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Although common and widespread today throughout the neotropical lowlands, the domestic dog (Canis lupus familiaris) *may have been a relatively recent introduction into certain areas. Numerous early documents, however, implicate the precolumbian presence of tamed endemic South American canids, at least in lowland areas of northern South America and the adjacent Caribbean. These early and limited descriptions of small dogs that did not bark were eventually dismissed in the scholarly literature as simply domesticated dogs that were trained not to bark. A review of the earliest documentation of indigenous canids in the Spanish Main, and subsequent accounts of tamed endemic canids in various parts of the continent, suggests that native foxes or forest dogs could have been tamed. Varied sources written at different times and from different areas of lowland South America also mention interbreeding of endemic canids with domesticated dogs. The control of tamed endemic canids by indigenous populations could also have factored into the late appearance of the domestic dog, particularly in portions of the Amazon Basin.*

DOGS WERE LIKELY THE EARLIEST of the domesticated animals, having been identified in later Pleistocene contexts throughout different areas of Eurasia. Although it is generally accepted that domestic dogs (*Canis lupus familiaris*) are descended from ancestral gray wolf (*Canis lupus*) populations, the early timing and location(s) of their domestication is open to debate (see discussion and references in Axelsson et al. 2013; Druzhkova et al. 2013; Germonpré et al. 2009, 2011; Larson et al. 2012). They are also generally considered to be exotic introductions into the Western Hemisphere; thus far their earliest appearance in North America is associated with later Early Holocene contexts in the seventh millennium before the Christian era (Morey 2010; Tito et al. 2011). Domestic dogs likely appeared in South America at a much later date, especially in Andean areas and often in association with agriculturalists (e.g., Prates et al. 2010; Prevosti et al. 2009; Stahl 2012a; see also Axelsson et al. 2013:363).

Domesticated dogs are common and widespread today throughout the Amazon Basin and Caribbean islands. However, in his thorough survey of lowland neotropical hunting dogs, Koster (2009) noted an intriguing lack of domestic dogs in large portions of the Amazon Basin until relatively recently. He also provided some plausible insights for explaining their late appearance;

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in some cases they only materialized as recently as the twentieth century. Local populations may have declined to adopt dogs when presented with the opportunity, or high mortality in neotropical environments may have hindered their diffusion into the area. Another, and entirely complementary, proposition is that indigenous populations already had their own endemic counterparts to the domestic dog. The earliest historical documents describe these dogs, which have been variously interpreted as tamed endemic foxes, wolves, bush dogs (*Speothos venaticus*), hybrid crosses with domesticated dogs, and even raccoons or ferrets. Although these interpretations were seriously considered in the early literature dealing with precolumbian animals (e.g., Ignacio de Armas 1888; Latcham 1922), they were eventually dismissed in subsequent authoritative accounts. Gilmore's (1950) influential treatment of the "Fauna and Ethnozoology of South America," which appeared in the respected *Handbook of South American Indians,* rejected endemic origins, and this remains the definitive interpretation today.

Here, I review the earliest descriptions of indigenous dogs in the Caribbean and adjacent northern mainland of South America. I then discuss the significance of a defining characteristic they all shared—their mute or non-barking behavior—followed by accounts of tamed endemic canids and hybrid canids that do not bark like domestic dogs. I propose that the earliest accounts of indigenous dogs may indeed be descriptions of tamed endemic canids, possibly the crab-eating fox (*Cerdocyon thous*), bush dog, or even hybrid crosses with exotic domesticated dogs. It is not my intention to suggest that indigenous populations actually domesticated canids. Amazonian ethnography clearly suggests that in situ animal domestication is minimally problematic and most likely impossible (Erickson 2000; Hugh-Jones 2001). Elsewhere (Stahl 2012a, 2012b), I discuss these concerns in the context of an indigenous Amazonian perspective. I do suggest, however, that local populations already in possession of a possibly hardier and tamed endemic canid may have had no compelling reason to adopt the domestic dog, perhaps until this form of animal manipulation had declined.

EARLIEST ACCOUNTS OF INDIGENOUS CARIBBEAN AND NORTHERN SOUTH AMERICAN DOGS

Zoogeographically, the endemic West Indian terrestrial mammalian faunas are severely impoverished. Early mammalian colonization of the archipelago most likely proceeded over open water, principally from South America (Simpson 1956). Neither canids nor any kind of mammalian carnivores were native to the islands, and their later dispersal implicates human involvement. Canids became widespread throughout the Caribbean only after the appearance of ceramic-bearing Saladoid agricultural colonists from the South American mainland during the first millennium before Christ (Newsom and Wing 2004:204). After this time, dog specimens are reported from the Caribbean archipelago as far north as the Turks and Caicos Islands, but usually in smaller numbers, in association with human burials, sometimes as worked specimens (especially teeth), and rarely from midden contexts (Wing 2008).

