The Wild Felid Monitor

The Newsletter of the Wild Felid Research and Management Association

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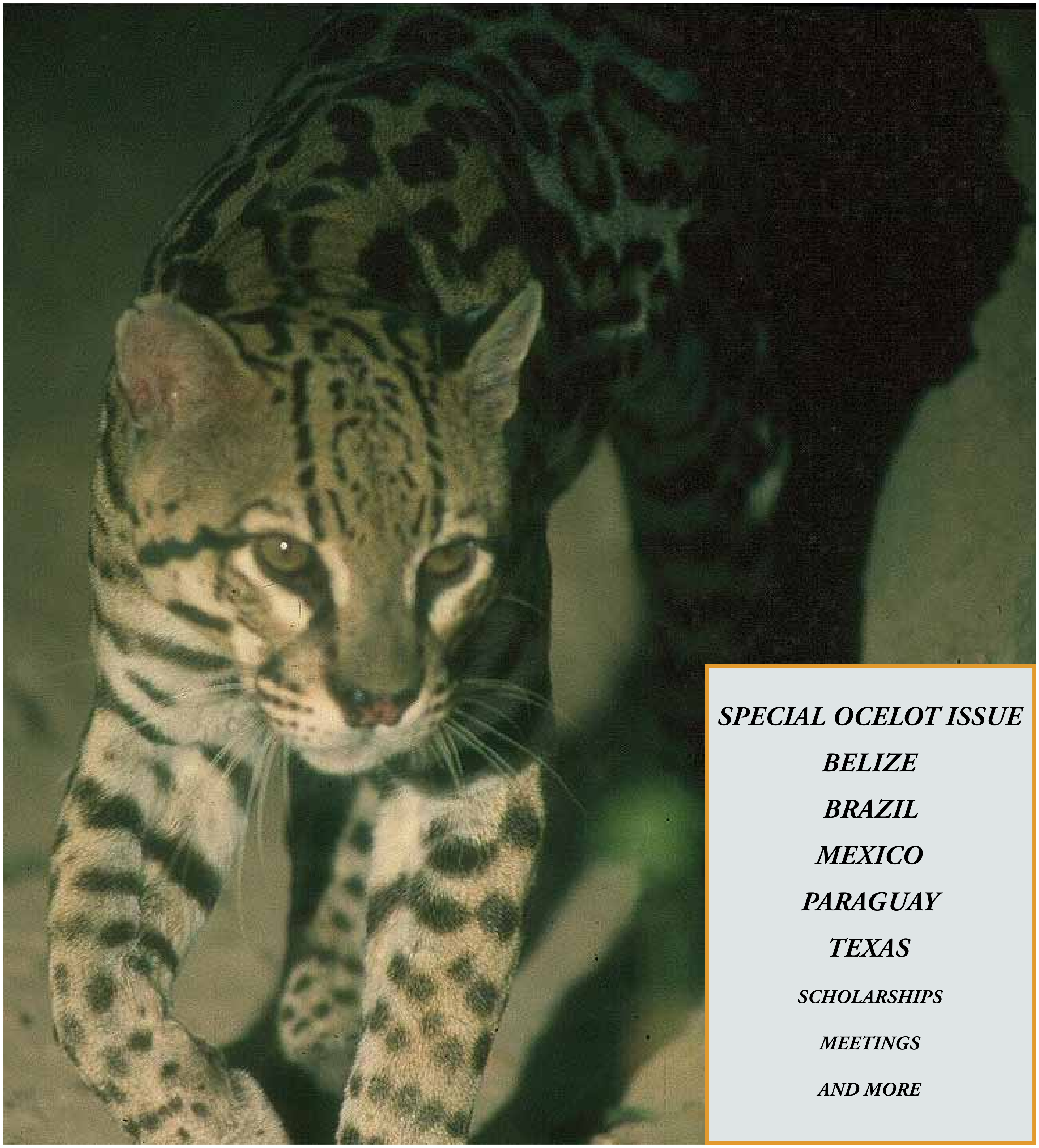

SPECIAL OCELOT ISSUE

BELIZE

BRAZIL

MEXICO

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TEXAS

SCHOLARSHIPS

MEETINGS

AND MORE

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WFA logo designed by Ben Wright, *ben@bwrightimages.com*
Covers photos: Front cover ocelot photographed by Arturo Caso.
Male ocelot photographed in Belize by MJ Kelly, Virginia Tech.

The Wild Felid Monitor

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

The publication is provided to current Association members. To join, renew your membership, or to obtain back-issues of the newsletter, please visit our website at *www.wildfelid.org.*

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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. 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.

From the President

More than a month now into 2018, I have reflected much on what I believe was another successful year for WFA. Among our successes, yet another group of amazing young scholarship recipients who are poised to advance the science, management, and conservation of felids. One of whom, Maria Fernanda of Venezuela, I had the distinct pleasure of meeting in Cartagena last July. In thinking of her commitment to jaguar conservation in Venezuela in the face of day-to-day personal and professional challenges she endures now in her home country, I cannot help but be inspired. Knowing she is there, still fighting that fight, has encouraged me to do more and frankly, it is now hard to look at obstacles in my own path the same way.

WFA also played an important role at the latest Mountain Lion Workshop last May in Colorado. There we were so excited to support two of our colleagues from Latin America to travel from their home countries of Brazil and Costa Rica, and share their experiences and perspectives regarding felid research and management with North American agency professionals. And of course there is the Wild Felid Monitor, WFA's cornerstone, which just keeps getting better and better, broadening the diversity of topics we cover and providing a unique outlet to our membership. No question that we have our editor and emeritus puma biologist Harley Shaw to thank in part for that. But we also have dozens of other contributors from around the Western Hemisphere who either in their consistency, or in sharing their new ideas and findings, make the Monitor what it is.

