Reproducing Animals in Latin America

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ABSTRACT

This article explores the history of artificial insemination (AI) in order to suggest the value of writing histories of human intervention in animal reproduction in Latin America/Caribbean. Writing histories of how people have tried to direct animal reproduction is important for understanding changes in biological diversity and also for exploring intimate relations between people and animals beyond killing. Stories of human attempts to inseminate animals have circulated for centuries, but institutional programs emerged at the end of the nineteenth century and expanded greatly in the mid-twentieth century. After an early focus on horses, practitioners of AI shifted to livestock including dairy cows and sheep. In Latin America, as elsewhere, livestock owners and government agencies viewed AI as a means to boost yields of food and fibers via the efficient transfer of desirable genetic traits across generations of livestock. The extraction and storage of semen enabled ranchers to inseminate female livestock with sperm from "pedigree" bulls or rams that they did not own or that were even deceased. The diffusion of AI relied on inexpensive technologies and new forms of cooperation and communication between people and animals. In the late twentieth century, conservation biologists turned to AI as a means to reproduce captive populations of endangered or threatened species. The history of AI therefore allows us to cross the dividing line between "domesticated" and "wild" animals.

Keywords: inseminación artificial; tecnociencias; reproducción; ganadería; biodiversidad.

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M any centuries ago, in an Arabic-speaking land, there lived a magnificent horse whose stature and comportment stirred the pride of its owners and the jealousies of neighbors. One day, a member of a rival clan devised a plot to obtain a horse of equal stature. Dressed in disguise, he approached the prized stallion and aroused it with a cotton cloth infused with the scent of a mare in estrus. When the horse ejaculated, the thief collected the semen and hurried back to his home where he used the sperm-soaked cloth to inseminate a mare. Months later, this surreptitious insemination resulted in the birth of a beautiful colt that resembled the esteemed stallion.

I found multiple versions of this orientalist story in the publications of mid-twentieth-century veterinarians studying artificial insemination.[2] Most of these men of science included a disclaimer that expressed doubt about the story's veracity, yet many elements of the fourteenth-century tale likely resonated with them. For example, they would relate to the challenges of extracting sperm and keeping it viable in order to inseminate a female in estrus– a feat that often required a slight of hand and cooperation from the animals themselves. Finally, the motivation for the theft –to improve breeding by using "pedigree" stock–was central to twentieth-century, technoscientific projects focused on managing the reproduction of animals. In this essay, I urge historians to focus less on the killing of animals or destruction of their habitats, and more on interventions in life-creating processes, that is, the historical reproduction of animals in Latin America and the Caribbean.

The "animal turn" in the humanities has arguably been pushed by scholars troubled by both the invisibility of animals in historiographies and the mass killings and destruction of habitats that portend of mass extinctions. Nearly twenty years ago, the Animal Studies Group, a collective of mostly British scholars, declared killing to be the "ultimate" form of power that people exercise over animals.[3] Much more recently, in *The Tame and the Wild*, historian Marcy Norton links the sixteenth-century introductions of European livestock and ontologies to the Americas with contemporary

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[2] Walter Heape, "The artificial insemination of mammals and subsequent possible fertilization or impregnation of their ova," *Proceedings of Royal Society of London* B 61 (1897): 52-63; Fidel Ochoa, "Fecundación Artificial," *Revista Facultad Nacional de Agronomia* (Medellín) 1, 2 (1939): 183-203; and Milciades Martínez G. "Contribución al estudio de la inseminación artificial," *Revista de Medicina Veterinaria* (Bogotá) 9 (1939): 347-373.
[3] Animal Studies Group, *Killing Animals* (Champaign, IL: University of Illinois Press, 2006).

modes of interactions that include the mass production and killing of animals for meat, and biodiversity decline due to habitat loss and hunting.[4] Other scholars addressing animals in Latin American/Caribbean contexts have also called attention to extinctions past and present, as well as animals killed in the name of science, profit, or fashion.[5]

Killing however, is not the only way that some people have dominated, or tried to dominate, certain kinds of animals. As the fourteenth-century version of genetic theft reveals, people across times and cultures have also intervened in animal affairs for purposes of reproduction. The managed reproduction of organisms is critical to any notion of livestock and often distinguishes "taming" from "domestication." Writing histories of people and animals in Latin America/Caribbean therefore, should not be limited to histories of hunting and/or killing animals directly or indirectly via habitat destruction. There is value therefore, in examining how people have intervened in animal reproduction, including but not limited to processes of domestication. Driven by the rise to pre-eminence of genetics as well as the expansion of institutional veterinarian sciences, the techniques used by people to direct animal reproduction changed rapidly during the twentieth century. Today, biotechnologies such as cloning, gene transfers/editing, and tissue culture often capture headlines and scholarly attention.[6] Here, I want to explore a somewhat older form of reproductive technologies: artificial insemination (hereafter, "AI"). Defined by one Argentine practitioner as "a procedure that consists of introducing sperm via artificial means into female genital tracts," AI eliminated "the need to have the parents present to copulate."[7] In the past century, the range of life forms that people have reproduced via AI extends beyond terrestrial livestock (bovines, horses, and sheep) to include birds, bees, and fish.