Writing in the first decades of European exploration in the Western Hemisphere, Fernández de Oviedo y Valdés noticed that the island of Hispaniola (Española) was already infested with vicious dogs that had been introduced originally from Spain but were now feral due to "human carelessness" (Oviedo 1946:474, Capítulo 2). Despite the rapid and pervasive invasion of exotic animals intentionally and unintentionally introduced after European arrival, the earliest written accounts of the Caribbean and northern mainland of South America consistently describe a number of important details about pre-European dogs.

The first descriptions of animals in the Western Hemisphere are in Christopher Columbus's journal during his first voyage of exploration and discovery. On 17 October 1492 the admiral was told of a village on the island he christened Fernandina (probably Long Island, Bahamas) in which possibly two different kinds of dogs were kept. The journal was forwarded to the Spanish monarchs after the voyage, but it was subsequently lost. Bartolomé de Las Casas, who in 1516 had been granted the title of Protector of the Indians and was an eyewitness to many of the earliest contact events in the New World, had access to the original manuscript. He abstracted it in his *Historia de las Indias,* begun in 1527 and finished five years before his death in 1566. In the first volume, or decade, of his history, Las Casas writes that sailors sent to fetch water on the island told the admiral that the villagers had dogs they described as *mastines* and *branchetes*. The former refers to mastiffs; the latter is most likely *blanchete*, derived from the French *blanchet,* which refers to a little white dog (*perillo blanquesimo*) (Real Academia Española 1984:197). Las Casas mentions that although the other dogs were called mastiffs by the sailors, they looked like hounds, and emphasizes that these and the smaller dogs never bark but only growl "from inside their throats." They differed from Spanish dogs only by not barking (Las Casas 1875a:311, Capítulo 42). A copy of the journal of Columbus's first voyage in the handwriting of Las Casas resurfaced at the end of the eighteenth century. It was collated by both Juan Bautista and Martín Fernández de Navarrete (Markham 1893), whose 1791 version is often considered authoritative. In it, the smaller of the dogs is described (Navarrete 1922:38) and subsequently translated variously as hound, small dog, or cur dog. Antonio de Herrera y Tordesilla, writing in Spain at the end of the sixteenth century as Chief Chronicler of the Americas, saw at least a copy of the original journal. He refers only to the presence of "*perillos mudos, pequeños*" or little mute dogs (Herrera 1601:29, Decada 1, Libro 1, Capítulo 13).

Later during the same voyage, on 28 October 1492, Columbus personally encountered the abandoned house of fishermen who had fled in fear. Here, on the island of Cuba, the admiral mentions finding a dog that did not bark. Herrera y Tordesillas (1601:30, Decada 1, Libro 1, Capítulo 14) describes it as a dog that did not bark (*un perro que no ladrava*), and later Navarrete (1922:48) refers to it as a dog that never barked (*un perro que nunca ladró*). Las Casas repeatedly describes mute or non-barking dogs in the Caribbean. His version (Las Casas 1875a:319, Capítulo 44) is identical to Herrera's, but Las Casas goes on to describe more non-barking dogs on the following day when Columbus visited a much larger town, still on the island of Cuba (1875a:321, Capítulo 44).

In the second volume, or decade, of his *Historia de las Indias*, Las Casas (1875b:57, Capítulo 95) again mentions mute dogs that do not bark (*perros de los mudos que no ladran*). In his *Apologetic History of the Indies*, Las Casas is more specific. He wrote of the animals of Hispaniola, mentioning little mute lap dogs that did not bark but growled, and whose only use was to be eaten (Las Casas 1909:26, Capítulo 10). He also mentions that island dogs were used to hunt *hutias,* the large endemic capromyid rodents (Las Casas 1875b:341, Capítulo 155; 430, Capítulo 170). Information on island dogs is also supplied by Peter Martyr d'Angheira, who, in 1520, as chronicler in the Council of the Indies, had access to personal interviews and original documents. In his *First Decade* he reports that Columbus encountered four ugly dogs on islands off the coast of Cuba which were eaten by the native inhabitants, much like Spaniards ate goat kids (Martir 1892:189, Capítulo 5). He also mentions the use of native dogs to hunt *hutia* (Martir 1892:228, Capítulo 1; 294, Capítulo 3). Writing in Spain during the early sixteenth century, the chaplain and palace clergyman Andrés Bernáldez provides an interesting account of dogs encountered by Columbus on his second trip. Somewhere between southern coastal Cuba and Jamaica they found a beach with infinite numbers of turtle shells along with 40 small, not very ugly, non-barking dogs. They believed that these dogs were raised on fish and eaten by the Indians; apparently they tasted good, like young Castilian goats (Bernáldez 1856:315, Capítulo 127). These dogs were the source of the later claim by Ignacio de Armas (1888:42) that the Spaniards had encountered what were undoubtedly examples of the native crab-eating fox.