Here I am happy to present yet another compelling and informative issue of the Monitor. You'll quickly note that it isn't just any issue; rather, maybe it is a portending of things to come. For this is our first "special issue", featuring an exclusive deeper dive into an often-overlooked felid, the ocelot (*Leopardus pardalis).* Considered a species of "Least Concern" by the IUCN Red List, ocelots of course are an endangered species in the United States, a country that has historically represented the northern limit of their distribution. Further south of the U.S.-Mexico border however, ocelots are often thought of as common and widely distributed, the small felid most likely to persist in mixed anthropogenic landscapes across the Neotropical biogeographical realm. But there is much to be learned about adaptable carnivores like the ocelot, particularly in and around habitats that are constantly changing. What can ocelot populations for example teach us about the overall health of these environments through time? Could our ability to frequently get robust data on ocelot populations make them the quintessential sentinel species in many tropical forest ecosystems? Or, has our tendency to overlook them across much of their range for so long led to unfounded assumptions about their distribution, or even the health of local populations? More attention given to the study of ocelots directly in recent years, as opposed to taking a back seat to jaguars or other felids, may now be starting to scratch the surface of these ideas.

Although I am very excited that we chose ocelots to focus on for this special issue, I'm perhaps more excited about what this issue might mean for the future direction of WFA and the Monitor. I expect that this will not be the last such "special" issue you will see. In addition to future issues and sections of the Monitor being dedicated to other felids of the Western Hemisphere, I believe there is tremendous value in our flagship publication training its focus on a variety of timely and important subject areas. Among potentially important topics for upcoming volumes of the Wild Felid Monitor are: research themes and methods, management needs and guidelines, educational approaches, science and policy, graduate student perspectives, and best practices, to name a few. I invite you, as one of our members and loyal readers, to send us your ideas about what important topics you'd like to see discussed.

A regular visitor to camera-traps at Asa Wright Nature Center and part of the Trinidad Ocelot Project led by S.P.E.C.I.E.S. Photo:, Anthony J. Giordano and Trinidad Ocelot Project.

You can also expect to see some other changes at WFA this year, and in the years ahead. As we build on the ideas of our founders and maintain their integrity, we're hoping to diversify our programs and activities. We'll be ramping up our grantseeking efforts soon, and be on the lookout for our new website this year, with new features and a fresher look. Finally, look for us to leverage our successes and resources to have a greater impact where it matters, like with this year's scholarship program with a twist: one we hope will contribute more to the conservation of this hemisphere's most endangered cat species, the Andean cat. Make no mistake, WFA is on the rise!

~Anthony J. Giordano

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We are pleased to announce~

The 2018 Wild Felid Legacy Scholarship

Puede encontrar una versión en español del anuncio de la beca en este enlace www.wildfelid.org/ legacy.php

The Wild Felid Research and Management Association began awarding the Wild Felid Legacy Scholarship in 2009 to encourage and support graduate level university students involved in wild felid research. To date, 23 scholarships have been awarded. The scholarship honors distinguished and dedicated biologists who lost their lives while seeking to understand and contribute to the conservation of wildlife: Dave Maehr, Ian Ross, Rocky Spencer, Eric York, Deanna Dawn, and Donna Krucki. More on these inspiring biologists can be found on the WFA's web site:*www.wildfelid.org*. Scholarships are made possible through grants and donations to WFA from The Summerlee Foundation, Dee Dawn, WFA members, Altria Group, and other contributors.

FOCUS FOR 2018: The Andean cat (*Leopardus jacobita*) is the most threatened felid in the Western Hemisphere. Threats to Andean cats include habitat loss and conversion, hunting of both the cat and its prey, direct mortality from domestic dogs, and of course, climate change. **Accordingly, this year WFA has decided to enhance our impact by only accepting applications that focus on Andean cat conservation efforts**. To this end, S.P.E.C.I.E.S. *(http://carnivores.org)* has agreed to contribute an additional $1000 toward the 2018 award. Also for 2018, we will open the award to individuals working with/for a conservation NGO, in addition to university graduate students. Projects aiming to solve or mitigate threats to Andean Cats, including enhancing management, mitigating conflict or sources of mortality, and directly promoting conservation through education, outreach, and community-based activities, are strongly encouraged to apply. The scholarship will reopen to students involved in research on any Western Hemisphere felid in 2019.

SCHOLARSHIP FUND ADMINISTRATION: The WFA's Scholarship Committee administers the Wild Felid Legacy Scholarship and selects recipients, who are subject to relative ranking based on materials submitted and approval by the Committee, and subsequently by a majority of the WFA Council. This year's awards will be granted in early summer 2018. One to three recipients will be selected to receive awards varying from $1000-$4000. The Review Committee reserves the right to provide or deny award(s), depending on the Committee's opinion of applicant qualifications and the availability of funds. All Committee decisions are final.

APPLICATION CRITERIA: Applicants for the Wild Felid Legacy Scholarship must be a member of the Wild Felid Research and Management Association (If you are not currently a member, simply go to our website at *www.wildfelid.org* and sign up) and, if selected, agree to provide an update of their research for the *Wild Felid Monitor*.

APPLICATION DETAILS: Please go to the scholarship link on our website: *http://www.wildfelid.org/legacy.php* to learn what to include in your application. Send your completed application electronically to Dr. Marcella Kelly, Associate Professor: *makelly2@vt.edu* and put "Wild Felid Legacy Scholarship Application" in the subject line. Clearly name files with your last name and subject (e.g., Smith WFLS Resume.doc). References can also send their letters electronically.

All application materials must be received by the Scholarship Chairperson by **MARCH 30, 2018**.
Incomplete applications will not be considered.

WFA COUNCIL ELECTION 2018

WFA will be having an election for 6 Council members this coming summer. Up for election are 4 officer positions: President, Vice President North America, Vice President Latin America, and Secretary, and 2 General Councilor positions. The election will be via electronic ballot and only current WFA members will be eligible to vote.