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[4] Marcy Norton, *The Tame and the Wild: People and Animals after 1492* (Cambridge, MA: Harvard University Press, 2024).

[5] Regina Horta Duarte, "História dos animais no Brasil: tradições culturais, historiografia e transformação." *Historia Ambiental Latinoamericana y Caribeña* (HALAC) 9, 2 (2019): 16-44; Germán Vergara,"Animals in Latin American History" (*Oxford Research Encyclopedia of Latin American History*, 2018) DOI: 10.1093/acrefore/9780199366439.013.436; Germán Vergara and Emily Wakild, "Extinction and its intervention in the Americas," *Environmental History* 27 (2022): 294-306; Sharika D. Crawford, *The Last Turtlemen of the Caribbean: Waterscapes of Labor, Conservation, and Boundary Making* (Chapel Hill, NC: University of North Carolina Press, 2020); John Soluri *Creatures of Fashion: Animals, Global Markets, and the Transformation of Patagonia* (Chapel Hill, NC: University of North Carolina Press, 2024).

[6] Sarah Franklin, "Kinship, genes, and cloning: Life after Dolly." In *Genetic nature/culture: Anthropology and science beyond the two-culture divide* edited by Alan H. Goodman et al. (Berkeley: University of California Press, 2003), 95-110; Vajta, Gábor, and Mickey Gjerris. "Science and technology of farm animal cloning: state of the art," *Animal Reproduction Science* 92, 3-4 (2006): 211-230; L.B. Ferré, et al. "Recent advances in bovine in vitro embryo production: reproductive biotechnology history and methods." *Animal* 14, 5 (2020): 991-1004.

[7] Adrián Bitsch, *Inseminación artificial de ovinos en el sur Argentino* (Rio Grande, Argentina: 1972), 27.

In this essay, I offer an overview of the modern history of AI with an emphasis on its diffusion in Latin America and the Caribbean. There are numerous ways to engage histories of animal reproduction; the prevalence of artificial insemination and other Assisted Reproduction Techniques (ARTs) makes them a worthy topic of research but certainly not the only one related to animal reproduction. Historians for example, have written about the introduction of cattle breeds, the acclimatization of exotic fish, and the nurturing of native species via the creation of protected areas.[8] These are all valuable approaches to histories of animal reproduction. My focus on AI is not because I consider it to be the most pervasive way that people influence animal reproduction, but rather because it is a very direct and powerful means by which people have influenced both the lived experiences and genetic diversity of a variety of animal types that extend far beyond those typically found on ranches in Latin America/Caribbean.

The emergence of AI was closely linked to the rise of genetics, eugenics, and state-supported institutions of veterinary medicine. In this sense, environmental histories of assisted reproduction of animals provide an opportunity to link histories of science, technology and society with animal studies. Interventions in animal reproduction however, need not be conceptualized narrowly as "techniques;" modern histories of animal reproduction necessarily intersect with histories of capitalism and state projects that have sought to transform and subjugate animals, people and places. AI illustrates how forms of accumulation based on bio-commodities have increasingly relied on controlling processes of reproduction.[9] AI literally extracts materials (i.e. semen) for purposes of reproducing life in order to generate surplus. Ultimately, twentieth-century livestock production, be it for capitalist accumulation or socialist surplus, relied less on killing animals, than on the capacity to reproduce them efficiently.

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[8] Robert W. Wilcox, "Zebu's Elbows: Cattle Breeding and the Environment in Central Brazil,1890-1960", in *Territories, Commodities and Knowledges: Latin American Environmental Histories in the Nineteenth and Twentieth Centuries*, ed. Christian Brannstrom (London: Institute for the Study of the Americas, 2004); Sergio Basulto del Campo, *El largo viaje de los salmones: Una crónica olvidada* (Santiago: Maval, 2003); and Pablo Camus and Fabián Jaksic, *Piscicultura en Chile: Entre la productividad y el deterioro ambiental, 1856–2008* (Santiago, Chile: Pontificia Universidad Católica de Chile, 2009); Emily Wakild, "Saving the Vicuña: the political, biophysical, and cultural history of wild animal conservation in Peru, 1964–2000," *The American Historical Review* 125, 1 (2020): 54-88.

