The Wild Felid Monitor

The Newsletter of the Wild Felid Research and Management Association

Summer, 2020, Volume 13, Issue 2

WFA website: www.wildfelid.org

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WFA logo designed by Ben Wright, *ben@bwrightimages.com*

Front cover: Ocelot photo by Fred Hood, *fredhoodphotography.com*

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is the biannual newsletter of the Wild Felid Research and Management Association.

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PO Box 486, Hillsboro NM, USA
E-mail: *wildfelidmonitor@gmail.com* Website: www.wildfelid.org
ISSN 2167-3861 (print), ISSN 2167-387X (online)

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Editorial Policy

The *Wild Felid Monitor* encourages submission of articles, information and letters on ecology, research, management and conservation of wild felid species, and particularly of those species native to the Western Hemisphere. Preferred length of submissions is about 750 words. Submissions of photos, drawings and charts are encouraged. ***Please send photos, graphics and tables as separate files suitable for portrait page formatting. Graphics must be suitable for grayscale reproduction.*** Electronic submissions to *wildfelidmonitor@gmail.com* are preferred; otherwise mail to the address above. For more information on formatting requirements, go to *http://www.wildfelid.org/monitor.php*. The WFA reserves the right to accept, reject and edit submissions. The photos and artwork are copyrighted – please do not reproduce without permission.

Predation events of the jaguar (*Panthera onca*) recorded with camera traps in mangroves of Nayarit, western Mexico

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Abstract

The jaguar (*Panthera onca*) is an opportunistic predator whose diet is based on the prey that are most available in the ecosystems in which it lives. In Mexico, studies have been conducted on their diet in various ecosystems, excluding mangroves and western wetlands. We report 9 photographic events, evidence collected by camera traps, of prey (4 mammals and 3 birds of which 2 are novel species: the white heron *Ardea alba* and American stork *Mycteria americana*) captured by jaguars in mangroves and marshes in a highly anthropomorphic altered landscape of the Coastal Plains of Nayarit, western Mexico.

Key words: Jaguar; *Panthera onca*; prey; mangrove; Nayarit

Resumen

*El jaguar (*Panthera onca*) es un depredador oportunista cuya dieta se basa en las presas que están más disponibles en los ecosistemas en los que habita. En México, se han llevado a cabo estudios sobre su dieta en varios ecosistemas excluyendo los humedales y manglares del occidente del país. Reportamos aquí nueve eventos fotográficos, evidencia colectada con cámaras trampa, de presas (4 mamíferos y 3 aves de las cuales 2 son nuevos registros para la dieta del jaguar: la garza blanca* (Ardea alba*) y la cigüeña (*Mycteria americana*) capturadas por jaguares en manglares y marismas en un paisaje altamente modificado por actividades antropomórficas en la Planicie Costera de Nayarit, Occidente de México.*

Palabras clave:Jaguar; Panthera onca*; presas; manglar; Nayarit*

Introduction

The jaguar is an opportunistic predator whose diet is based on the prey that are most available in the ecosystems in which it is extant (Mondolfi and Hoogesteijn 1986; Rabinowitz and Nottingham, 1986; Emmons 1987; Sunquist and Sunquist 2002; Harmsen et al. 2010). More than 110 species have been reported in their diet, ranging from small rodents to cattle weighing more than 200 kg (Hayward et al., 2016).

In Mexico, several studies to determine the diet of the jaguar have been completed in the rainforests of the Yucatan Peninsula (Aranda and Sánchez-Cordero, 1996; Ávila-Nájera et al. 2018), tropical deciduous forests of the west (Núñez et al. 2000), and northwest (Villordo-Galván et al. 2010; Rueda et al. 2013; Hernández-Saint-Martin et al. 2015), as well in the desert thorn scrub in northern Sonora (Cassaigne et al. 2016). These studies document jaguar prey in Mexico, particularly white-tailed deer (*Odocoileus virginianus*), collared peccary (*Pecari tajacu*), coati (*Nasua narica*) and nine-banded armadillo (*Dasypus novemcinctus*). However, despite the fact that Mexico's jaguars are extant in a variety of habitats throughout the country, there is little known about the diet of jaguar sub-populations (Luja et al. 2017). This is particularly true in mangrove and marsh habitats of Nayarit, in western Mexico.

Study Area

Our study area was 72 km^2 in the ecological sub-province of the "Delta of the Rio Grande de Santiago" (INEGI 1991). The northern limit of our study area was defined by the townsite of Los Corchos (21.732469 ° N, -105.469970 ° W, 3 m elevation; Municipality of Santiago Ixcuintla); the southern limit was the estuary mouth called "La Boca Cegada" (21.596216 ° N, -105.400016 °, 0 m elevation; Municipality of San Blas); the western boundary was the Pacific Ocean; while the eastern boundary was approximately 6 kilometers from the coastline. The climate is humid with mean temperature 31^0 C. The predominant native tree species is the mangrove (*Avicennia germinans* and *Conocarpus erectus*) interspersed with patches of low deciduous palapar forest. These fragmented mangrove forest are being replaced by farm crops and shrimp farm aquaculture (Luja et al. 2017).