If you are interested in running for Council or would like to nominate someone to run, please contact Melanie Culver (*Culver@ag.arizona.edu),* WFA's Election Committee chair. This is a great opportunity to become more involved in the WFA and help establish our organization's future course. Please look in the summer issue of *Wild Felid Monitor* for a list of candidates and directions on how and when to vote.

North America Congress for Conservation Biology (NACCB 2018)

Conservation Science, Policy, & Practice: Connecting the Urban to the Wild

JULY 21-26, 2018, Toronto, Ontario, Canada

Abstract submission for oral, poster, and speed presentations is open through
January 19th, 2018

For more information, please go to: *http://scbnorthamerica.org/index.php/naccb2018/*

The Latin America and Caribbean Section (LACA) of the Society for Conservation Biology (SCB)

is joining the University of the West Indies to host the inaugural Latin America and Caribbean Congress for Conservation Biology (LACCCB 2018) in Trinidad and Tobago.

Strengthening Conservation Connections between the Caribbean and the Americas

July 25-27, 2018

For more information

visit *https://lacccb2018.org/*

El comité organizador conformado por la Colección Boliviana de Fauna (Museo Nacional de Historia Natural – Instituto de Ecología) y la Red Boliviana de Mastozoologia, tienen el agrado de anunciar el "VIII Congreso Boliviano de Mastozoología y IV Congreso Latinoamericano de Mastozoología" a desarrollarse del 10 al 13 de julio de 2018, en la ciudad de La Paz – Bolivia.

Dicho evento se constituye en una oportunidad para compartir experiencias referidas al estudio y la conservación de los mamíferos, generar alianzas, crear *oportunidades* de interacción con investigadores especialistas tanto estudiantes como a jóvenes profesionales; y de esta forma, fortalecer los lazos de hermandad que toda Latinoamérica comparte.

Bolivia espera con los brazos abiertos a todos los investigadores y estudiantes del mundo, que deseen participar y se sientan motivados de ser parte de este evento. Todos los interesados pueden inscribirse ingresando a la página web del congreso (*www.congresomamiferos.org*).

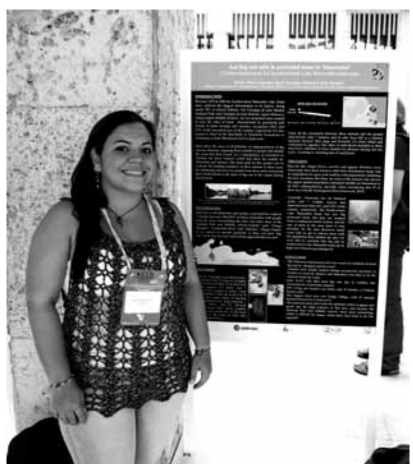
The organizing committee formed by the Bolivian Collection of Fauna (National Museum of Natural History - Institute of Ecology) and the Bolivian Mastozoology Network, are pleased to announce the Eighth Bolivian Congress of Mammalogy and Fourth Latin American Congress of Mammalogy to take place on July 10-13, 2018 in La Paz, Bolivia. This event will provide an opportunity to share experiences related to the study and conservation of mammals, generate alliances, create occasions for interaction with research specialists for students as well as young professionals, thereby strengthening the fraternal bonds that are shared by all of Latin America. Bolivia awaits with open arms all researchers and students of the world that desire to be part of this event. All interested should go to the Congress web page (*www.congresomamiferos.org*).

28th INTERNATIONAL CONGRESS FOR CONSERVATION BIOLOGY

Maria Fernanda Puerto Carrillo, WFA representative, Venezuela

The 28th INTERNATIONAL CONGRESS FOR CONSERVATION BIOLOGY (ICCB-2017) was held in Cartagenas de Indias, Colombia on July 23-27, 2017. The conference theme was "Insights for Sustaining Life on Earth." People attended from all over the world to discuss current conservation challenges and to encourage a better connection between man and earth's biodiversity by sharing experiences in conservation science and practice. Most of the 2,000 participants exchanged ideas and experiences through oral and visual aide presentations, symposia, posters, workshops, knowledge cafés, short courses, art, games, and plenaries.

Dr. Brigitte L. Baptiste (General Director of the Institute for the Research on Biological Resources at Alexander von Humboldt Institute, Bogota, Colombia) spoke about the challenges that Colombia is facing in biodiversity conservation. Dr. Robin Chazdon (Professor Emerita of the Department of Ecology & Evolutionary Biology at the University of Connecticut, USA) presented her vision for the integration of restoration ecology and conservation as a model for managed ecosystem biodiversity. Dr. Arun Agrawal (School of Natural Resources & Environment at the University of Michigan) discussed his experience in India, and how conditional and unconditional compensation help overcome deficiencies regulation, thereby generating environmental awareness for future action. Dr. E.J. Milner-Gulland (Tasso Leventis Professor of Biodiversity in the Department of Zoology at the University of Oxford and Director of the Interdisciplinary Centre for Conservation Science) explained the importance of understanding dynamic and multi-scale social-ecological systems based upon her 25 years of experience studying the use of natural resources by hunters and other consumers, legally or illegally, locally and internationally; and the importance of maintaining a positive perspective for effective future conservation.



In addition to these extraordinary plenary sessions, I was privileged to participate in symposia where researchers discussed the importance of involving government, local communities, schools and children to create conservation awareness, generate new laws and protected areas, and provide strategies that support coexistence of big cats with other carnivores, large mammals, and humans. Their presentations stimulated new visions of management of human-predator conflicts in protected areas, borderland landscapes, and livestock-dominated areas. They discussed improvements in population evaluation techniques for cryptic species, techniques to minimize the impact of carnivore predation on domestic animals and minimize reprisals against them, and ways to attract a wider public into conservation projects.