Various details about early canids in the Caribbean islands and adjacent mainland areas were recorded by Gonzalo Fernández de Oviedo y Valdés, a long-time resident of Santo Domingo, who was appointed official Chronicler of the Indies in 1526. A lengthier description of dogs in Hispaniola is provided in the twelfth book of the first part of his *Historia General y Natural de las Indias,* which was first published in 1536 (Oviedo 1959a:30–31, Capítulo 5). At the time of his writing, dogs were no longer present, but he mentions that domesticated cur dogs (*gozques*) were previously raised in native houses throughout the islands. He claims that they were like Spanish dogs in color (single-color, also spotted white and brown or reddish, ruddy, or mottled) and fur (matted, silky, satiny), "but most of them are between silky and satiny and the fur of all of them rougher than ours', and the ears enlivened and vigilant like those of wolves. All these dogs, here and on other islands are mute, and even when beaten or killed, they do not know (how) to bark; some yelp or howl lowly when they are mistreated" (Oviedo 1959a:30). Oviedo considered non-barking to be very natural for these cur dogs and observed that it would be interesting to see if mute dogs would bark if they were relocated to other locales. Here, he also mentions that naturally mute dogs were found in Panama, and that there were many in Nicaragua where they were eaten in feasts. The head was reserved for the chief, and they tasted no worse than goats (Oviedo 1959a:30–31). Elsewhere, he repeats that the cur dogs of the mainland did not bark, were mute, and of many colors (Oviedo 1959a:45, Capítulo 18).

In his *Sumario de la Natural Historia de las Indias,* written for Charles V of Spain and first published in 1526, Oviedo provides important commentary about little cur dogs kept by mainland Caribs in their houses which were brought to the Caribbean coast for trade. He repeats descriptions of their fur and coloration, and he claims that

> they are mute, because they neither bark nor yelp, nor howl, nor cry out or groan even when knocked on the head, and have the demeanor of little wolves, but they are not, as they are native dogs. And I have seen them killed, and they neither complain nor groan . . . and they never bark nor do anything, except eat and drink, and they are far more shy than ours, except in their homes, when they demonstrate affection to those who feed them, wagging their tails and jumping for joy, ingratiating those that feed them and are their masters (Oviedo 1946:491, Capítulo 26).

Oviedo provides another important mention of non-barking dogs on the mainland via reference to Francisco de Orellana's early and accidental voyage down the Amazon River in 1542. His report, most likely written in Santo Domingo sometime between 1543 and 1546 and included in his *Historia General y Natural de las Indias,* was the first to describe the voyage and includes a version of Gaspar de Carvajal's account. Importantly, it supplements the latter with oral testimony from Orellana and some of his companions while they were briefly in Santo Domingo awaiting passage to Spain (Heaton 1934:383–84). In Book 11, Part 3, Oviedo speaks of the land of Quito, the plants encountered by the Spaniards on the Amazon, and the many animals, both wild and domesticated, that it shared in common with the (then) known South American mainland, including "the dogs of the land that do not bark" (Oviedo 1959b:241, Capítulo 3). A later account of the Venezuelan llanos, written by Pedro Simón after his arrival in the New Kingdom of Grenada in 1604 and first published in 1627, also describes "little dogs that howl and do not bark, and have very good flavor, as those Spaniards who have eaten them say. They don't skin them in order to eat them, they only pluck them like piglets" (Simón 1882:196, Capítulo 27).

BARKING AND CANID VOCALIZATION

The earliest documents that describe animals from the West Indies and adjacent mainland areas of northern South and Central America mention dogs of indigenous populations. They variably refer to at least one kind of canid, usually depicted as a small dog. Occasionally described as white, these dogs were also said to be single-color, spotted white and brown, reddish, ruddy, or mottled, and with fur that was frequently between silky and satiny, yet rougher than that of Spanish dogs. They had erect ears like those of wolves and were shyer than Spanish dogs. They were raised in the house, assisted in the hunting of endemic rodents, and were eaten. They are most consistently and commonly described as relatively silent; they could growl or yelp and howl, but they never barked.