[9] William Boyd, W. Scott Prudham, and Rachel A. Schurman, "Industrial Dynamics and the Problem of Nature." *Society and Natural Resources* 14, 7 (2001): 555-570.

Beginning in the late twentieth century, AI and other forms of assisted reproduction (e.g., embryo transfer and cryopreservation) have been used to reproduce captive wildlife and even pets, demonstrating how technologies can be appropriated for reproducing animals that are valued not as commodities but rather as companions. And, of course, AI has been used to assist human conception with documented cases reaching back to the late eighteenth century.[10] The growing use of assisted reproduction techniques for people and animals has raised ethical questions −derived from both religious and secular viewpoints− that can offer a window into the shifting practices and discourses used to distinguish humanity from animality.

This is not merely an academic question: Soviet scientist Ilya Ivanovich Ivanof, a leading figure in twentieth-century AI, carried out experiments with women and animals in an ill-conceived quest to produce a human-ape hybrid.[11] Although such cross-species experiments, along with state-led eugenics, were widely condemned in the past century, human sperm banks at the start of twenty-first century continued to discriminate on the basis of bio-social factors including education, height, and sexual orientation.[12] For researchers committed to integrating social and environmental actors and processes, writing histories of how people have tried to reproduce animals− be it for profit, for conservation, or for affection− is useful for revealing the quotidian entanglements of people and animal kinds.

THE BIRTH OF ARTIFICIAL INSEMINATION

Some of the first recorded efforts to demonstrate the viability of artificial insemination took place in the late 1700s when Italian biologists inseminated female dogs on two separate occasions that resulted in pregnancies and the live birth of pups (Heape 1897; Zeiger, 2018). According to Walter Heape, a prominent Cambridge-based researcher, these experiments did not generate immediate interest among veterinarians or animal breeders; in the early nineteenth century, there were more

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[10] Jessica R. Zeiger, "Perceptions of Conception: The History of Artificial Insemination," *Veterinary Heritage* 41 (2018): 49-54.
[11] Zeiger, "Perceptions of Conception."
[12] Cynthia R. Daniels and Janet Golden, "Procreative Compounds: Popular Eugenics, Artificial Insemination, and the rise of the American Sperm Banking Industry," *Journal of Social History* 38, 1 (2004): 5-27.

published accounts of the assisted insemination of women than efforts to inseminate non-human animals.[13]

This began to change by the end of the nineteenth century when a growing number of reports circulated on experiments using AI with horses in Europe and the United States. The focus on equines may have reflected long-standing interests in the selective breeding of horses for military purposes.[14] Soviet researcher Ivanov began experimenting with AI using horses and later expanded his tests to include dogs, foxes, rabbits, and poultry. His work influenced researchers in Europe, Japan, and the United States. A few years after Ivanof's dismissal for his controversial experiments with apes and women, the Soviets revived research in AI and developed tools to collect sperm such as artificial vaginas (a tube consisting of layers of rubber in between which warm water could be added) that enabled the large-scale use of AI with cows, ewes and mares.[15] In the United States, research on the use of AI with farm animals increased during the 1930s.[16]

The dissemination of AI gave rise to new forms of social organization in the United States: small-scale dairy farmers formed "dairy herd improvement associations" in order to pool the financial resources needed to buy a stud bull and pay for trained specialists to collect semen and inseminate the cows belonging to members of the association.[17] There were some two thousand bulls in semen-collecting centers in the United States by the end of the 1940s.[18] In addition to touting the ability of AI to give dairy farmers access to "pedigree" sires, advocates of AI also claimed that it eliminated hazards posed by powerful bulls that reportedly injured hundreds of dairy farmers every year.[19] Evidence suggests that livestock owners and veterinarians in Latin America and the Caribbean pursued AI for a similar set of reasons as their US counterparts.

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[13] Heape, "The artificial insemination of mammals;" and R. H. Foote, "The History of Artificial Insemination: Selected Notes and Notables," *Journal of Animal Science* 80, 2 (2002): 1-10.

[14] Margaret E. Derry, *Masterminding Nature: The Breeding of Animals 1750-2010* (University of Toronto Press, 2015).

[15] Zeiger, "Perceptions of Conception."

[16] L. M. Winters, "Artificial Insemination of Farm Animals," University of Minnesota, Agricultural Experiment Station, Bulletin 336 (May, 1938).

[17] One cooperative in the state of Illinois consisted of two thousand members who used nine beef and 23 dairy bulls to impregnate some ten thousand cows via the labor of a team of "impregnators" who performed inseminations under the direction of a veterinarian. Ross L. Holman, "Sires by Remote Control," *The American Mercury* 56 (1943): 204-209.

