



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
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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10 | MEDIA REPRESENTATIONS OF INTRODUCED INVASIVE MAMMALS: A COMPARISON BETWEEN TRENDS IN ARGENTINA AND TIERRA DEL FUEGO PROVINCE

REPRESENTACIONES MEDIÁTICAS DE LOS MAMÍFEROS INTRODUCIDOS INVASORES: UNA COMPARACIÓN ENTRE LAS TENDENCIAS PARA LA ARGENTINA Y LA PROVINCIA DE TIERRA DEL FUEGO

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Abstract. Despite recognizing the need to integrate the ecological and social dimensions of environmental problems, biological invasions research and management still lack broad assessments of their human dimensions. In contemporary Western societies, mass media has become a fundamental social factor in the creation of shared ideas about nature, shaping different stakeholder's values, attitudes and behaviors. However, little attention has been paid to media portrayals of biological invasions. Using communication theories to build a conceptual framework, we studied the media representations of introduced invasive mammals (IIMs) in newspapers, comparing national-level outlets with those from Tierra del Fuego (TDF). Using key words related to IIMs, we identified and selected relevant articles ($n=344$) that were assessed for 1) importance given to the topic of IIMs (*e.g.*, cover stories, article length, accompanying photographs); 2) the values present and thematic orientation (*e.g.*, negative, positive, neutral); and 3) information sources referenced in articles. Only 13 of Argentina's 23 IIMs were portrayed in newspapers; none were frontpage news. TDF showed a greater frequency of negative-oriented articles, coinciding with the scientific perspective provided by both scientific and political sources, and a lesser degree the agricultural sector. Plus, in TDF these articles were placed mostly in the newspapers' politics section. Nationally, articles were more general, citing both scientists and Non-Governmental Organizations (NGOs). Nationally, there were cases of information errors, and frequently "exotic" had polysemic meanings (*e.g.*, exuberant, desirable, interesting) with an unclear value-orientation regarding biological invasions. IIMs are part of public discourse and part of TDF's public agenda. However, their portrayal in the media is highly conditioned to territorial issues and information sources. We recommend including science communication as

part of professional media training, but biological invasion researchers and managers should also recognize the diversity of values and understandings of IIMs and the way that can affect policies.

Resumen. La forma de estudiar y manejar el ambiente debe basarse no solo en sus dimensiones biofísicas, sino también en la construcción social sobre cómo entendemos y nos relacionamos con esta realidad. Sin embargo, a pesar de ser cada vez más claro que es necesario integrar las dimensiones ecológica y social de los problemas ambientales, temáticas como la investigación y el manejo de las invasiones biológicas aún carecen de evaluaciones integrales. En las sociedades occidentales contemporáneas, los contenidos de prensa gráfica se han convertido en un factor social fundamental, dado que se articulan con la agenda pública, y recortan, jerarquizan e instalan temas que afectan a la construcción de valores y comportamientos de diferentes actores sociales sobre distintas problemáticas, incluyendo las ambientales. Sin embargo, a la fecha este proceso ha recibido poca atención en la literatura de las invasiones biológicas.

Por este motivo, en el presente capítulo se construyó un marco conceptual en base a las teorías de comunicación, con el objetivo de estudiar las representaciones de los mamíferos introducidos invasores en diarios argentinos entre 2013–2015 (ambos inclusive), comparando cuatro principales diarios nacionales (*Clarín*, *La Nación*, *Página/12* y *Crónica*), seleccionados por sus diferentes líneas editoriales, con los tres de mayor circulación de la provincia de Tierra del Fuego, Antártida e Islas del Atlántico Sur (*El Diario del Fin del Mundo*, *El Sureño* y *Provincia 23*), dado que es la que presenta un mayor número de mamíferos introducidos invasores. Se espera que las representaciones de los mamíferos introducidos invasores en los medios del nivel provincial sean más frecuentes y además estén más influenciadas por el discurso científico, teniendo en cuenta que el tópico de las invasiones biológicas ha sido posicionado como un problema ambiental y político en la Patagonia Austral.