I attended talks on big cat conservation, conservation conflict, human and wildlife interaction, threatened species management and recovery, and communicating and learning from existing conservation projects. I also attended several symposia, including adaptive management, challenges, and opportunities in Latin American protected areas, human-carnivore conflict in regions undergoing land-use change, wildlife crime and bridging the gap between conservation science and criminology, and cost-effective tools to support conservation decision-making for protected areas in Latin America. The symposium, "Adaptive Management in Latin American Protected Areas," provided a unique opportunity to learn new tools for improving public policies for protected areas in Latin America. I consider this an essential step for biodiversity conservation, especially in those countries that are considered critical habitats for threatened species and are undergoing changes at devastating rates.

The poster sessions provided opportunities to share field experiences, including successes, improvements and failures in equipment used, variation and problems in data collection, experiences with local communities, and more. Posters also provided information on techniques used to evaluate distributions, habitat loss, conflicts and threats to wildlife populations, including establishing priority areas for coexistence programs and developing reintroduction and reproduction programs for endangered or threatened species. I presented a poster titled: "Are Big Cats Safe in Protected Areas in Venezuela? The Current Situation in the Southwestern Lake Maracaibo Basin Area." I identified hunting by local people as the main cause of jaguar and puma mortality in the areas surrounding Ciénagas de Juan Manuel National Park and Ciénagas de Juan Manuel, and Aguasblancas and Aguasnegras Wildlife Reserves. I explained how such high fatality could put the existence of jaguar and puma subpopulations at risk in those areas in the near future.

I also attended the "Camera Trapping Community Gathering" organized by Tropical Ecology Assessment and Monitoring (TEAM) Network, where those of us currently working with camera traps could exchange ideas and identify needs and future initiatives.

In other important event, Dr. Alan Rabinowitz (Panthera's CEO), Esteban Payán (Panthera-Colombia), Carlos Castaño-Uribe (Fundación Herencia Ambiental Caribe), Angélica Diaz-Pulido and Dr. Brigitte L. Baptiste (Alexander von Humboldt Institute) presented their new book, *Conflicts between humans and felids in Latin America*, which in 32 chapters discusses the experiences of 110 authors from 18 countries about ways to reduce conflict where human-felid conflicts have caused decreasing wild felid populations.

The International Congress provided a unique opportunity to expand my knowledge of conservation and provided tools that I hope to incorporate in my future projects with jaguars and pumas. Much remains to be done in Venezuela and in Latin America, and information from such conferences are of critical importance. We must now assess what we have learned and strive to apply our new knowledge in every country to guarantee future biodiversity. I want to thank The Wild Felid Research & Management Association (WFA) for helping finance my trip to Colombia with a $300 grant.

SOUTH AMERICA

ARGENTINA

In November, the 30th Conference of the Argentinean Mammal Society was held in Bahía Blanca, Argentina. The conference attracted participants from Chile, Uruguay, Colombia, and Brazil as well as Argentina. Of more than 200 abstracts, 10 were specifically about *Puma concolor* (two of them authored by previous recipients of the Wild Felid Legacy Scholarship). The puma, along with other carnivores, was mentioned in 14 additional works. It was one of the species that we talked about the most! Four of the presentations discussed puma-human conflicts, four discussed puma diet in relation to conflict and three analyzed habitat use in relation to conflict or distribution. The presentations highlighted the importance of research in the search for solutions to intensifying conflicts in our region.

The objective of The Fund for Environmental Conservation (FOCA – a monetary award offered jointly by Galicia bank and William Foundation: *https://goo.gl/KKsqyK*) is to encourage research and management projects that seek environmental conservation and sustainable development in Argentina. It has the institutional support of the Ministry of Environment and Sustainable Development of the Nation and the National Parks Agency (APN). In 2017, the grant was focused on "Mammal biodiversity and conservation" projects. "Conservation of the threatened Andean cat and other Patagonian carnivores through the mitigation of conflict with subsistence livestock", by María José Bolgeri (PhD in biology currently working in Wildlife Conservation Society), was one of the winning projects.

In La Pampa province, central Argentina, there has been a long, and still unresolved, history of conflict between livestock and predators, mainly the puma and Pampas fox (*Lycalopex gymnocercus*). A combination of social and economic factors, such as inefficient livestock management, extensive farming systems, and progressive depopulation of rural areas, has led to an increase of complaints towards wild predators and, consequently, their persecution and non-selective hunting to reduce predation. Consequently, in 2018 Esperanza Iranzo, PhD in biology from the Institute of Earth and Environmental Sciences of La Pampa (INCITAP-CONICET), will begin a two-year postdoctoral research project whose objectives are to: 1) estimate puma densities, 2) assess space and time use in areas under different management strategies, 3) describe puma diet, 4) empirically quantify the damage that pumas cause to livestock production, 5) evaluate ranchers' perceptions and attitudes toward this species, and 6) evaluate the puma's ecological role at community and ecosystem scales. These results will help design a management plan for puma populations in the province of La Pampa, including its coexistence with livestock.

-Nicolás Caruso

NORTH AMERICA

California

Three papers from southern California explored various aspects of landscape and connectivity planning for puma populations. Zeller et al. (2017a) applied multi-scale path selection functions (PathSFs) to spatial data from the Santa Ana puma population to explore the relationship between resolution of spatial data and connectivity models, and found that models were very sensitive to spatial grain of geospatial layers. In a separate paper, Zeller et al. (2017b) also conducted a multi-level, multi-scale resource selection function that incorporated resistance surfaces to quantify habitat preferences for pumas in the Santa Ana Mountains, and used their results to develop a conservation plan for that population. Gustafson et al. (2017) documented the genetic impacts of a single male migrant puma from the larger Eastern Peninsular Range to the more isolated Santa Ana Mountains. This migrant successfully bred and produced 11 offspring, substantially increasing heterozygosity of the Santa Ana population.