[18] "Artificial Insemination on Increase in US Herds," *Science News Letter* Nov. 19, 1949, 326.

[19] Holman, "Sires by Remote Control," 205.

ARTIFICIAL INSEMINATION AND LIVESTOCK LATIN AMERICA AND THE CARIBBEAN

In 1936, the U.S. Department of Agriculture shipped refrigerated semen collected from "prized American Holstein" bulls in Beltsville, Maryland to Buenos Aires, Argentina where it was administered to cows.[20] By that point, interest in AI (sometimes called *fecundación artificial*) had already emerged among Latin American veterinarians including in Colombia.[21] In 1941, Chile's Sociedad Nacional de Agricultura sponsored a university seminar on AI taught by University of Missouri researcher Fred Mackenzie.[22] After morning lectures on the reproductive physiology of livestock, students gained practical experience collecting, analyzing, and storing semen. They also examined the ovaries of horses, cattle, and sheep. By the early 1940s, experiments with AI were underway in Colombia, Peru, Uruguay, and Venezuela.[23]

Dairy farmers were among the first to utilize AI on a large scale in Latin America. In fact, some support for AI came from state officials concerned about population growth and nutrition who envisioned AI as a valuable tool for boosting milk production via the breeding of high-yielding cows.[24] For example, in Colombia and Brasil, where veterinarians expressed concern over the introduction of dairy breeds from Europe that failed to thrive in tropical agroecosystems, AI was seen as an effective means to cross European dairy cows with Zebus and criollo breeds. By 1952, Brazil had 100 posts for the collection of semen and insemination.[25] However, a review of animal breeding in Latin America published in 1967, warned that the use of AI did not ensure breed "improvement" unless guided by experts in assessing livestock.[26]

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[20] "Breeding: Government to Mate Cattle Miles from Each Other" *Newsweek*, Sep. 12, 1936, 25.

[21] István Moskovits, "Trabajos recientes relativos a la teoria y a la practica de la fecundación artificial de los animales domesticos," *Revista de la Facultad de Medicina Veterinaria y de Zootecnia* (Bogotá) 6, 53-55 (1934): 1000-1007.

[22] "EL curso sobre Inseminacion artificial y fisiologia de la reproducción," *El Campesino*, Sep. 1941, 502-503; Claire E. Terrill, "Tribute to Dr. Fred F. McKenzie," *Journal of Animal Sciences* 51, issue supplement II (1980): 1.

[23] Martínez, "Contribución al estudio de la inseminación artificial"; J. Gutierrez Fabre, "Trabajos de fecundación artificial realizados en el Uruguay y algunas consideraciones sobre el mismo," *Anales de la Facultad de Veterinaria,* 4, 2 (1943): 303-307; Franz Uhlenhaut and Teodoro Ramos, "La técnica de la inseminación artificial y la importancia que tendría la implantación de este metodo en el mejoraimiento de la ganadería nacional" (Lima, Peru: Dirección de Agricultura y Ganadería, 1941).

[24] Jesus Díaz Barriga A., "El problema de la leche en México," *Boletín de la Oficina Sanitaria Panamericana* (Nov. 1952): 405-409; José J. Cañón and José A. Serrano, "Informe de la Comisión de Colombia a la 2a. Reunión Interamericana de Producción Animal," *Revista de la Facultad de Medicina Veterinaria y Zootecnia*, 20, 105 (1952): 98-117; and Carlos A. Amtmann, Francisco Fernández, and José Naranjo, "Impacto de la asistencia técnica médico veterinario en la adopción y retracción de la inseminación artificial," *Archivos de Medicina Veterinaria* 9, 2 (1977): 127-133.

[25] Cañón and Serrano,"Informe de la Comisión de Colombia," 102.

[26] Antonio Bacigalupo, "Veinticinco años de genética y mejoramiento animal en América Latina." In *Las Ciencias Agrícolas en América Latina. Progreso y Futuro* (San José, Costa Rica: Instituto Interamericano de Ciencias Agrícolas, 1967), 403-419.

Latin American interest in AI was not limited to profit-seeking ranchers. The Fidel Castro-led government in Cuba embraced AI in conjunction with a post-Revolution goal to promote dairy production.[27] In 1969, *La Granma* reported that the government hoped to increase the number of cows in its AI program in the province of Camaguey from less than 400,000 to 500,000. The program included some 20,000 Brown Swiss and Holstein cows. Cuba's Director of Artificial Insemination called for increasing the knowledge and skill of the inseminators, a seemingly common concern given the important role played by these technicians.[28] Determining how widely and consistently AI was used in dairy herds in Latin America/Caribbean, and its significance for people, animals, and ecologies, requires more research.