Se utilizaron diferentes palabras clave referidas a los mamíferos introducidos invasores (generales: *especie exótica*, *especie introducida*, *especie no nativa*, *especie invasora*; y los nombres científicos y comunes de cada especie de mamífero introducido invasor) para encontrar los artículos de prensa que hicieran mención a la temática en los correspondientes buscadores de cada diario seleccionado durante los años de referencia. Se encontraron un total de 344 artículos relevantes que fueron analizados en términos de importancia (presencia en tapa, extensión del artículo/número de palabras y uso de material fotográfico), orientación (valoración de las invasiones y sección temática dentro del diario), y fuentes de referencia consultadas. Solo 13 de los 23 mamíferos introducidos invasores de Argentina fueron nombrados en los artículos encontrados, y en ninguno de los casos la relevancia dada a estas noticias fue suficiente como para figurar en las tapas de los diarios. Sin embargo, esto se vio atenuado por un tratamiento un poco más profundo dentro del diario, con artículos de mayor extensión y la presencia de fotografías.

Las representaciones en Tierra del Fuego fueron más frecuentes e influenciadas por el discurso científico, con mayor cantidad de artículos brindando información acerca de los impactos negativos de los mamíferos introducidos invasores sobre los ecosistemas nativos y las personas. Además, la mayoría de los artículos se ubicaron en la sección de política de los diarios, indicando que los mamíferos introducidos invasores han sido posicionados como un problema político-ambiental para la provincia. Incluso, las principales fuentes de información para los diarios de Tierra del Fuego incluyeron tanto científicos como políticos y gestores. En particular, a nivel provincial en Tierra del Fuego, los perros asilvestrados (*Canis lupus familiaris*) y los castores (*Castor canadensis*) fueron las especies más

reportadas, y los artículos que las mencionaban tuvieron principalmente una valoración negativa respecto a sus impactos. Estas dos especies probablemente constituyen las más reconocidas entre los mamíferos introducidos invasores en la provincia, los primeros por su impacto sobre la actividad ganadera (*i.e.*, pérdidas por depredación, cambio de ovejas a vacas para evitar pérdidas económicas, etc.), mientras que los segundos por sus impactos en los bosques fueguinos (los castores afectaron el 40% de la superficie de bosque ribereño).

Por su parte, en los diarios nacionales se evidencia que las representaciones fueron más generales y descriptivas, incluso con errores de información, el uso de términos fuertemente polisémicos (por ejemplo, debido al uso de la palabra «exótico» como algo «lindo» y/o «raro») y una valoración dispar hacia las invasiones biológicas. En este caso las principales fuentes de información predominantes fueron los científicos, pero también el sector privado conservacionista representado por las organizaciones no gubernamentales (ONGs).

Concluimos que los mamíferos introducidos invasores en general no han sido priorizados en la agenda pública y que su aparición en la prensa está fuertemente condicionada a problemáticas territoriales y a la experiencia directa de los lectores. Se recomienda incluir la comunicación de la ciencia en la prensa como parte de nuestra formación y quehacer profesional, pero también reconocer la necesidad de incluir la diversidad de valores de diferentes actores para incorporar a las especies introducidas invasoras y sus impactos en la agenda pública-política.

Introduction

We live in a natural world that we represent in concepts, images and words that are the product of a socio-ecological construction built upon our biophysical surroundings and culturally-derived elements, understandings, behaviors and processes (Morin, 1998). For example, social imaginaries of nature are constituted by shared ideas that in turn regulate our actions and behaviors. These ideas are acquired through direct experience with nature, but also via formal (*e.g.*, schools, churches) and informal institutions (*e.g.*, the family, celebrities) (Díaz, 1996). As such, the relationship between what is “natural” and what is “social” includes both causes and consequences driven by ecological and human factors.

Increasingly, scientists, authorities and society in general recognize and accept that problems traditionally considered “environmental,” such as climate change, habitat fragmentation and biological invasions, should be conceived of not only as biological issues, but also as socio-ecological phenomena (see Anderson and Pizarro, this volume). Nonetheless, the natural sciences, including invasion biology, usually consider humans almost exclusively through the lens of being a disturbance that drives environmental change, as reflected in the increasing prominence of the Anthropocene concept in ecology (Crutzen, 2002). Consequently, it is a theoretical and practical challenge for environmental research and management to fully incorporate the multi-faceted aspects of human subjectivity, including social representations and constructions.

In all societies throughout history, human beings have produced and exchanged information and content in multiple ways, but for contemporary Western culture, mass media has come to fulfill a central role in the production of significances and meaning about the world we inhabit; mass media communication is fundamentally a re-elaboration of the

symbolic character of social life and a restructuring of the way in which subjects relate with others, with their own selves and with their surroundings (Thompson, 1988). Today, media are one of the most influential social actors involved in the circulation of images and words and engaged in the dispute of social meanings regarding the world and our shared ideas about it (Schuliaquer, 2014).