The bark, which is a relatively short and wide-banded sound, is included in an ample repertoire of canid vocalizations. It can be modulated in timing, frequency, and bandwidth, and is characterized by a marked tendency toward repetition with various cycle sequences (Tembrock 1976:59). Wolves and domestic dogs produce a range of shared vocalizations, including grunts, whines, yelps, screams, howls, growls, barks, coughs, and tooth snaps. What can distinguish them, both from each other and from coyotes and foxes, are the contexts in which the bark is commonly used (Cohen and Fox 1976:79). The canid bark "is released by circumstances which excite the animals and affect the emotional state. In this way the number of repetitions correlates with the degree of excitement. Barking is primarily a warning for other members of the species, particularly the young" (Tembrock 1976:65). Barking by domestic dogs is clearly distinct from barking by wild canids. It is hypertrophied among domestic dogs because they use barks in all contexts. Wolves use barks only in defense, threats, and group vocalizations. Foxes bark only in the context of threats (Cohen and Fox 1976:79).

Why do domestic dogs bark more repetitively and with greater frequency in more contexts than wild canids? Domestication undoubtedly had a direct influence on canid behavior, particularly with a shift to anthropic contexts and successive selection for specific traits (Coppinger and Coppinger 2001; Lord et al. 2013). This involved the prolongation of an infantile stage (neotony) and perpetuation of juvenile characteristics (pedomorphosis) into adulthood, which can reduce wild characteristics while simultaneously facilitating increased adaptability (Fox 1968). Heterochronically retarded dogs retain juvenile care soliciting and bonding behaviors into adulthood and lack the aggression, territoriality, and hierarchical dominance of wild adults (Coppinger and Feinstein 1991). It is suggested that hypertrophied barking in domestic dogs is derived from a form of cooperative anti-predator behavior elicited by some stimulus and directed at both conspecifics and intruders in situations that result in conflicting motivations. Mobbing behavior is produced by wild canids only in specific contexts; however, the domestic environment increases the frequency of contexts that elicit mobbing among heterochronically retarded dogs. As a component of mobbing behavior, barking is "by nature a reflection of conflict" and produced by a bolder animal more likely to stand its ground; it can be considered an adaptive trait retained in domesticated descendants which allowed increasingly tame ancestral progenitors to approach novel stimuli (Lord et al. 2009).

Others have suggested that the barks of domestic dogs are a form of referential communication. They argue that dogs can vary the acoustic parameters of their barks according to specific contexts. The frequency, tonality, and rate of barking can be varied in different situations and can be tools for communication among dogs and between dogs and humans. It is possible that hypertrophic barking emerged in the process of domestication and facilitated communication between dogs and humans. Captivity provides more stimuli for barking, and humans may have variably selected for barking or non-barking dogs depending upon circumstance. Some dog breeds (e.g., basenji, chow-chow, sharpei) either do not bark or rarely bark, while others selected for guarding or hunting use barks in

specific contexts. Certainly, dogs can be trained individually to bark or not to bark (Maros et al. 2008; Miklósi 2007; Molnár et al. 2006; Pongrácz et al. 2006, 2010; Yin 2002; Yin and McCowan 2003).

Why do wild foxes rarely bark, and only in very specific contexts? There is a clear distinction between vulpine (fox) and canine (wolf, coyote, dog) vocalization. The former can include such sounds as mews, coos, and clicks, which are not part of the latter's vocal repertoire. Foxes do not grunt, yelp, howl, or tooth snap, and they bark only when threatened (Cohen and Fox 1976:79–80, 90). Solitary hunting is a general characteristic shared by most fox species, which tend to be small, pursue small prey items in open habitats, and tend toward omnivorous scavenging. Although individuals can congregate under conditions of resource concentration, it is energetically more feasible for a fox to stalk in solitude (Fox 1975:431). This relative lack of sociability, compared with other canids, and the propensity toward nocturnal or crepuscular activity or where concealment by vegetation is possible, has important implications for fox social behavior. In general, the fox relies upon a basic repertoire of tail and body displays and facial expressions; vocal signals that are most effective at close proximity, which include little variation in pitch, frequency, and intensity; decreased tactile communication; increased olfactory communication; a shorter persistence of sexual bonding while young are raised; and selection for mutual intolerance, self-reliance, extroversion, and inquisitiveness (Fox 1975:436–42).

All of the recent endemic canids of South America (Table 1) are members of the zoological tribe Canini. The genera of endemic South American "foxes" (*Atelocynus*, *Cerdocyon*, *Lycalopex*) are not true foxes, or members of the zoological tribe Vulpini (Tedford et al. 2009). Two endemic South American canids are distributed today throughout the northern portion of the continent and along the Caribbean littoral; they offer interesting contrasts in behavior and vocalization. The crab-eating fox most commonly travels in pairs throughout a wide range of habitats from the Guianas westward through Amazonian Colombia, where separated foxes use "long distance, high-pitched, bird-like trill vocalizations" to maintain contact with each other (Courtenay and Maffei 2004:35). The crab-eating fox vocalizes infrequently through whines and pulsed vocalization but does not bark in rapid succession. During their third week of life, young foxes begin to growl and bark; however, adult males only bark when encountering a disturbance around their den when young pups are present. The female retreats to her young, and then they immediately flee (Brady 1981:656–61). The bush dog occupies a variety of habitats throughout northern South America from Brazil to southern Panama. Because it hunts cooperatively in small groups, it is considered to be the most social of the endemic canids (Zuercher et al. 2004). Bush dogs emit whines, pulsed vocalizations, screams, growls, and barks. After 50 days in age, young dogs growl and bark at unfamiliar objects. Adults bark only during aggressive interaction, as when subordinates approach dominants, and during intercourse (Brady 1981:650–56). Close-range and affiliative vocalizations are considered to be particularly elaborated amongst bush dogs in order to facilitate communication between group members in dense forest (Brady 1981:668).