Dairy farmers were not the only livestock raisers to experiment with artificial insemination. In 1941, a sheep rancher in the province of Buenos Aires reported inseminating some 6,300 ewes.[29] That same year, the Suárez family in Rio Gallegos, Argentina, enlisted the aid of Uruguayan veterinarian Fernández Goyecheo to inseminate some 2,000 ewes on their Patagonian sheep ranch. In order to do the job, Goyecheo fabricated a "thermo-vagina" – a device that collected semen and maintained it at a consistent, warm temperature, a necessity for carrying out insemination during southern Patagonia's cool mating season. In 1947, Chilean veterinarian Adolfo Albornoz inseminated more than nine hundred Corriedale sheep owned by the Sociedad Explotadora de Tierra del Fuego, the largest wool producer in Patagonia. Chile's Ministry of Agriculture provided training in AI for veterinarians throughout the province of Magallanes in the 1950s. The same ministry also issued regulations for "Semen Production Centers" (Centros Productores de Semen) defined as any operation that collected semen "from one or more breeding animals" for purposes of fertilizing female animals owned by third parties.[30] The regulations emphasized the need to register and inspect animals to prevent the spread of diseases.

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27 Reinaldo Funes-Monzote, "The rise and fall of dairy cows in socialist Cuba," *Global Environment* 9, 2 (2016): 342-375.
28 I am citing an English-language translation of an article credited to Rolando Ramírez published in *La Granma* (Havana), Jan. 21, 1969. I have not seen the original text in Spanish.
29 Enrique Garcia Mata and Alberto E. Cano, "Inseminación artificial de ovinos en vasta escala; operaciones realizadas en 6,300 ovejas en un establecimiento de la provincia de Buenos Aires," *Revista de Medicina Veterinaria* (Bogotá) 23 (1941): 208-231.
30 Chile, Ministerio de Agricultura, Decreto, Mar. 23,1958. Chile, Archivo Nacional de la Administración, Fondo: Ministerio de Agricultura, v. 1276.

Between 1955-1967, the annual number of artificial inseminations performed on sheep in Chilean Tierra del Fuego increased by several thousand, peaking around 66,000 in 1967.[31] Two years later (1969) a newspaper report on ranching in Argentine Tierra del Fuego stated that "all of the large ranchers" used AI with their flocks of pure-bred, crossed sheep (*planteles puros por cruza*).[32] During the 1960s, the use of AI spread among sheep ranchers elsewhere in Latin America including Brazil, Peru, and Uruguay.[33]

By briefly analyzing the contents of a 1972 guide for using AI with sheep published by Argentine veterinarian Adrián Bitsch, a graduate of the Escuela Agrotécnica Salesiana in Tierra del Fuego, we can glean insights into how the technology was implemented in a specific socio-ecological context. The guide's preface conveyed the importance of reproductive technologies: "Taking into account that a bad animal eats as much as a good one, yet generates very different results in terms of production, artificial insemination should constitute a primary technological resource that, with relatively modest investments, yields great benefits including saving labor and avoiding soil erosion produced by overstocking."[34] Written during an era of rising concerns over soil erosion in Patagonia, as well as land reform in neighboring Chile, the guide's notion of a "good" sheep was based on the efficient use of both grasslands and human labor.

Bitsch's advocacy of AI focused on reproducing sheep capable of producing a commodity: "The ideal is to achieve a flock that produces wool of uniform structure and fineness appropriate to the breed and keeping in mind the demands of the market."[35] He stressed the importance of selecting female sheep (*madres*) as well as rams (*carneros*): "By means of artificial insemination and the use of carefully chosen young female sheep – daughters of distinguished fathers (*hijas de padres sobresalientes*) – we will be able to produce higher quality offspring so that we can quickly eliminate the ewes (*madres básicas*) that formed the original flock."[36] Bitsch also foresaw a

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[31] Donald Mackinnon Y. and Carlos Concha B., "Inseminación Artificial Ovina en Magallanes," *Revista Corriedale* (1969):104.

[32] "La Ganadería en Tierra del Fuego," *El Día* (Córdoba) Sep. 12, 1969.

[33] Mackinnon and Concha, "Inseminación Artificial Ovina en Magallanes," 103; Bitsch, *Inseminación artificial de ovinos*, 28.

[34] Aurelio Muñoz in Bitsch, *Inseminación artificial de ovinos*, 8.

[35] Bitsch, *Inseminación artificial de ovinos*, 14.