Within the body of literature about introduced invasive species there has been little emphasis on media's role in the construction of social imaginaries about biological invasions. Yet, studies about the metaphor of “invasion” (Larson, 2005) and on the diverse stakeholders and values involved in invasive species conflicts (Estévez *et al.*, 2015) indicate that there is a plurality of ways that people understand, value and assess these species and biological invasions in general. In this context, media representations are crucial to understanding this environmental problem as a socio-ecological phenomenon, and communication studies provide conceptual elements to elucidate these complex interactions. For example, the theory of agenda setting (McCombs and Shaw, 1993) explains that the process of topic construction, including the selection and prioritization of newsworthy issues, should influence the ways that invasive species appear and are portrayed in the media. Agenda setting posits that the press may not be successful much of the time in telling people “what to think,” but it is stunningly successful in telling its readers “what to think about” (Cohen, 1963).

At the same time, the study of the way that these issues are enunciated (Verón, 2004) provides a qualitative and quantitative analysis of news items, assessing such aspects as their value and thematic orientation (*e.g.*, values can be negative, positive, neutral; news items can be classified as political, scientific, general interest). Within such a theoretical framework, the social imaginary concept (Castoriadis, 1975) is a useful analytical tool to apply to media representations and identify key elements in the social construction of meaning, allowing us to distinguish on the one hand the ideas about invasive species and biological invasions that are shared by social groups, but on the other to determine the institutional structures or processes that promote specific conceptualizations (*e.g.*, sources cited in the media). In particular, the relationship between a newspaper and its readers is a method to study the media setting, and the type of media-reader “contract” is a specific mode that is established between both from discourse analysis (Verón, 1985). Taken together, we constructed an integrated theoretical scaffolding from the social sciences to comprehend the ways that biological invasions are produced, circulated and read in the media.

We evaluated newspaper media's role in the representation of introduced invasive mammals (IIMs) at the national level in Argentina and at the provincial level in Tierra del Fuego (TDF). While there is currently a dynamic reconfiguration of the media due to new technologies, from the possible universe of media sources and outlets (*i.e.*, radio, TV, multi-media platforms, social networks, etc.), we chose to study newspapers because they are still a principal media actor responsible for installing reference points and interest topics, or what is called the “media agenda” (Boczkowski, 2006). Specifically, we sought to elucidate how at national and provincial levels, information about these species and biological invasions in general is mediated. We analyzed: 1) the species that are mentioned in newspapers (*i.e.*, assemblage of taxa reported); 2) the importance given to these news items (*i.e.*, number of publications, placement in the newspaper, photographs, word count);

3) the values and thematic orientation of the articles (*i.e.*, negative, positive, or neutral; section of the newspaper); and 4) the sources cited as references for information in the new items (*i.e.*, stakeholders, institutions). Results found at the national level were compared to findings from TDF because we expected that news about IIMs coming from the Fuegian Archipelago would be heavily influenced by the scientific tradition that has made TDF a “natural laboratory” for this topic and achieved making it part of the political agenda of the province, as well as in adjacent Chile (Anderson *et al.*, 2011; Valenzuela *et al.*, 2014). Additionally, the Magellanic subpolar forest is the biogeographic unit with the most IIMs in southern South America, and in TDF these species represent more than the 60% of the terrestrial mammal species assemblage in the province (Valenzuela *et al.*, 2014; Ballari *et al.*, 2016). Finally, we anticipated that the media representations of biological invasions in a territory associated with virgin and pristine nature, like TDF and Patagonia more generally (Moss, 2008), would create a different level of importance and valuation of the topic compared to the national social imaginary.