Table 1. Recent endemic canids of South America

Atelocynus microtis	short-eared dog	western lowland South America
Cerdocyon thous	crab-eating fox	northern South America to Argentina
Chrysocyon brachyurus	maned wolf	central Brazil to northeast Argentina
†*Dusicyon australis*	Falkland Islands wolf	Falkland Islands
Lycalopex culpaeus	Culpeo	Colombia to Tierra del Fuego
Lycalopex fulvipes	Darwin's fox	Chiloe Island
Lycalopex griseus	S.A. gray fox	Chile to northern Tierra del Fuego
Lycalopex gymnocercus	pampas fox	grasslands of the Southern Cone
Lycalopex sechurae	Sechuran fox	southwest Ecuador, northwest Peru
Lycalopex vetulus	hoary fox	Brazilian highlands
Speothos venaticus	bush dog	forested lowlands to southern Brazil
†*Canis avus*	extinct canid	southern South America

† extinct

ENDEMIC SOUTH AMERICAN CANIDS AND TAME BEHAVIORS

The extant endemic canids of South American are a highly variable assemblage, including two genera of wolflike (*Chrysocyon, Speothos*) and three genera of foxlike (*Atelocynus*, *Cerdocyon*, *Lycalopex*) species. The most species-rich genus (*Lycalopex*, also synonymous with *Dusicyon*, *Pseudalopex*) has at least six species (Table 1) that share a number of important behavioral characteristics. Although carnivores, they are all to some extent generalists inclined to heightened omnivory as they incorporate variable, often significant, amounts of plant food into their diet. Opportunism is a strongly shared characteristic, as they all adjust their dietary preferences and timing of activity to local and seasonal conditions. Comfortable in a range of habitats, they often prefer open settings and tolerate anthropogenic disturbance, particularly where it increases local resource supply. Their shared characteristics—an inclination toward broad-spectrum diets, opportunistic behavior, and tolerance of wide-ranging habitats, especially open settings with increased resource supply—can underlie a tendency to habituate to anthropogenic conditions and humans (see Stahl 2012a).

Archaeologists interested in South American zooarchaeological assemblages have long considered the possibility that humans and endemic canids shared a temporally deep and intimate relationship, minimally involving some form of commensalism and perhaps even taming (e.g., Clutton-Brock 1977; Mengoni Goñalons 1987:64; Miotti and Salemme 1999:60; Mondini 2002, 2004; Stahl 2012a; Wing 1988, 1989). Various species of fox, including culpeo (*Lycalopex culpaeus*), chilla or gray fox (*L. griseus*), pampas or Azara's fox (*L. gymnocercus*), and Sechuran fox (*L. sechurae*), have been identified in many early archaeological contexts throughout South America (Stahl 2012a). The number of preserved skeletal specimens is typically low, and in some assemblages their appearance

cannot be unequivocally attributed to past human involvement. Although local carnivores may not have played an important role in early faunal accumulation, their contribution to archaeological assemblage formation cannot be entirely ruled out. This is particularly important in settings where early sites were often alternately occupied by humans and carnivores (Mondini 1995, 2000, 2002, 2004). The preserved associations do not allow us to unequivocally rule out the use of endemic canids for food or raw materials. Nevertheless, we have a few early contexts in which fox specimens are found in association with human burials. Recent research and reanalyses of preserved canid specimens recovered from archaeological contexts suggest that the appearance of the exotic domestic dog was relatively late in South America (e.g., Austin et al. 2013; Prates et al. 2010; Prevosti et al. 2009; Stahl 2012a).

