

**NOTE ON THE WINTER DIET OF JAGUARS *Panthera onca* IN THE PARAGUAYAN
TRANSITIONAL CHACO**

Rocky Mc Bride¹, Anthony Giordano² and Warren B Ballard²

¹ Alpine, TX, 79830

² Department of Natural Resources Management, Texas Tech University, Box 42125, Lubbock, TX 79409

ABSTRACT

Although jaguar (*Panthera onca*) diet has been intensively studied in recent years, there are many ecoregions where the cat's ecology is poorly understood. One of these is the Chaco ecoregion of central South America. Between June and August in 2002, 41 jaguar scat samples were collected in the Transitional Chaco of Paraguay to determine the winter diet of jaguars. All scats were collected from Faro Moro Ranch, a property containing mostly intact semi-arid deciduous scrub forest in the Boqueron Department, Paraguay. Scats contained the remains of 12 mammal species, two reptile species, and those of unidentified birds. White-lipped peccary (*Tayassu pecari*) remains occurred (58%) in more than twice as many scats (n = 23) as the next most frequently-occurring species, collared peccary (*Tayassu tajacu*) (23%) (n = 9). Although our study was based on a small sample, our findings are similar to many other jaguar diet studies in that they illustrate the importance of peccaries in jaguar diet.

Key words: Jaguar, *Panthera onca*, diet, food habits, Chaco, Paraguay, scat analysis

RESUMEN

Aunque la dieta de jaguar (*Panthera onca*) ha sido intensivamente estudiada en años recientes, hay muchas ecoregiones donde la ecología del gato está todavía poco entendida. Una de éstas es el Chaco ecoregion de Sudamérica central. Entre junio y agosto 2002, 41 muestras de excremento (scat) de jaguar fueron coleccionados en Chaco transicional de Paraguay para determinar la dieta invernal. Todas las muestras de excremento fueron coleccionadas en Rancho Faro Moro, una propiedad consistiendo de bosque de fregado de hoja caduca semiárido casi intacto en el Departamento Boqueron, Paraguay. Las muestras de excrementos contuvieron los restos de 12 especies de mamífero, dos especies de reptil, y aquellos de aves no identificadas. Los restos de peccari labio-blanco (*Tayassu pecari*) fueron presentes (el 58 %) en más que dos veces más excrementos (n = 23) que la siguiente más frecuente especie, peccari de collar (*Tayassu tajacu*) (el 23 %) (n = 9). Aunque nuestro estudio estuvo basado en una pequeña muestra, nuestras conclusiones son similares a muchos otros estudios de dieta de jaguar en los cuales ellos ilustran la importancia de peccaries en la dieta jaguar.

INTRODUCTION

Jaguars are the largest neotropical felid and the third largest cat in the world [1]. Prior to the 1970's, much of what was known about jaguar ecology was anecdotal [2]. In the past 30 years, however, there have been numerous studies investigating different aspects of jaguar ecology, including diet. Although the jaguar's diet has been well documented in parts of Mexico and Central America [3, 4, 5, 6, 7, 8], few studies have been conducted in South America outside Brazil [9, 10, 11, 12]. Emmons [13, 14] investigated the food habits of jaguars in Manu Biosphere Reserve, Peru, and several studies have reported on the diet of jaguars in Venezuela [15, 16]. Taber et al. [17], the only published account of jaguar diet in the Chaco prior to this study, determined that brocket deer (*Mazama gouazoubira*) and rabbits (*Sylvilagus brasiliensis*) comprised nearly half of all prey occurrences in scats. Here we present our findings from an analysis of jaguar diet in the transitional Paraguayan Chaco.

STUDY AREA

Faro Moro is a privately-owned ranch approximately 50,000 hectares in area and consisting of > 80% intact, semi-arid scrub and thorn vegetation. It is located approximately 135 km due south of Defensores del Chaco National Park in the Boqueron Department of Paraguay. Trees typical of this part of the Chaco



include red quebracho (*Schinopsis quebracho-colorado*), white quebracho (*Aspidosperma quebracho-blanco*), palo santo (*Bulnesia sarmientoi*), tala (*Celtis pubescens*), and mistol (*Ziziphus mistol*) [18]. The undergrowth is dense with many thorny and spiny trees and shrubs, and *Opuntia* cacti are common in the forest litter. Precipitation in the dry and humid Chaco is considered seasonal, ranging from 300 to 900 mm per year, most of which occurs during the wet season between November and April [19]. Temperatures range from -2 C to 44°C [17].

Faro Moro Ranch is characterized by several permanent artificial water holes of varying size, all of which were at least partially full year round during this study. The presence of permanent standing water in this region, as well as large tracts of natural brush, supports a wide range of terrestrial mammal species, including tapir (*Tapirus terrestris*), peccaries, and capybara (*Hydrochoerus hydrochaeris*), the latter of which were transplanted from the Chaco savannah to the east more than 10 years ago (R. McBride, unpublished data).

MATERIALS AND METHODS

Scats were collected opportunistically from June through August 2002 along roads and trails. Scats were collected while checking camera traps and monitoring collared jaguars as part of another ongoing study. All scats were classified as jaguar and differentiated from puma (*Puma concolor*) according to size, morphology, location, the movement of camera-trapped and collared individual jaguars, and by the presence of tracks and/or scrapes. All scats were sorted and separated as to skeletal material, hair, hooves, claws, and teeth. Positive identification of prey was facilitated through comparison with reference materials of known origin. All mammal remains were identified to species. We used frequency of occurrence (% occurrence in scats) and relative frequency (% of total prey items) to quantify jaguar diet, as they are both considered efficient and accurate measures of carnivore diet, and make fewer assumptions than biomass or other interpretations [20,21]. Evidence for the occurrence of multiple individuals of the same species in a scat was still treated as only one occurrence of that species for that scat.