Methodology

An integrated methodological strategy was used by bringing together different types of data and knowledge production by way of triangulation between quantitative and qualitative sources (see Creswell, 2014). First, we chose to study the most important newspapers at two spatio-political levels: i) national in Argentina—*Clarín*, *La Nación*, *Página 12*, *Crónica*; and ii) provincial in Tierra del Fuego (TDF)—*El Diario del Fin del Mundo*, *El Sureño*, *Provincia 23*. National newspapers were selected to cover a spectrum of types of readers and political orientation. In the provincial context, the media-reader contract (Verón, 1985) does not have major differences, given that these outlets are mostly conditioned by the production of local news and links to territorial references. As a result, for TDF, the selected media were those with the greatest circulation in the province's major cities (Ushuaia and Río Grande). Using each of these newspapers' online database, we searched for articles published between 2013–2015, using keywords in Spanish that included general terms for biological invasions (*especie exótica*, *especie introducida*, *especie no nativa*, *especie invasora*) and the names of the IIMs, including their scientific and common names (Table 1). The possible assemblage of IIMs in Argentina was taken from Ballari *et al.* (2016) and SAyDS and SAREM (2019), and included 23 species.

To quantify and describe the importance of the representation of these general and specific terms about IIMs in newspapers, we used agenda setting (McCombs and Shaw, 1993), which is a positivist approach that seeks to understand not only the news that are produced, but also their hierarchy and classification within the newspaper. Two units of analysis were used to obtain these data: 1) the news item itself, and 2) the placement and categorization of the article inside the newspaper. This dual standard was designed because frequently multiple key words appeared in the same article. Importance was assessed by considering whether 1) the article appeared as a headline or cover story on the newspaper's front page; 2) it had accompanying photographs; and 3) the overall length of the article measured as

word count (small: < 300 words, medium: 300–600 words, large: 600–1,100 words, very large: > 1,100 words).

Table 1. List of Spanish keywords used for the search of articles about introduced invasive species in Argentine and Tierra del Fuego newspapers.

especie exótica	<i>rattus</i>	<i>Lepus europaeus</i>	zorro gris
especie introducida	ratón doméstico	ciervo dama	<i>Lycalopex griseus</i>
especie no nativa	<i>Mus musculus</i>	<i>Dama dama</i>	<i>Lycalopex gymnocercus</i>
especie invasora	ganado exótico	perros asilvestrados	<i>Pseudalopex griseus</i>
visón	ganado silvestre	perros baguales	rata almizclera
<i>Neovison vison</i>	conejo	<i>Canis lupus familiaris</i>	<i>Ondatra zibethica</i>
<i>Mustela vison</i>	<i>Oryctolagus cuniculus</i>	<i>Canis familiaris</i>	ciervo axis
castor	jabalí	gatos silvestres	<i>Axis axis</i>
<i>Castor canadensis</i>	<i>Sus scrofa</i>	gatos asilvestrados	peludo
ciervo colorado	chanchos salvajes	<i>Felis sylvestris</i>	<i>Chaetophractus villosus</i>
<i>Cervus elaphus</i>	chanchos silvestres	ardilla de vientre rojo	antílope
ratas	liebre	<i>Callosciurus erythraeus</i>	<i>cervicapra</i>

Then, we applied a qualitative interpretive strategy for content analysis of these articles. The social imaginary concept allowed us to understand the mechanisms at play in the construction of these news articles' communicational setting and analyze the production, circulation and reception of these terms in different enunciation contexts. The articles' values and thematic orientation were assessed as being negative, positive or neutral. The assessment of the news values was carried out based on the ways that the enunciator (the editorial line of each newspaper) established evaluative referential frameworks. If from its positioning, the article conceived the introduction of invasive species to be incorrect or having negative impacts on native ecosystems and species, then it was classified as negative. If it was not possible to identify a valuation in the discourse, either for or against, it was classified as neutral. Finally, if the newspaper detracted attention from the biological invasion aspects or directly supported introducing invasive species, then it was categorized as positive. To restrict the polysemic dimension of the keywords in the assessment of news values, only the news articles that name the targeted species were used. In addition to orientation, we categorized the article by the section in which it appeared, constructing four categories: 1) Science, 2) General Information, 3) Tourism and 4) Politics.

Finally, information sources referenced in the article were identified, including individual stakeholders and institutions. These sources were categorized as Political, Private Citizen, Private Sector, Protected Area and Science. The categories of Private Sector and Science were sub-divided to determine Private Sector sources related to agriculture and conservation, and Science references coming from the Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET) and all other institutions, including museums, universities and zoos. A category of Other was used to group remaining articles.