Two new papers out of the Santa Cruz Mountains describe elements of human impacts on pumas. Smith et al. (2017) found that pumas flee from the sound of human voices and significantly reduce feeding after exposure to human sounds. Wang et al. (2017) describe altered puma movement and activity patterns near residential areas, resulting in increased energy expenditure and prey requirements for pumas in more developed habitats.

At least two adult pumas, one male and one female accompanied by three kittens, were documented from camera trap monitoring in the human-dominated Butte Sink region of the Sacramento Valley between March and November of 2016 (McClanahan et al. 2017).

-Justine Smith and Anna Nisi

Georgia

Bobcats (*Lynx rufus*) are the only remaining native felid in the state of Georgia and maintain stable populations overall. Similar to other mesopredators in the state, bobcats are common predators of species such as northern bobwhite quail (*Colinus virginianus*) which are declining in the state and have been a focus of restoration projects involving longleaf pine (*Pinus palustris*) savannas. Due to their importance as game birds, bobwhites are heavily managed for hunting on quail plantations. Consequently, mesopredators such as bobcats, that raid nests or kill the birds directly, are managed heavily as well. Researchers at the University of Georgia and the Joseph W. Jones Ecological Research Center have collected 7 years of movement data from collared bobcats and have focused on bobcat habitat selection. Andrew Little, a Senior Research Associate at UGA, explained that understanding habitat selection goes hand-in-hand with the management of habitat for prey species, as there may be techniques managers can implement to alter bobcat movements and foraging behavior, with the goal of reducing selective pressure on certain prey species. Biologist Little indicated that results of the study will be published soon.

-Kelsey L. Turner

Illinois

Bobcat *(Lynx rufus)* populations in southern Illinois have recovered since a statewide hunting and trapping ban in 1972. In 2016-2017, the first bobcat hunting and trapping season in over 40 years was conducted, with 500 permits sold and 141 bobcats harvested. This year, an additional 350 permits will be issued. To understand more about the population status of bobcats in central Illinois, a study was initiated by Tim Swearingen and Edward Davis, both master's students in Dr. Chris Jacques' lab at Western Illinois University. They deployed 50 camera stations over a 77-day period from February–April 2017 to evaluate the utility of spatial capture-recapture (SCR) models for estimating bobcat density in an agriculturally dominated landscape of west-central Illinois. The researchers photographed 23 uniquely identifiable bobcats

115 times. Estimated densities ranged from 1.44–1.57 bobcats per 100 km².

Swearington and Davis also evaluated the potential effects of camera station density on rates of photographing and rephotographing bobcats within the study area. In spring 2016 and 2017 they deployed 31 camera stations and monitored them for greater than 1,800 trap nights. Their analyses revealed that effects of camera station density on bobcat detection probability was statistically significant. Numbers of individual bobcats detected increased with moderate and high camera station densities (8–10 cameras/9 km²) compared to lower camera station densities (1–2 cameras/9 km²). No differences in rephotography rates between low and high camera station densities were documented. Deploying moderate camera station densities or repositioning cameras to more productive areas within survey grids may improve capture success where bobcat densities are low. These findings will aid in the mapping of bobcat population demographics throughout the state.

-Evan Greenspan

North Dakota

Randy Johnson finished up the second phase of research conducted on the mountain lion population in the Little Missouri Badlands of North Dakota. This population resides on the eastern fringe of current North American mountain lion range. The 6 years of research (2011-2017) contributes significantly to understanding how mountain lions live in prairie-like habitats. as eastern recolonization continues. Johnson estimated average annual survival at 45.6% (95% CI = 26.4-66.1) between 2012 and 2016. However, sex-specific survival was estimated at 58.9% (95% CI = 33.8–80.0) for females and 25.9% (95% CI = 8.9–55.5) for males. Abundance estimates ranged from a low of 27 total mountain lions (95% CI = 1–52) in 2005-06 to a high of 165 total mountain lions (95% CI = 89–241) in 2011-12. The models suggested that mountain lions showed strong positive selection for landscape ruggedness, edge habitat, and forest, while displaying negative responses to disturbed anthropogenic landcovers. The statewide habitat suitability model indicated 3,969 km² of suitable habitat, approximately 60% in the Little Missouri Badlands and Missouri River Breaks and 40% scattered unevenly across the state in patches too small to sustain resident mountain lions, but which could represent important, temporary dispersal habitats. The results indicate North Dakota can support a relatively small population of mountain lions. The population has declined for several years, primarily due to human-induced mortality. A reduction in mortality, especially among adult females, would allow the population to stabilize, and perhaps increase. Based upon our survival analysis, this may be accomplished through a reduction in annual hunter harvest. Although this population should be considered at risk of over-exploitation, the research suggests it can remain a viable population while sustaining a conservative level of hunter harvest. Copies of the Master's thesis describing this research and the results can be found at *http://openprairie.sdstate.edu/* by searching 'Dave Wilkens' and 'Randy Johnson'.

-Emily Mitchell

South Dakota

In October, 2017, the South Dakota Game, Fish, and Parks (GFP) discussed the state mountain lion management plan, hunting season, and proposed petitions. The next two years' hunting seasons will run from December 26 through March 31 with a limit of 60 aggregate or 40 female mountain lions in the Black Hills Fire District and an open season with no limit outside of the Black Hills Fire District. The Commission also accepted a petition proposing to expand the use of hounds to hunt mountain lions outside the Black Hills Fire District. The proposed change would allow the pursuit of mountain lions on other public lands. GFP recently issued a press release requesting public comment on the current mountain lion management plan prior to the upcoming November 15th commission meeting.