[36] Bitsch, *Inseminación artificial de ovinos*, 14.

promising future for AI as a means of determining the quality of a ram's semen that would serve to "grant certificates for animals shown in fairs, auctions, and exhibitions, providing buyers with a guarantee."[37]

In practice, AI required not merely tools like artificial vaginas and microscopes, but also the sensory abilities of people and sheep alike. Bitsch acknowledged that AI required increased levels of management: "the tasks require trained workers and more labor time than unassisted mating (*la monta natural*).[38] For example, in order to use the artificial vagina, workers had to induce a ram to mount a restrained, ovulating female sheep.[39] When the ram attempted to copulate, a technician crouched by the side of the sheep or standing in a pit, diverted the ram's penis into the artificial vagina to collect the ejaculate.[40] Therfore, in order to be successful, AI required rams to overcome the fear of being in very close proximity to people when mounting a ewe. Winning the rams' confidence, Bitsch advised, required "patience and care."[41] For older rams less willing or unable to mount sheep, ranchers used an "electro-ejaculator" that applied an electric current to the ram's rectum to stimulate ejaculation.[42]

Once collected, semen was analyzed and then diluted with a mixture of egg yolk and sodium citrate prior to inseminations that usually took place shortly after workers collected semen because experience in the 1970s suggested that fresh semen improved fertility rates in sheep.[43] One or two workers restrained the ewe that was to be inseminated while another worker inserted a funnel-like device called a vaginoscope, followed by an "insemination pistol" used to transfer the diluted semen into a ewe's vagina.[44]

An emphasis on sperm extraction from male animals can marginalize the importance of female animals in AI procedures. In fact, a major challenge for practitioners of AI on sheep ranches in Patagonia was detecting when ewes were

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37 Bitsch, *Inseminación artificial de ovinos*, 76.
38 Bitsch, *Inseminación artificial de ovinos*, 30.
39 Bitsch, *Inseminación artificial de ovinos*, 65.
40 Bitsch, *Inseminación artificial de ovinos*, 106-108.
41 Bitsch, *Inseminación artificial de ovinos*, 112-113.
42 Bitsch, *Inseminación artificial de ovinos*, 74.
43 Bitsch, *Inseminación artificial de ovinos,* 106.
44 Bitsch, *Inseminación artificial de ovinos*, 76-77; 122-124.

ovulating (a process that in southern Patagonia lasted fourteen to seventeen days).[45] Ranchers solved this problem by using "scout animals" (*animales buscadores*) known as *retajos* – sexually active rams that workers prevented from copulating by placing a strong fabric – a *chaleco* – over the ram's genitals. The chaleco prevented coitus but did not interfere with mounting. Workers applied paint to the chest or bellies of *retajos* so that when they mounted ewes, the *retajos* left a telltale mark that ranch hands used to identify ovulating females.[46] In practice then, the people who directed AI on sheep ranches relied heavily on the senses and actions of the sheep themselves. The use of chalecos and paint was a means of "transliterating" communication among sheep. Similar practices were used for detecting cows in estrus in the 1970s and continued to be used in the twenty-first century.[47]

Practitioners of AI on sheep ranches in Patagonia recognized that socio-ecological contexts influenced the efficacy and value of the procedure. For example, the use of AI declined sharply during years marked by droughts because a reduction in snow or rain tended to reduce the amount of high-quality pasture, meaning less available nourishment for pregnant ewes that needed to eat more than other sheep.[48] Therefore, ranchers were less inclined to incur the additional costs associated with AI to boost rates of fertilization when pasture conditions were inauspicious.

Implementing AI with very large, dispersed flocks also required careful management of sheep following insemination. Bitsch noted that on many estancias "the inseminator completes the work and then leaves." In order to boost flock fertility and "guard against errors made by the inseminator," many ranchers allowed rams to copulate with already inseminated ewes.[49] This might suggest that some ranchers did not see AI as replacing pre-existing ways of managing reproduction but rather as an additional tool. A pair of Chilean veterinarians writing in 1969 noted that the results of AI could be improved via better control of the offspring of inseminated ewes:

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[45] Bitsch, *Inseminación artificial de ovinos*, 51.

[46] Bitsch, *Inseminación artificial de ovinos*, 81-83; 95-98.

[47] Diego González Pondal, "El uso de toros marcadores de celo en inseminación artificial," *Gaceta Veterinaria* 37, 304 (1975): 519-525; and G. L. Morgan and L. J. Dawson, "Development of teaser bulls under field conditions," *The Veterinary Clinics of North America: Food Animal Practices* 24 (2008): 443-53.

[48] Bitsch, *Inseminación artificial de ovinos*, 96.