Results and discussion

The species and concept assemblage represented by newspapers

Of the 53 terms used in each newspaper's search engine, only 17 were found in 344 articles (Table 2). At the national level, the majority (73.5%) of the 222 news items used general terms. However, at the provincial level there was more attention given to particular species; only 38.6% of the 122 mentions in TDF were of general terms. Furthermore, overall, the search discovered that only 13 IIM species were mentioned in the media: 12 at the national level and seven at the provincial level. Although the media IIM assemblage was more speciose in the national press, their frequency was less, and no species was in more than 4.1% of these articles about biological invasions and exotic species. In contrast, in

Table 2. Newspaper articles (number and percentage) that mention general biological invasion or specific introduced invasive mammals' terms from newspapers at national level in Argentina and the provincial level in Tierra del Fuego.

Search keywords*	# of articles		% of articles		
	National	Provincial	National	Provincial	
General terms	exotic species	55	11	24.8	9
	non-native species	75	8	33.8	6.6
	introduced species	23	5	10.4	4.1
	invasive species	10	23	4.5	18.9
	Subtotal	163	47	73.5	38.6
Common names	beaver	9	23	4.1	18.9
	red deer	7	1	3.2	0.8
	mink	6	2	2.7	1.6
	grey fox	6	0	2.7	0
	wild hog	3	0	1.4	0
	rabbit	4	2	1.8	1.6
	hare	8	0	3.6	0
	rat	3	2	1.4	1.6
	boar	8	0	3.6	0
	antelope	1	0	0.5	0
	feral livestock	0	1	0	0.8
	feral dog	2	44	0.9	36.1
Subtotal	57	75	25.6	61.2	
Scientific names	<i>Dama dama</i>	2	0	0.9	0
	Subtotal	2	0	0.9	0
Total	222	122	100	100	

*Search terms were in Spanish; see **Methods** for full list.

TDF, feral dogs (*Canis lupus familiaris*) and the North American beaver (*Castor canadensis*) were responsible for 36.1% and 18.9% of the newspaper articles, respectively. At the national level, these same species were treated in only 0.9% and 4.1% of the assessed articles.

Regarding the use and portrayal of these terms and concepts in the media, it is important to note that we detected a frequent polysemy of the term *especie exótica* ('exotic species' in Spanish). Almost half of the time it was used at the national level, it was as a synonym of rare, strange, exuberant. It was also often associated with articles about travel, tourism and zoos, referring positively to rare or beautiful species (Table 3).

Table 3. Ways that newspaper articles use the term *especie exótica* (exotic species in Spanish) at the national and provincial levels.

Use	National	Provincial	Total
Ecological meaning	27 (49%)	11 (100%)	38 (57%)
Other uses, like rare, exuberant	28 (51%)	0 (0%)	28 (43%)
Total	55 (100%)	11 (100%)	66 (100%)

Overall, the representation of biological invasions in TDF's provincial newspapers has been influenced by the position of these species as a socio-territorial problem, which has become important politically. For example, in 2017 a provincial law was approved regarding the control of feral dogs in rural settings, and in 2008 a binational agreement was signed between Argentina and Chile for beaver eradication (Menvielle *et al.*, 2010). Plus, it is noteworthy that at the provincial level the term exotic species was only used with its scientific-ecological meaning, and polysemy with other definitions was only observed at the national level (Table 3). Plus, regarding terminology, it is evident from these database searches of national and provincial print media that while scientific names for species are a common discursive form in academia, their use in newspapers is almost non-existent.

The importance of IIMs in newspapers

Of the total 344 newspaper articles found at the national and provincial levels, none appeared on the front page. The fact that during a 3-year period of news coverage there were no cover stories or headlines on biological invasions or IIMs indicates that the problem has less social resonance than other topics that appear with frequency, including security, economics, and others environmental issues that might be more immediately relevant to broader sectors of these largely urban societies, such as floods, earthquakes, mining, etc. However, at the same time, we found results that would attenuate this apparent thematic invisibility. Based on the extent and graphic support of the news, we found that articles about IIMs were treated and developed within the interior sections of the newspaper, which enhances the importance of articles. Specifically, 67% of national and 55% of provincial articles were large (600–1,100 words). Medium-sized news stories (300–600 words) constituted 22% and 36%, respectively, and small articles (<300) were the least, with 10% and

7%. Also, the majority at both levels (69% of national, 87% of provincial) of stories built their representation with at least one photo. Additionally, national news on this topic only appeared every 6.4 days on average during the 3-year period studied, while in TDF it was only once every 11.4 days.