-Emily Mitchell

Texas

Earlier this year, and for the first time in two decades, ocelot kittens (*Leopardus pardalis*) were photographed in South Texas. Several den sites and multiple litters were located on two wildlife refuges, via camera-traps and GPS collars. Texas has been one of the last strongholds of ocelots in North America, and the species has been listed as 'endangered' since 1972. Confirmation of a reproducing population has therefore been met with optimism and encouragement. Texas Parks & Wildlife (TPWD) has recently funded research at Texas A&M University at Kingsville (TAMUK) that will analyze and possibly expedite the restoration of potential habitat.

Though an official statement has not been released, TPWD has considered redefining the status of the jaguarundi (*Herpailurus yagouaroundi*) from critically imperiled to possibly extirpated, based upon the NatureServe definitions (*http://explorer.natureserve.org/nsranks.htm*). Jaguarundis were listed as endangered under the Endangered Species Act in 1976, and the U. S. Fish & Wildlife Service released a Gulf Coast Jaguarundi Recovery Plan as recently as 2013. The last confirmed sighting of a jaguarundi in Texas, however, was in 1986.

-Michael C. Stangl

Multi-state

Bobcats are widely distributed across North America, and have expanded to nearly the entire coterminous U.S. In the western U.S., high market demand for bobcat pelts requires balancing hunting and trapping with harvest sustainability.

Citizen challenges through ballot initiatives, regulatory, and legislative processes can erode state management authority over wildlife. Media coverage often questions whether state agencies are using the best science, making acquisition of reliable data more critical than ever.

Many state agencies started collecting harvest data when the bobcats were listed under CITES in 1977. Because the bobcat has been listed under Appendix II of CITES, it is subject to the same controls as species threatened by international trade, despite it not being of range-wide conservation concern (Association of Fish and Wildlife Agencies 2014). Bobcats serve as an ideal candidate for a multi-state approach using available data and contemporary analytical methods for estimating populations.

With Safari Club International Foundation funding, we are using statistical population reconstruction (SPR) to provide past population and associated error estimates. SPR also can forecast population responses under current or hypothetical harvest regimes. We are analyzing data from Wyoming Game and Fish Department, and working with other states to implement this project. Project web page: *http://www.wildlifeecology.org/bobcat-population-estimation-160350.html.* Project webinar: *https://vimeo.com/236930739.*

-Tim L. Hiller., Florent Bled, and Andrew Tyre

Conservation Status of the Ocelot (*Leopardus pardalis*) in Brazil

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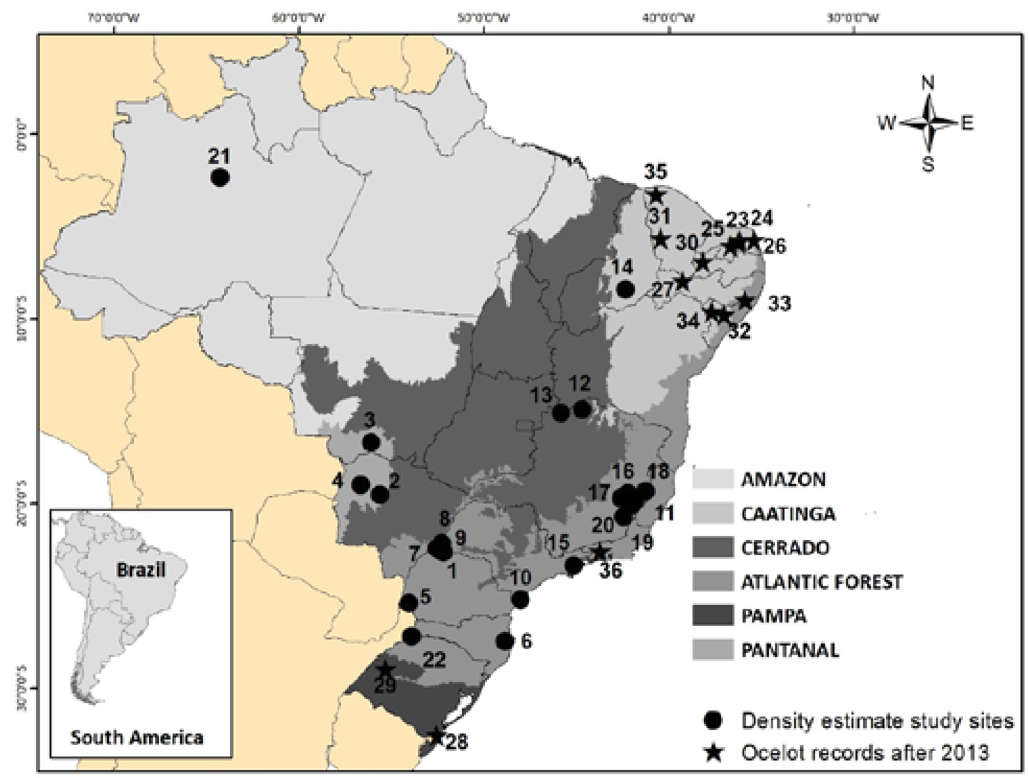

Figure 1 – Study site locations from where ocelot density estimates were reported in Brazil in the different biomes (black dots). Recent records of ocelots published after 2013 (black stars). Numbers correspond to those in Tables 1 and 2.

Of all the countries comprising the ocelot's distribution between the U.S.-Mexico border and northern Argentina, Brazil is probably home to the largest number of individuals. Brazil is the world's fifth largest country by area and one of the three most biodiverse countries in the world (Convention on Biological Diversity; *www.cbd.int*). Ocelots occur in all six of Brazil's biomes, including the Amazon, Cerrado, Atlantic Forest, Pantanal, Caatinga, and Pampas. The first two of these, the Amazon and Cerrado, are the most extensive biomes by area in the Neotropical region, whereas the Caatinga is unique only to Brazil. Most of the extent of five of six of these biomes occur in Brazil, and are all threatened to some degree. Although a thorough revision of the ocelot's conservation status was conducted by Oliveira et al. (2013), many newer studies on ocelots have occurred in recent years, further shedding light on the status of these widespread mesocarnivores. Here we have conducted a comprehensive review of the local population status of ocelots across Brazil (Figure 1), integrating findings of both the earlier and more recent (Tables 1-2) studies and surveys to present a revised update of the ocelot's overall conservation status in the country.