[49] Bitsch, *Inseminación artificial de ovinos*, 147.

"frequently, it is impossible to distinguish lambs produced via AI from those obtained by copulation." These observations point to the challenges of evaluating the historical impacts of new technologies liberated from laboratory settings.

The adoption of AI by livestock owners in Latin America/Caribbean was a manifestation of what Raj Patel has termed a "long" Green Revolution that sought to boost yields: getting animals to produce more meat, milk or fiber without expanding the soil base.[50] In this sense, AI represents one in a long line of techno-scientific innovations intended to boost yields be they for capitalist accumulation or state surplus (recall the Soviet and Cuban interest in AI). At the same time, AI also found uses in less anticipated contexts, including efforts to boost populations of animal types threatened with extinction, and also among breeders of animals intended to become pets.

BEYOND PROFIT: REPRODUCING THE ENDANGERED AND THE BELOVED

In the early 1970s, amid growing concerns about falling populations of raptors including peregrine falcons, public and private entities initiated captive breeding programs in North America. Confronted with problems of low rates of reproduction, some researchers drew inspiration from the use of artificial insemination in the poultry industry to attempt to apply AI to wild birds including the whooping crane, golden eagle, and red-tailed hawk. Significantly, the process of extracting semen from males and inseminating females was quite different than the methods used on mammalian livestock. Instead of restraining and/or actively touching animals, researchers conditioned male and female raptors to respond to the human caretakers as a "mate" via a process called "cooperative" semen collection.[51] The process was intended to reduce stress and trauma that would inhibit successful collection and transfer of semen. In other words, the application of AI to populations of wildlife required not only genetic models and laboratory analysis, but also intimate contact and even trust between people and animals.

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[50] Raj Patel, "The Long Green Revolution" *Journal of Peasant Studies*, 40, 1(2013): 1-63. For AI in an African context: Bafumiki Mocheregwa, "Artificial Insemination and the Cattle Industry in Botswana 1960-2011," *Botswana Notes and Records* 48, Special Issue (2016): 109-120.
[51] Robert B. Berry, "Reproduction by Artificial Insemination in Captive American Goshawks," *Journal of Wildlife Management* 36, 4 (1972): 1283-1288; Lester L. Boyd, "Reproduction of Prairie Falcons by Artificial Insemination," *Journal of Wildlife Management* 41, 2 (1977): 266-271.

Populations of captive birds are by no means the only kinds of animals that have been subject of experiments with AI; assisted reproduction and or cryopreservation of sperm has been attempted with a growing diversity of wild animals in Latin America including jaguars, peccaries, pumas, capuchin monkeys, white-tailed deer, and vizcachas.[52] However, not all captive breeding programs in Latin America have relied on the use of AI. In the case of the giant tortoises of the Galapagos Islands, Elizabeth Hennessy has shown how "assisted" reproduction can include interventions in reproductive processes both prior to, and after, the act of insemination.[53]

Finally, in recent years, pet breeders in some countries have followed livestock breeders in creating a market for the conserved sperm of male dogs to inseminate female canines.[54] Although many aspects of pet-keeping have long been commodified, the use of frozen sperm for dog breeding suggests a "doubling down" on the privileging of (male) genetics not unlike human sperm banks. My recent interactions with small-scale dog breeders in the United States suggests that AI is widely utilized, meaning that the genealogies (and geographies) of pet animals are becoming more complex. Of course, millions of dogs and cats continue to procreate without direct interventions, filling animal shelters in urban and rural areas. Large populations of feral pigs and even Pablo Escobar's rhinos serve as rather large reminders of the limits on the capacity of people to control animal reproduction.[55]

REPRODUCING ANIMALS IN HISTORIES OF LATIN AMERICA AND THE CARIBBEAN

At first glance, writing a history of Artificial Insemination can seem more like an effort to fill a niche than a means of expanding the horizons of the already broad field of Latin American/Caribbean environmental history. However, artificial insemination

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[52] Alexandre Rodrigues Silva (ed), *Assisted Reproduction in Wild Mammals of South America* (Boca Raton: CRC Press, 2023); and Claudia Gabrielda Orta Castillón, "Evaluación de tres técnicas de reproducción y algunos factores que afectan el desempeño reproductivo de venadas cola blanca sometidas a la inseminación artificial a tiempo fijo o al servicio natural." Tesis, Maestria en Ciencias (México: Universidad Autónoma Agraria Antonio Narro, 2013).

[53] Elizabeth Hennessy, "Producing 'prehistoric' life: Conservation breeding and the remaking of wildlife genealogies," *Geoforum* 49 (2013): 71-80.

