males and 5 females), Brown Bay (10 males and 37 females), Aguirre Bay (28 males and 36 females), Tethis Bay (12 males and 14 females), and the rest of the individuals in Sloghett Bay. These animals have colonized a wide range of habitats, evidencing the plasticity of the species to adapt to different environmental conditions.

Patterns of expansion and current distribution

The native distribution of muskrat is in North America, from Labrador in Canada to Arizona and Louisiana in USA. Due to its fur, muskrat farms were established in Europe, and later escapes resulted in the invasion of this continent and north Asia.

In Argentina, muskrats are present in all freshwater bodies of TDF province, including lentic (lakes, lagoons, wetlands, etc.) and lotic (rivers and streams) environments (Fig. 2). The species was recorded not only in the main island of TDF but also in almost all islands in the Beagle Channel. The Fagnano Lake area is the most beneficial environment for this species, with an estimated abundance of 15–125 individuals per hectare, before and after reproduction respectively (Deferrari, 2007).

Impacts

Muskrat impacts have been mainly studied in Europe and Asia, where the species high density generates problems of habitat degradation due to its tunneling activities in river banks, leading to control actions in different countries (Le Boulenge, 1972). The impacts on TDF, Argentina, are not quantified, but they may not be significant given their relatively low abundance. Additionally, the species seems to be controlled, at least to some degree, by the invasive American mink (*Neogale vison*; Valenzuela *et al.*, 2014). The species is not affected by human presence, since individuals have been recorded inside houses or even in urban areas, where dogs could limit their activities.

Management

Muskrat exploitation was regulated in 1981, more than 30 years after its introduction. However, this activity was not successful due to several issues, such as lack of biological information in TDF, adequate traps, management plans, etc.

Muskrat trapping is open through the year in TDF as a way to control its population; however, until now, annual harvesting is practiced in a very small scale by few seasonal hunters, mostly due to the low value and use of their fur. Even when muskrats' musk glands are used in the perfume industry, the exploitation of the species remains at low levels. In TDF, the use of Conibear® 110-2 traps was recommended (Lizarralde *et al.*, 1996).

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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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