Amazon Basin. The Amazon Basin has long been considered the largest stronghold for ocelots; however, there is very little information on the ecology and status of the species in this part of Brazil (Michalski & Peres 2005, Michalski et al. 2010). A recent study in the Amanã Sustainable Development Reserve (ASDR) in Central Amazonia by Rocha et al. (2016) was the first to estimate ocelot density in the central Brazilian Amazon. The authors incorporated both spatially-explicit (SECR) and non-spatial estimates as part of three camera-trap surveys across three consecutive dry seasons. The more robust SECR approach yielded a high average density estimate of 24.84 (±6.27) ocelots / 100km²) based on the entire sampling period. The authors cautioned that this estimate is likely to be conservative, as density may have been underestimated due to a movement parameter biased toward male ocelots.

Non-spatial models using the two most common approaches to calculate effective sampling area (ESA, e.g., MMDM and ½ MMDM) and making estimates comparable to prior studies (Table 1) led to an average of 28.9 ocelots/100km². Even the highest density estimate from the second year of their survey (40 ocelots/100km² *via* ½MMDM) is lower than estimates of ocelot density from other parts

Table 1 – Study sites where ocelot densities were estimated in the distinct Brazilian biomes, ordered by time of study. Densities were estimated through different approaches, most of them using non-spatial models, three using SECR models, two using telemetry, and one using line transect. Id numbers correspond to those at figure 1. [1]HP stands for Potential Habitat, and it was used by some authors to provide more realistic figures. [2]The FMA (Feliciano Miguel Abdala Reserve) study site was surveyed by different authors with very distinct figures. [3]The NHU (Fazenda Nhumirim and surroundings) sites correspond to a distinct number of ranches within the same central area for each of the studies. *Average from different surveys of the same study.

ID	Study site	Size (ha)	Biome	Density (ocelots/100km^2) / Method					Source
				½ MMDM	MMDM	HP[1]	SECR	Telemetry	
1	Morro do Diabo State Park	36,000	Atlantic Forest	31.3	18				Jacob (2002)
2	Fazenda Santa Emília	2,700	Pantanal	56.4	41				Trolle & Kéry (2003)
3	SESC Pantanal	106,000	Pantanal	11.2	6.93				Trolle & Kéry (2005)
4	NHU[3]	5,000-20,000	Pantanal			30		34	Rocha (2006); Desbiez *et al.* (2010)
5	Iguaçu/Iguazu National Park	259,400	Atlantic Forest	16.8	10.2			15.2	Di Bitetti *et al.* (2008)
6	Caraguatá Ecological Reserve	4,300	Atlantic Forest	4					Goulart *et al.* (2009)
7	Ponte Branca	1,274	Atlantic Forest	17	9	30			Lima (2009); Lima *et al.* (2017)
8	Seis R (6R)	405	Atlantic Forest	25	10	95			Lima (2009); Lima *et al.* (2017)
9	Santa Mônica (SM)[4]	453	Atlantic Forest	62	28	110			Lima (2009); Lima *et al.* (2017)
10	Ilha do Cardoso State Park	15,100	Atlantic Forest	40	21				Fusco-Costa *et al.*(2010)
11	FMA[2]	958	Atlantic Forest	35	16				Paschoal *et al.* (2012)
11	FMA[2]	958	Atlantic Forest	3	2	7			Massara *et al.* (2015)
12	Veredas do Peruaçu State Park	31,500	Cerrado	11	4				Oliveira (2012)
13	Grande Sertão Veredas NP	230,714	Cerrado	5	2				Oliveira (2012)
14	Serra da Capivara NP	129,953	Caatinga	4.5	2.67		3.16		Penido (2012); Penido *et al.* (2016)
15	Serra do Mar State Park	315,300	Atlantic Forest	16.7	10.3		8.37		Mendonça (2014)
16	Fazenda Macedônia	560	Atlantic Forest	13.5	6.5	117			Massara *et al.* (2015)
17	Rio Doce State Park	35,970	Atlantic Forest	28.5	13.5	41			Massara *et al.* (2015)
18	Sete Salões State Park	12,520	Atlantic Forest	6	3	10			Massara *et al.* (2015)
19	Mata do Sossego Reserve	134	Atlantic Forest	9.5	4	14,5			Massara *et al.* (2015)
20	Serra do Brigadeiro State Park	14,985	Atlantic Forest	10.5	5.5	17,5			Massara *et al.* (2015)
21	Amanã SDR	2,350,000	Amazon Forest	28.9*	19.6*		24.84*		Rocha *et al.* (2016)
22	Turvo State Park	17,500	Atlantic Forest	51.5*	18.5*				Kasper *et al.* (2016)

of the Amazon forest (Emmons 1988, Kolowski & Alonso 2010) and 2-3 times lower than predicted, based on Di Bitetti et al. (2008). The latter approach may therefore have limited application for estimating local population densities and thus for conservation planning.

Rocha et al. (2016) proposed that these incongruities are due to local environmental effects more than latitude and regional rainfall, and proposed that ocelot density is highly variable throughout the Amazon. They emphasized that, although ASDR consists of a large tract of intact forest (23,500 km^2), with 85% of it perhaps suitable ocelot habitat (i.e. '*terra firme*' forest); the adjacent Mamirauá SDR (11,240 km^2) likely has no resident ocelot population due to it being composed almost entirely of flooded forest (Rocha et al. 2006). Using the more robust SECR density estimate (24.84 ocelots/100 km^2) and including both protected areas in addition to Jaú National Park (23,670 km^2), also contiguous with this PA complex, we might expect a population of some 10,840 ocelots. However, if we assume that only 10% of this total are contributing to reproduction at any one time (Frankham 1995, Oliveira et al. 2013), no more than one thousand ocelots may be breeding across a very large contiguous tropical forest expanse of 58,000 km^2. Although speculative, we hope this last exercise highlights a need for additional investigations of ocelot populations in the Amazon Basin. Such investigations would better account for the variation in habitat suitability across what superficially appears to be an otherwise homogenous biome, the largest tropical forest biome in the world.