Most South American canids differ from gregarious wolves that live in hierarchically organized packs; their relatively solitary behavior could be a major obstacle standing in the way of domestication. Nevertheless, we do have accounts, some highly anecdotal, of fox taming and breeding throughout the length and breadth of the continent, particularly in Amazonia. Early descriptions abound of either "fox/wolflike dogs," tame wild animals, or selective breeding of endemic canids throughout South America (e.g., Allen 1920; Beebe et al. 1917; Cabrera and Yepes 1960:130; Darwin 1962; Latcham 1922; Roth 1922; Thurn 1883; Wallace 1889). This is supplemented by more recent observations of endemic canids raised as pets or even crossed with domestic dogs. A captured and tamed Sechuran desert fox was said to be "as tame as any dog or cat" (Birdseye 1956:285), and today they are sold illegally as pets in Peruvian cities (Cossías 2004:136). Similarly, a captive bush dog in Venezuela was kept in a dog house, sought belly rubs from humans, and "seemed to be completely adapted to association with man and to show behavior patterns strikingly similar to those of the domestic dog" (Bates 1944:154).

Krieg (1925) describes an Argentinean hybrid created from a tamed pampas fox mother and a domestic fox terrier father (Figure 1). Interestingly it could not bark, but it growled like a fox, and although not particularly obedient, it knew its name. Casual attempts by the dog's owner to breed the hybrid were unsuccessful; Krieg (1925:706) suspected that it was sterile. Domestic dogs differ from all but one South American canid in chromosome number. The latter is variable in the South American canids (2n=37 to 2n=78), and only the maned wolf shares the same chromosomal complement (2n=78) as the domestic dog (Sillero-Zubiri et al. 2004). Owing to their differing chromosomal numbers (2n=74 in *Lycalopex* and *Speothos,* and 2n=78 in domestic dog), resulting offspring would most likely be sterile.

Gusinde (1937) refers to repeated accounts by early European visitors in Tierra del Fuego of small, local dogs that looked like foxes. Although during Gusinde's time the pure-blooded Yamana dog no longer existed, he mentioned its resemblance to a smaller version of the fox (Gusinde 1937:564). Of the Selk'nam, Gusinde could not add anything concrete about their only domesticated animal, but previous authors had remarked on its relationship to

Figure 1. A 20-month-old cross between a pampas fox (*Lycalopex gymnocercus*) and a fox terrier (*Canis lupus familiaris*). This nearly-century-old image has not (to the author's knowledge) been published in the English-language literature before. Reprinted from Krieg (1925), courtesy Springer+Business Media.

foxes (Gusinde 1982:14). However, Lönnberg's (1919) early study of a Yahgan dog skull from Nordenskjöld's 1885–1886 expedition suggested that it was a domesticated dog.

Since Darwin's (1962:194) early observations collected during his voyages with the HMS Beagle, much has been made of the tameness of the now-extinct Falkland Island or Malvinas canid. Known today only through museum specimens, recent nuclear and mtDNA analyses place its closest genetic affinity with the South American maned wolf (*Chrysocyon brachuyrus*), although subsequent study may reveal an even closer relation to the morphologically similar and extinct *Canis* (*Dusicyon*) *avus* (Austin et al. 2013; Slater et al. 2009). In *The Natural History of Dogs* Hamilton-Smith (1839) extensively mentions the mainland *aguara* dogs used by native hunters. These he describes as crosses with domestic dogs or as animals entirely derived either from endemic wolves (*Chrysocyon*) or different species of local foxes (*Lycalopex*). Latcham (1922:14) discusses the wild *Canis aguara* of Buenos Aires and its possible relation to the endemic maned wolf or *aguara guazu* (*Chrysocyon brachyurus*), while Krieg's (1925) hybrid cross involved a wild, yet docile, female *aguará-chay* or pampas fox (*Lycalopex gymnocercus*). The Guarani name *aguará-chai* is also used in Argentina to refer to *Cerdocyon thous*, the crab-eating fox (Courtenay and Maffei 2004:32).

In Amazonia, where exotic domesticated dogs may have been introduced only recently (Koster 2009), indigenous peoples recount the taming of wild canids. For example, the Bororo of southern Brazil retain memory of taming and domesticating both endemic wolf and foxes, which they claim could be mated with domestic dogs (Crocker 1985:181). Our best information, however, is from northern Amazonia, where many accounts affirm that wild foxes were tamed and/or interbred with domestic dogs. Darwin (1868) mentions that interbreeding crab-eating fox with domestic dogs in Guiana was known since the time of Buffon. He included a personal communication from explorer

Richard Schomburgck in which he reports that coastal Arawaks improved their dogs through cross-breeding, resulting in a dog that resembled the crab-eating fox. Schomburgck further mentions that the latter was seldom kept for domestic purposes, nor was the *ai*, another endemic canid the Arecunas used for hunting (Darwin 1868:28).