In synthesis, these data indicate that while newspaper articles about IIMs and biological invasions are not important enough to merit a headline, they were consistently treated in some depth in the interior of the newspaper, considering both length and graphic material. Plus, it is of note that their treatment was not drastically different between national and provincial levels.

Value and thematic orientation

More than 95% of provincial news items construct their story about introduced invasive species, and mammals in particular, generally from a critical or negative perspective (Table 4). However, at the national level, most articles were classified as presenting the topic from a neutral stance (51.7%), and only 38% were explicitly negative. Plus, we only found positively oriented articles at the national level. Given the largely negative assessment of invasive species, particularly in TDF, we can argue that these value systems transcend the media-reader contract of specific newspapers and affect the overall social representation of environmental issues, where in this case the newspapers agree with and re-enforce this specific value, which appears to be upheld by broader social forces as well. At the same time, we can observe some variation that would affect the way readers understand this issue, related to the polysemy previously described for “exotic species,” which can also mean different, far away or even desirable.

Table 4. Value orientation of articles referring to introduced invasive mammals in Argentine and Tierra del Fuego newspaper items.

Values orientation	National (%)	Provincial (%)	Total (%)
Negative	37.9	95.9	74.2
Positive	10.4	0	3.9
Neutral	51.7	4.1	21.9

Regarding the construction of the thematic orientation of these reports, most were published in sections that deal with General Interest (51.7% and 53.2% respectively for national and provincial news; Table 5). Science sections contained 20.8% and 25.3% of national and provincial news, respectively. However, a difference between the two levels was that in national media 26.7% of articles were published in sections that dealt with Tourism. In this case, though, a large portion of the articles used the term “exotic species,” but had a different meaning (see above on polysemy). In TDF, 20.3% of articles were published in sections related to Politics, again demonstrating the insertion of this topic into the public/political agenda, particularly surrounding the specific issues of feral dogs and beavers that are explicitly part of the provincial government's environmental agenda.

In particular, besides impacts to native biodiversity, feral dogs are being recognized as a major threat to sheep production in the ranches located in northern TDF, where there are reports of high economic losses and even some ranches are transitioning from sheep to cattle production as a result (Zanini *et al.*, 2008; Valenzuela *et al.*, 2014; Lartigau *et al.*, 2019; Barbe *et al.*, this volume). Furthermore, beavers were introduced in TDF in 1946, and since then, they have spread throughout the entire archipelago and reached the mainland, affecting more than 40% of all riparian forests in TDF (Anderson and Roulier, this volume).

Table 5. Percentage of articles about introduced invasive species categorized by newspaper section.

Section categories	National (%)	Provincial (%)
General information	51.7	53.2
Tourism	26.7	1.3
Science	20.8	25.3
Politics	0.8	20.3

News sources

Overall, specific sources were cited in 27.1% and 89.4% of national and provincial news articles, respectively. At the national level, the principal sources were Science (47.8%) and Private Sector (26.1%), which included representatives from agricultural, hunting and industrial associations. At the provincial level, in TDF, we observed a dominance of Political sources (51.2%), but also an important contribution from scientific experts and institutions (39.3%) (Fig. 1a). At both national and provincial levels, within the scientific sources, the CONICET was the specific institution with a highest contribution to newspaper articles about this topic (21.7% and 22.6%, respectively), followed by the Universidad Nacional de Tierra del Fuego (UNTDF). In contrast, at the national level, the private sector contribution was driven largely by conservation non-governmental organizations (NGOs), while in TDF we found a high citation of sources from the agricultural sector, particularly the Rural Association's opposition to feral dogs (Fig. 1b).

In general, it is striking to see the general lack of specific sources being cited in the national media, but the fact that scientists and politicians are driving the discourse in TDF coincided with the hypothesis that this “natural laboratory” of invasion biology (*sensu* Valenzuela *et al.*, 2014) has led the topic to be not only of high scientific interest, but also part of the political agenda. Indeed, the provincial governor and other authorities were often cited in these news items, as well as scientists from CONICET's Centro Austral de Investigaciones Científicas (CADIC) and UNTDF's Instituto de Ciencias Polares, Ambiente y Recursos Naturales (ICPA), the UNTDF's school of the environment. Other social actors that had prominent roles included both traditional environmental organizations, such as conservation NGOs at the national level and also protected areas, such as provincial and national parks administrations. However, it is remarkable to note the inclusion of specific private sector actors, including the agricultural sector in TDF. Yet, among all the news

articles found in this search, only three interviewed private citizens. Therefore, the full diversity, breadth and depth of the issue has yet to be addressed in the representation of these species and the issue in general.