[54] Marco Quartuccio, Vito Biondi, Luigi Liotta, and Annamaria Passantino, "Legislative and ethical aspects on use of canine artificial insemination in the 21st century," *Italian Journal of Animal Science* 19, 1 (2020): 630-643; Josh Loeb and Eleanor Evans, "Puppy power: fertility clinics on the rise," *Veterinary Record* 186, 5 (2020): 140.

[55] J. Alfonso Ortega, Johanna Delgado-Acevedo, Jorge G. Villareal-González, Rafael Borroto-Páez, and Roberto Tamez-González, "Wild Pigs in Mexico and the Caribbean," In *Invasive Wild Pigs of North America: Ecology, Impacts, and Management*, edited by Kurt C. VerCauteren et al. (New York: Routledge, 2020); and Claudia Leal, "Wild and trapped: a history of Colombian zoos and its revelations of animal fortunes and State entanglements, 1930s-1990s," *História, Ciências, Saúde-Manguinhos* 28, suppl 1 (2021): 81-101.

is merely one example of the many ways that people have intervened in the reproduction of animals. People have moved animals over distances large and small, they have altered habitats, they have introduced technologies, and they have removed (some) people in order to promote the reproduction of (certain) animals. Burning a grassland, building a fence, or buying frozen sperm are all measures that can be used to favor the reproduction of certain kinds of animals. In this sense, histories of animal reproduction should not be confined to genetic scales or the relatively short period since genetics emerged as a fundamental idea informing notions of biocultural diversity. Indeed, the subject of reproduction opens up the possibility of writing very deep histories that stretch far earlier than colonial Latin America/Caribbean. Histories of animal reproduction can lend dynamism to concepts like "domestication" or "wild" that are often understood as essential, rather than historical, conditions of being.

This initial foray into artificial insemination of animals suggests that the twentieth century stands as a period of rapid qualitative and quantitative changes in how people directed the reproduction of animals in Latin America/Caribbean. Animals such as cows and sheep designated as "livestock" were often at the center of these changes, but by the late twentieth century, people used AI for breeding animals whose existences extended well beyond the production of food or fiber. For better or worse, state and private entities have increasingly intervened in the reproductive processes of animals whose values are defined less by dollar amounts than by biodiversity counts.

On the one hand, the trend toward using assisted reproduction technologies with endangered animals can be understood as a last-gasp effort to save animals whose habitats have all but disappeared. Critical, contextualized analyses of AI techniques are needed to understand their ability to nurture biodiversity in light of historical aims that often prioritized selecting for specific phenotypes and genotypes, goals potentially at odds with biocultural diversity. On the other hand, AI represents a chapter in a longer history about the extraordinary lengths to which some people have gone to reproduce certain kinds of animals for multiple reasons including accumulation, companionship, and conservation. This suggests that at least certain animals are more central to Latin American/Caribbean societies than prevailing androcentric histories of the *patrias* would lead us to imagine.

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Reproduciendo Animales en América Latina

RESUMEN

El artículo centra la historia de la inseminación artificial (IA) para llamar la atención a la importancia de investigar historias de intervenciones humanas en la reproducción de los animales en América Latina/Caribe. Historias de intervenciones humanas, directas e indirectas, en la reproducción de animales es importante para entender cambios en la diversidad biológica y también para poder apreciar relaciones íntimas más allá de la matanza entre animales y personas en la historia. Historias de inseminación tienen siglos de estar en circulación con un enfoque inicial en los caballos. Programas institucionales sólo aparecieron a finales del siglo XIX; el uso de IA fuera de espacios científicos tuvo lugar en los medios del siglo XX con enfoque en ganados vacunos y ovinos. En América Latina/Caribe, el IA les interesaba a ganaderos particulares y técnicos del estado por su promesa de aumentar rendimientos de comida y fibra por medio de la transferencia precisa y eficiente de rasgos genéticos y fenotípicos a través de generaciones de ganado. La extracción y preservación de semen permitieron a ganaderos inseminar a sus vacas y ovejas con materia genética de reproductores de pedigree reconocidos sin ser dueños de ellos. Un análisis del uso de IA en estancias de ovejas en Tierra del Fuego señala que la difusión de IA fue realizada por medio de tecnologías económicas y nuevas prácticas de cooperación y comunicación entre las personas y los animales. Hacia el fin del siglo XX, científicos preocupados por la conservación de la biodiversidad empezaron a experimentar con la IA como medida para reproducir poblaciones cautivas de animales a riesgo de la extinción. Por tanto, el tema de la IA nos permita atravesar las categorias "domesticado" y "silvestre."

Palabras clave: inseminación artificial; tecnociencias; reproducción; ganadería; biodiversidade.