The crab-eating fox figures heavily in these accounts. Currently very common throughout its wide range from the coasts and mountains of Colombia and Venezuela into northern and southern Amazonia, it is considered to be "one of the most versatile of canids" because of its catholic diet and habitat flexibility (Courtenay and Maffei 2004:35). The crab-eating fox is often identified in the literature with the *maikang,* which Beebe et al. (1917:464) earlier described as "audacious" because it was known to forage diurnally in villages for a wide variety of food. Thurn (1883:232) describes the best hunting dogs as domestic dogs crossed with either the crab-eating fox or *Canis azarae.* In 1924, Roth (1970) wrote that the indigenous dogs of Guiana were either crab-eating fox or *Lycalopex azarae,* which looked like the former yet differed. He identifies the *maikang* as the crab-eating fox, further stating that "a tamed maikang has an especial value for the Indians in that it makes an excellent cross with their dogs, the cross being especially good hunters. . . . A tamed maikang is one of the most treasured possessions of an Indian, who will feed it on cooked flesh, fish, and fruit, especially ripe plantains" (Roth 1970:553). Linares (1987) identifies an archaeological specimen of crab-eating fox from a precolumbian (AD 425) context in northern Venezuela. Extensive patterned dental attrition, in association with calculus and tartar deposition on specimens of both domesticated dog and the crab-eating fox, indicate that they were fed a diet of human food waste while in captivity.

Unfortunately, *C. azarae* is an archaic binomial that was applied at different times to a variety of endemic species, including the crab-eating fox (Cabrera and Yepes 1960). Other authorities have suggested that the bush dog may have been an important indigenous hunting dog in northern South America. The bush dog and crab-eating fox are sympatric throughout much of their respective ranges, and although comparable in head-body length and total weight, the bush dog is more robust overall with shorter legs and a noticeably shorter tail (Zeurcher et al. 2004). Early naturalists in the Amazon described wild forest dogs that hunted in small packs and were easily domesticated and bred with dogs (Wallace 1889:316; Rivière 2006:200). These were most likely bush dogs, which, although generally solitary, are the most social of the local small canids and capable of hunting cooperatively (Zeurcher et al. 2004:78). The Guianese Wai-Wai and Mawayán believe that before there were exotic domestic dogs, the creator of the Wai-Wai lived much like humans and hunted with bows and arrows and trained foxes which were identifiably bush dogs (Guppy 1958:274). In Venezuela Civrieux (1980) remarked that the Cumanagoto traded with the Kariña for their hunting dogs, as they were renowned for raising the best dogs. They were described as crosses between endemic canids and domestic dogs; he further suggests that the principal hunting dog of precolumbian Venezuela was the bush dog.

DISCUSSION

No canids are native to the Caribbean islands; however, since Columbus's first voyage European explorers noted that both insular and mainland South American populations had some form of mute dogs. In his tripartite classification of Indian dogs, Allen (1920) considered the "wolflike and foxlike" common Indian dogs and smaller terrier-sized *techichi* as possible candidates for the canids described in the earliest accounts. In the early 1920s, Roth (1970:552) added that when Europeans first entered the Orinoco, local mute dogs were referred to as *maios auries; auries* was a distinct Maypure, not European, name. Latcham (1922) considered many different endemic sources for early indigenous dogs, including the maned wolf and crab-eating fox. In particular, he and previous scholars considered the crab-eating fox or *koupara* as the progenitor of both the early dogs encountered throughout the northern Neotropics and those that were eventually imported to Europe as the *perro turco* (Latcham 1922:54, fn. 2). Later authorities considered the island dogs to have been crossed with crab-eating fox and used to hunt the now-virtually-extinct endemic capromyid *hutia* rodents (Cabrera and Yepes 1960:130).

An endemic contribution to the native dogs of the early Spanish was eventually dismissed in the scholarly literature. Gilmore (1950), aware of the earlier claims that mute West Indian dogs might have had some endemic ancestry, conceded that "rare individuals" of crab-eating dogs "conceivably might have been the basis of some of the numerous descriptions of a mute dog" (Gilmore 1950:378) and that bush dogs may have been tamed or even semi-domesticated on the mainland. However, in discounting the assertions of Latcham (1922), he emphasized that the blood of any endemic fox was not known to have entered into "any breed of aboriginal dog" because they rarely mate, and even then only infertile offspring would be produced (Gilmore 1950:377). He further considered it questionable that a neotropical breed of mute dog was recorded in the early documents, yet he maintained the possibility that some of them may have been tame foxes or bush dogs.

> Close examination of the quotations and text, however, reveal that these dogs were not truly mute, but merely nonbarkers, and that they represented several of the above-mentioned breeds. Some modern breeds or local populations of dogs do not bark normally (Eskimo dog, Basenji dog of Africa), and nonbarkers or their descendants learn to bark in association with barkers. Hence, it seems best to conclude now, in respect to these early Neotropical "mute" dogs, that they were local populations of one or of several breeds which, through severe conditioning (training) or through natural inclination or isolation, were nonbarkers. They could vocalize in whines and perhaps howls. Barking, and even howling, may have been sternly suppressed by severe punishment as a precaution against disclosing hidden villages to human marauders (Gilmore 1950:425–26).