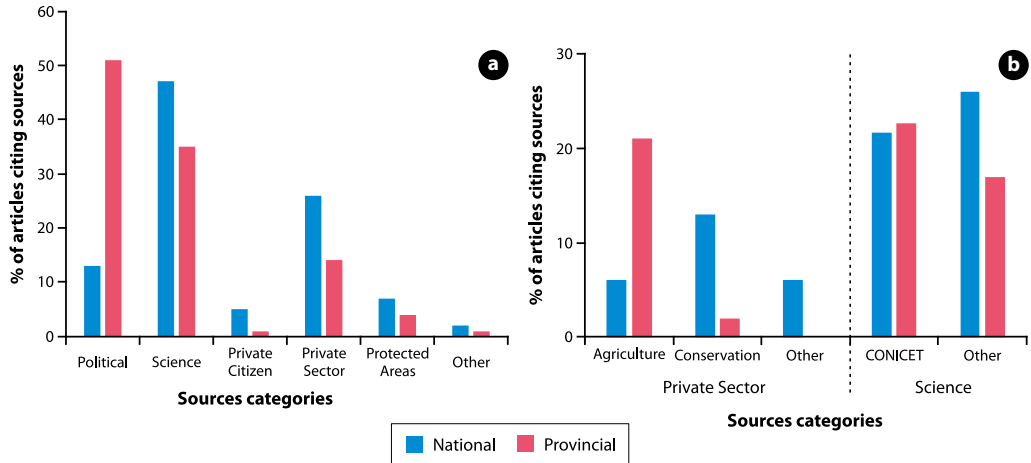


Figure 1a. Percentage of news articles that cited information from different source types; **1b.** percentage of articles citing sources from a subdivision of Private Sector and Science categories.

Conclusions

A total of 23 IIMs have been described for Argentina and 18 for TDF (Valenzuela *et al.*, 2014; Ballari *et al.*, 2016), but this study found that only 13 of these are portrayed in newspapers. Furthermore, since none one of the 344 newspaper articles found were a cover story, the overall position of topic has not been a priority, as is reflected by the news items' relegation to interior pages of the newspaper. This finding leads us to conclude that introduced invasive species are not a priority public issue at both national and provincial levels, which contradicts our expectation that the topic would be more prominent in the provincial media. In TDF, we had expected that the positioning of biological invasions by local scientists would give it greater prominence in the media. Nonetheless, despite not being “front page” news, when presented the articles were frequently well developed (in length and graphic support), and particularly in TDF reports dealt with specific issues surrounding the management of two problematic taxa: North American beaver and feral dogs.

At the same time, it is important to point out that a high percentage of articles in national newspapers use the term “exotic species” in a way that is different than its technical and scientific meaning in invasion biology. Indeed, a high number of publications dealt with “rare” and “beautiful” species that were attractive from a tourism perspective. This polysemy is crucial to take into account, given the contested and potentially contentious nature of invasive species management, which if not addressed can lead to conflicts. Indeed, if large segments of society understand these terms differently, effective communication will be difficult, and invasion scientists and managers should consider other ways of describing the issue. Overall, there is a need to strength the social comprehension of the consequences

of species introduction and the impacts of biological invasions, but communication is not a unidirectional activity. Indeed, there is much room for researchers and practitioners to incorporate new metaphors and terms, rather than simply “educate” the public.

At the same time, though, 100% of provincial news in TDF used the term “exotic” related to the term's ecological meaning. Regarding news classification, even when these issues are not in the front page, the politics section of newspapers became key to give importance to them in the public agenda, and also to legitimize the negative perception of species introductions as a harmful practice that not only affects the environment, but also human well-being. The provincial news highlighted the main socio-environmental issues in TDF, which are feral dogs and their impacts on sheep ranching, and the North American beaver that affects riparian forest and the freshwater bodies. This finding indicated that media representations are more important when there are direct experiences that involve the general public in a socio-ecological territorial problem with concrete and visible consequences. We suggest that future communication strategies regarding biological invasions focus media articles in regional/local newspapers to better contextualize each species with its territorial situation, rather than general national-level articles.

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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.

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



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