Methods

We used the methodology described by the National Jaguar Census project as described in CENJAGUAR by Chávez et al. 2013. Using Google Earth Pro®, we established a grid of cameras covering an approximate area of 72 km^2 divided into 8 quadrants of 9 km^2 each. For every 9 km^2 quadrant we selected 3 camera sites to set a camera trap. Each site was separated by a minimum of 1 km for a total of 24 camera sites. Cuddeback®, HCO Scoutguard®, and Bushnell® cameras were used at 17single-camera stations and at 7 sites we set two cameras facing each other. Cameras were set at a height of between 35 and 50 cm and perpendicular to wildlife paths, as described by Chávez et al. 2013.

Results

Between 2016 and 2020, we captured 9 photographs of 5 different jaguars (3 females and 2 males) carrying 7 species of prey in their jaws (Figure 1). Prey items consisted of 4 mammals: nine-banded armadillo (*Dasypus novemcinctus*) (Figure 1a), coati (*Nasua narica*) (Figure 1b), raccoon (*Procyon lotor*) (Figure 1c), and a domestic cat (*Felis catus*) (Figure 1d). Additionally, we documented 3 birds: a white heron (*Ardea alba*) (Figure 1e), black vulture (*Coragyps auratus*) (Figure 1f), and an American stork (*Mycteria Americana*) (Figure 1g) as prey species. The species with the most photo records as prey was the nine-banded armadillo (3 events), while 6 additional species were photographed once, each.

Discussion

The nine-banded armadillo was previously documented as one of the most frequent prey species in the diet of the jaguar (Hayward et al. 2016). This is supported by our documentation as the most common species in the photographs of this study. All 3 photographs of nine-banded armadillo as prey were obtained during night-time hours (20:55; 22:12; 03:31 h). Jaguars are considered as both diurnal and nocturnal predators in our study area, with many visual