RESULTS

Forty-one scats (n = 41) containing 65 prey items (n = 65) were collected from roads and trails. A minimum of 15 different prey species occurred in jaguar scats, including 12 mammals positively identified to species (Table 1). White-lipped peccaries (*Tayassu pecari*) occurred in 56% of scats collected (n = 23), more than twice as many scats as the next most frequently occurring prey species, collared peccary (*Tayassu tajacu*) (22%, n = 9). All three peccary species (*T. pecari*, *T. tajacu*, *Catagonus wagneri*) comprised 53% of the total number of prey items detected in scats (n = 36). Four species of armadillos combined accounted for 11% of total prey remains (n = 6), while giant anteaters (*Myrmecophaga tridactyla*) and lowland tapirs (*Tapirus terrestris*) together comprised 15% of prey items (n = 5 each). Red-footed tortoises (*Chelonoidis carbonaria*) occurred once in scats, and tegu lizards (*Tupinambis* sp.) identified only to genus occurred twice. Remains of birds also occurred twice but were not further identified.

Table 1. Frequency of occurrence and relative frequency of prey items occurring in 41 jaguar scats (Estancia Faro Moro, Paraguayan Transitional Chaco, June – August 2002).

Prey Species	FOC (n=41)	RF (n=65)
MAMMALS		
White-lipped peccary (<i>Tayassu pecari</i>)	56.1% (23)	35.4%
Collared peccary (<i>Tayassu tajacu</i>)	22.0% (9)	13.8%
Chacoan peccary (<i>Catagonus wagneri</i>)	9.8% (4)	6.2%
Feral hog (<i>Sus scrofa</i>)	4.9% (2)	3.1%
Lowland tapir (<i>Tapirus terrestris</i>)	12.2% (5)	7.7%
Giant Anteater (<i>Myrmecophaga tridactyla</i>)	12.2% (5)	7.7%
Capybara (<i>Hydrochareris hydrochareris</i>)	4.9% (2)	3.1%
Coypu (<i>Mycastor coypus</i>)	2.4% (1)	1.5%
Giant Armadillo (<i>Priodontes maximumus</i>)	2.4% (1)	1.5%
Southern Three-banded Armadillo (<i>Tolypeutes matacus</i>)	7.3% (3)	4.6%
Nine-banded Armadillo (<i>Dasybus novemcinctus</i>)	2.4% (1)	1.5%
Six-banded Armadillo (<i>Euphractus sexcinctus</i>)	2.4% (1)	1.5%
REPTILES		
Tegu (<i>Tupinambis</i> sp.)	4.9% (2)	3.1%
Red-footed Tortoise (<i>Chelonoidis carbonaria</i>)	2.4% (1)	1.5%
BIRDS (Unidentified)		
	4.9% (2)	3.1%
PLANT MATERIAL (Unidentified)		
	7.3% (3)	4.6%

DISCUSSION

Prior research has indicated that jaguars exhibit a broad and opportunistic diet in many parts of their range [14, 22, 23, 24, 25, 26, 27]. Many of these studies were useful in describing jaguar diet despite small sample sizes. For example, Nunez et al. [7], found 7 different prey species in 50 fifty jaguar scats collected from the state of Jalisco, Mexico. Another study from Calakmul Biosphere Reserve in the southern Yucatan Peninsula identified at least 9 different prey species in 37 scats [23]. Crawshaw et al. [28] listed 15 vertebrate species as jaguar prey in 73 scats collected from Iguazu National Park, Brazil. In Costa Rica, 9 different prey species were identified in only 22 scats [5].

Many studies have demonstrated the importance of peccaries to the diet of jaguars [5, 7, 11, 23, 26, 28]. Contrary to these findings and to our own, Taber et al. [17] described relatively few occurrences of peccaries in scats collected from the Paraguayan Chaco. Instead, gray brocket deer (*Mazama gouazoubira*) were the large mammal recorded as occurring most frequently (23% of occurrences) in jaguar scats. We found no evidence of *Mazama* in jaguar scats collected from Faro Moro Ranch, despite their frequent occurrence in camera-trap records (RTM, AJG, and WBB, unpublished data). However, deer have been reported as important jaguar prey in the Atlantic Forest of Brazil and the Venezuelan Llanos [11, 16, 28].

Taber et al. [17] also reported that 42% of 135 prey items in scats (n= 106) belonged to small (< 1 kg) mammals including rabbits (*Sylvilagus brasiliensis*), rodents, and marsupials. Several studies have shown that despite their size, jaguars can subsist on smaller prey such as armadillos and coatimundis (*Nasua nasua*) [3, 8, 29]. It is also well known that jaguars often take advantage of locally and seasonally abundant food sources, such as river turtles (*Podocnemis* sp., *Platymys* sp.), sea turtles and their eggs (e.g., *Chelonia mydas*, *Dermochelys coriacea*, *Lepidochelys olivacea*), fish, caimans (*Caiman* sp.), lizards (Family Iguanidae), primates, and chachalacas and curassows (*Ortalis* sp.) [3, 7, 14, 16, 25, 30, 31]. However, we did not find evidence that either smaller mammals, including armadillos, or non-mammalian prey, were important to jaguars overall.

The differences in jaguar diet as recorded by our study and by Taber et al. [17] were unexpected. As these are the only two accounts of jaguar diet in the Chaco ecoregion, more long-term research, including more samples from different regions, may still be needed to clarify this apparent discrepancy. We note that our samples, restricted both in number and geographically, may not be characteristic of annual jaguar diet for the entire region. In contrast, Taber et al. [17] sampled over a much wider region. Furthermore, increased habitat conversion and changes in land use have occurred throughout the region since Taber et al. conducted their research.

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