Gilmore appears to have based his interpretation of the early documentary evidence on Ignacio de Armas (1888), who dismissed earlier assertions that the mute dogs described in these texts were actually raccoons which were based on the assumption that if they could not bark, then they could not be dogs. Considering Oviedo's description to be the oldest and best known source, he suggested that it dispels any confusion. The mute dogs had diverse fur colors, and some were clear [monochrome] or plain. Some dogs howled, others were used to hunt. These characteristics were all alien to raccoons and were found only in the dog (Ignacio de Armas 1888:33). He further asserts that barking was not innate; muteness was acquired, and he cites this characteristic in many extant dogs (Ignacio de Armas 1888:34–35).

The earliest historical accounts consider a time prior to the rapid establishment of European-derived canid populations in the Spanish Main. These documents describe indigenous dogs in the Greater Antilles and Bahamas, and the northern mainland of Colombia, Venezuela, and the Amazon basin. They may have been depicting more than one kind of dog; however, nothing in any of the documents would suggest "that these dogs were not truly mute, but merely nonbarkers" (Gilmore 1950:425). They were not entirely silent; they could growl, yelp, and howl, yet they never barked. Barking is a hypertrophied behavior that is characteristic of heterochronically retarded domesticates in which juvenile characteristics are retained in adult dogs. Endemic canids can bark, but they do so only in very specific contexts; otherwise, their relatively silent vocalizations might be considered somewhat mute.

Indigenous dogs were described as small with fur that was white or variably spotted or mottled and silky to satiny yet rougher than a dog's. This is unlike wild canid coloration (Ignacio de Armas 1988:33; Gallardo 1964–1965:51), which tends toward darker, relatively monochromatic hues. Northern populations of crab-eating fox have notably bristly and coarse pelage which is variably colored but generally silver grey or dark grey to black with occasional yellow to orange flecks dorsally and cream to buff neck and under parts (Courtenay and Maffei 2004:32-33). Bush dogs can be highly variable in color, ranging from black to very light blonde but with a generally reddish/tan to tawny head and neck that darkens to black or dark brown hindquarters and legs, and with occasional pale throat or chest patches (Zuercher et al. 2004:77). A subspecies of small and light-colored bush dog is recognized in northwestern South America (Beisiegel and Ades 2002:17).

Although it is entirely speculative to suggest that indigenous populations selectively bred tamed fox, Belyaev's famous fox farm experiments demonstrate the possibility of producing morphological and behavioral changes within only a few generations. Through simple selective breeding of tamed individuals, monochromatic foxes rapidly produced a distinctive piebald coat color within only eight to ten generations (Trut 1999). Within only six generations some foxes, upon seeing approaching humans, whined, yelped, wagged their tails, licked the humans' hands and faces, and followed them like dogs (Belyaev 1979:303; Trut et al. 2004:645). Bush dogs could quickly become adept cooperative hunting

companions in the pursuit of forest rodents, their main prey items in the wild (Beisiegel and Ades 2002:19). It is also interesting that the crab-eating fox and bush dog are unlike other wild canids in that they do not retain seasonal reproduction in captivity, which may be "an indication of the flexibility and context-dependence of their reproductive behavior" (Beisiegel and Ades 2002:20).

We have no evidence that any endemic South American canid was ever domesticated, certainly in the way that we understand the concept today. Common features shared by domesticated animals such as genetic change, reproductively viable offspring, and pronounced difficulty to survive in the absence of humans may never have developed. This might be an interesting future area for ancient DNA (aDNA) studies to explore. The genetic signatures of Caribbean and Amazonian canids are relatively unknown. Interestingly, Boyko et al. (2009) have recorded haplotype A29 in a sample of Puerto Rican street dogs, a signature which has never been reported outside of southern Asia, Australia, or the North American Arctic (Brown et al. 2013). Haplotype A29 is found in Australian dingoes and is suggested to be derived from the first population of pre-Neolithic dogs to have become reproductively isolated from wolves in Asia (Oskarsson et al. 2012; Sacks et al. 2013; Savolainen et al. 2004).

The extent and degree to which precolumbian peoples may have tamed foxes or produced hybrids with exotic domestic dogs in the neotropics could certainly be explored through aDNA studies of selected archaeological specimens with secure associations. The solitary nature of many endemic South American canids alone might be considered a major problem constraining domestication. However, in light of Koster's (2009) hypothesis of high mortality in lowland neotropical environments, it is conceivable that domestic dogs were only accepted at a later date in portions of Amazonia because indigenous populations may have already possessed their own endemic and possibly hardier version of a tamed canid.

NOTE

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