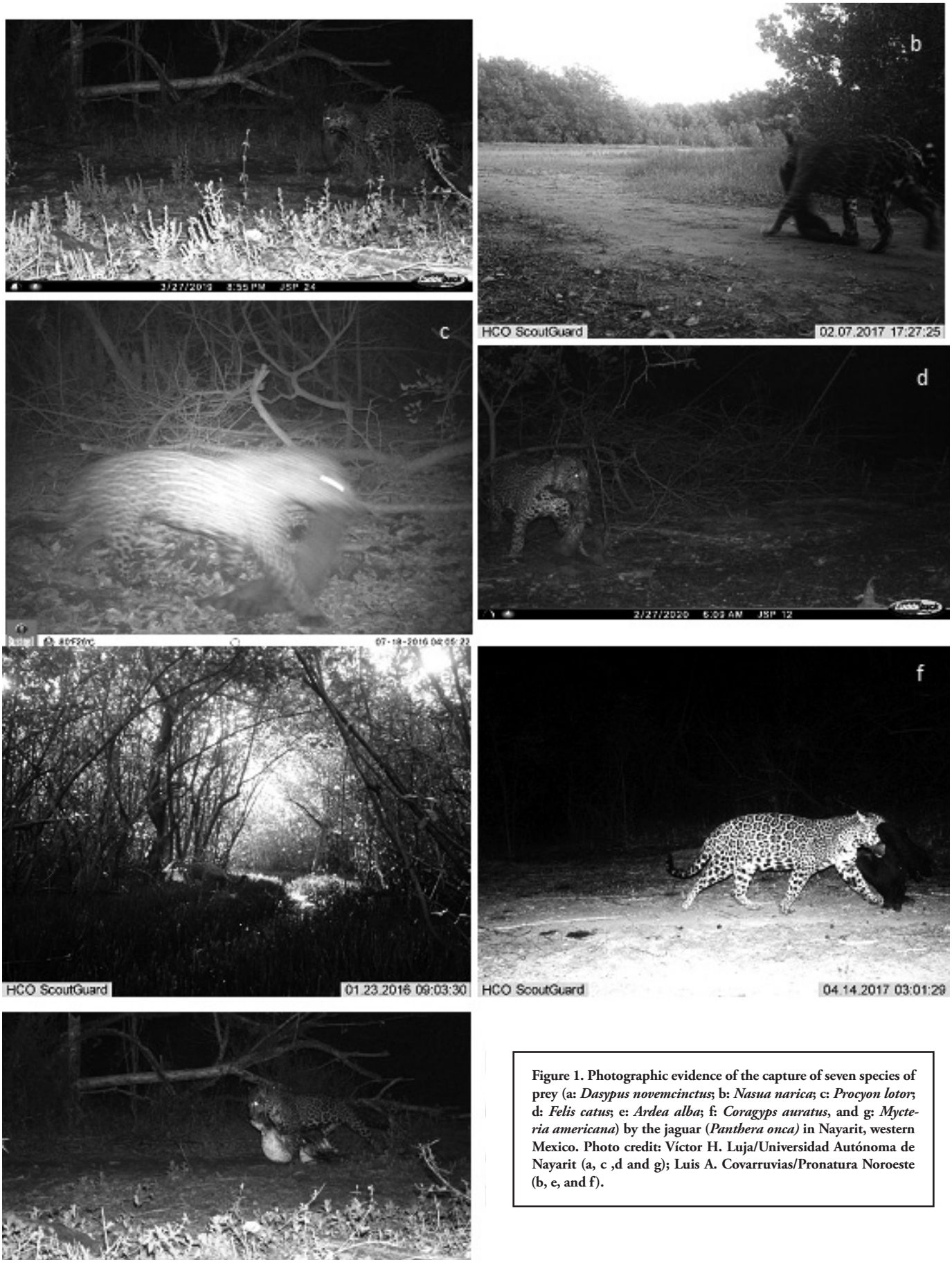

Figure 1. Photographic evidence of the capture of seven species of prey (a: *Dasypus novemcinctus*; b: *Nasua narica*; c: *Procyon lotor*; d: *Felis catus*; e: *Ardea alba*; f: *Coragyps auratus*, and g: *Mycteria americana*) by the jaguar (*Panthera onca)* in Nayarit, western Mexico. Photo credit: Víctor H. Luja/Universidad Autónoma de Nayarit (a, c ,d and g); Luis A. Covarruvias/Pronatura Noroeste (b, e, and f).

observations by area fishermen during both daylight and night hours. Raccoon and coati are both commonly reported as prey of the jaguar (Hayward et al. 2016). Our photo of a jaguar with a coati, considered a diurnal species, was captured in daylight (17:27 h) while the jaguars with nocturnal raccoons were captured at night (04:05 h). Jaguar predation on domestic cats has been poorly documented. In a study in Tamaulipas northeastern Mexico, Carrera-Treviño et al. (2016) collected only verbal testimonies of domestic cat predation by jaguars as evidence. During this study we obtained photographic evidence of an adult male jaguar with a domestic cat as prey while in a mangrove habitat during the early morning hours (06:09 h).

Although very rare, the black vulture *C. auratus* had already been reported as prey of the jaguar in the Yucatan peninsula (Cassaigne et al. 2016; González-Gallina et al. 2017). The photography of the jaguar with the black vulture was obtained during the night (03:01 h) in a dirt road in a mangrove forest. Due to the time of the picture, presumably it was inactive so it is likely that the jaguar hunted it while perching. The other two species of birds (white heron and stork) are, to our knowledge, novel items as prey of the jaguar. The white heron was preyed inside a mangrove forest at 9:03 am. Two photographs show how an adult female jaguar jumps approximately 3 m to capture the bird. Seconds later, a second photograph shows the jaguar with the bird in its mouth. The photograph of the stork predation was obtained in a patch of secondary vegetation at 20:35 h. From the direction the jaguar (adult female) was heading, it is inferred that it captured the bird in an "aguaje" (artificial waterhole for cattle to drink) located at 250 meters east from the photo site. It is common to see flocks of herons, storks, spoonbills, ducks and other birds sleeping in these artificial waterbodies, a situation that takes advantage of the jaguar. Birds can be an important food resource for this jaguar population since the marshes and coastal wetlands have been internationally recognized by the large diversity and abundance of birds (key site for bird conservation, Ramsar Site for the conservation of wetlands, and Area of Importance for Conservation of the Birds) (Cervantes-Abrego 2000; Mendoza et al. 2019).

This paper presents information on both common and novel prey consumed by jaguars in declining costal mangrove habitats of western Mexico. Our photographic evidence of novel prey items of an American stork and white heron, when combined with predation of a freshwater turtle endemic to Mexico (Luja and Zamudio 2018), suggest that the diet of the jaguar in the mangrove region of costal western Mexico is adaptive to prey availability of the region. Future studies incorporating the DNA identification of prey in scat collections and prey site investigations are needed to document statistically significant diet information relative the diet of this iconic Mexican predator. During our study we identified garbage landfills as a possible source of a cat as one prey item. Both cats and dogs are often seen abandoned by people within these humane waste sites. One of these dumps is 200 m from our photo site. The establishment of garbage dump sites within highly fragmented jaguar habitat not only provides an available source of domestic prey species for jaguars, but also a source of habituation to easy prey associated with humans and eventual human-predator conflicts. Additionally, domestic animals are a documented source of feline diseases that may severely affect the survivorship of jaguars on an already anthropogenically altered landscape. We suggest this cause and effect relationship may additionally support a threatened species' existence in an endangered habitat – the mangrove swamps of costal western Mexico.

Aknowledgements

Thanks to P. Virgen, R. Virgen, I. Vallarta, M. Zamudio, D. Guzmán, A. Ponce, L. Ramírez and other people who collaborated in the field work. To Ron Thompson because his observations substantially improved this manuscript. This work was possible thanks to the financing granted to VHL by the National Council of Science and Technology (CONACYT) to project 3369 "Ecology and Conservation of the jaguar (*Panthera onca*) and its potential prey outside the Natural Protected Areas of Nayarit, Mexico.during the early morning hours (06:09 h).