Caatinga. The semi-arid Caatinga biome covers almost 740,000 km^2 in northeastern Brazil (MMA/SBF 2002). To date, only a handful of studies of ocelot ecology have occurred there (e.g., Oliveira 2012, Oliveira 2016, Penido et al. 2016). Further limiting applicability, all of these occurred within Serra da Capivara National Park (SCNP), an area of 1,300 km^2 located in Piauí State (Figure 1).

Oliveira (2012) established 70 double-sided camera-trap stations in SCNP to estimate ocelot density. Data collected over 140 days yielded an estimated abundance of 58 ocelots (95% CI = 54-72). Using buffers based on MMDM and ½ MMDM around the 70 trap-stations, he concluded ocelot densities were 2.67 (±0.94) and 4.49 (±1.05) ocelots/100 km^2, respectively (Table 1). Spatially-explicit estimates of the park yielded a comparable density estimate of 3.16 (±0.46) ocelots/100 km^2 (Penido et al. 2016), or approximately 42 ocelots in the park.

Using the regression model provided by Di Bitetti et al. (2008), the predicted density for SCNP ranged somewhere between 18 (based on rainfall) and 85 (based on latitude) ocelots /100km^2. As Rocha et al. (2016) claimed, however, rainfall and latitude alone cannot reliably predict ocelot densities at different sites. Oliveira (2016) concluded ocelot occupancy at SCNP was positively correlated with small mammal presence, and negatively influenced by jaguar presence. He recorded a decrease in ocelot abundance in the park from 2009 to 2010 which was concurrent with an increase in jaguars during the same period (Astete 2012).

Point	Biome	State	Latitude; Longitude	Record type	Source
23	Caatinga	RN	5° 52,78'S; 36° 14,03'W	Pelt/hunt	Marinho *et al.* (2017)
24	Caatinga	RN	5° 46,58'S; 36° 10,12'W	Hunt	Marinho *et al.* (2017)
25	Caatinga	RN	6° 04,32'S; 36° 39,58'W	Hunt	Marinho *et al.* (2017)
26	Atlantic Forest	RN	5° 45,73'S; 35° 22,9'W	Roadkill	Marinho *et al.* (2017)
27	Caatinga	PE	7° 57,18'S; 39° 15,42'W	Capture	Kaminski *et al.* (2013)
28	Pampas	RS	32° 33,49'S; 52° 33,09'W	Camera-trap picture	Peters *et al.* (2017)
29	Pampas	RS	28° 57,32'S; 55° 19,25'W	Tracks	Peters *et al.* (2017)
30	Caatinga	PB	6° 56'S; 38° 9'W	Voucher specimen	Feijó & Languth (2013)*apud* Marinho *et al.* (2017)
31	Atlantic Forest	CE	5° 41'S; 40° 27' W	Voucher specimen	Feijó & Languth (2013)*apud* Marinho *et al.* (2017)
32	Caatinga	AL	9° 47,65'S; 37° 00,12'W	Hunt	Silva & Palmeira (2014)*apud* Marinho *et al.* (2017)
33	Atlantic Forest	AL	8° 59,7'S; 35° 50,45'W	Sighting	Mendes Pontes *et al.*(2016)
34	Caatinga	SE	9° 39'S; 37° 40'W	Camera-trap picture	Dias & Bocchiglieri (2016)*apud* Marinho *et al.* (2017)
35	Caatinga	CE	3° 18'S; 40° 41'W	Voucher specimen	Feijó & Languth (2013)*apud* Marinho *et al.* (2017)
36	Atlantic Forest	RJ	22° 35,86'S; 43° 42,32'"W	Tracks	Gomes (2014)

Table 2 – Records of ocelots published after revision of Oliveira *et al.* (2013). Numbers correspond to those in figure 1.

Despite extensive research on ocelot ecology in SCNP, more studies in other parts of the Caatinga are needed to provide a broader understanding of ocelot area requirements and habitat needs in this unique biome. The existing estimates are suggest that ocelot density in Brazil might be at its lowest in the Caatinga. Future investigations might focus on the impacts of different land uses on ocelots in this region and ocelot distribution and/or occupancy on private land. Very recent records of ocelots in this biome (Figure 1; Table 2) might help identify study areas and ecological contexts worth investigation.

Cerrado. The Cerrado biome also suffers from a lack of investigations of its ocelot populations. The Cerrado is the second largest biome of Brazil (2 million km²), and many of the country's major river basins originate within its borders. Unfortunately, more than 50% of its original cover has disappeared at a rate of approximately 21,300 km²/year (Klink & Machado 2005, Ganem et al. 2013), most converted to agriculture. This makes it a top national priority for conservation.

In an area of about 700km², where only about 8% of the original cover remained, scattered across a matrix of sugar cane and Eucalyptus, ocelots avoided isolated habitat fragments and were less likely to cross dissimilar agricultural matrices (Ciocheti 2007, Lyra-Jorge et al. 2008). In two conservation units of the Cerrado in the states of Minas Gerais and Bahia (Figure 1, Table 1), Oliveira (2012) used camera-traps to estimate ocelot density. For the larger of the two, Grande Sertão Vereda National Park (GSVNP; c. 2,300 km²), ocelot density was low, ranging from 2 (MMDM) to 5 (½MMDM) ocelots/100km². Density in the much smaller Veredas do Peruaçu State Park (VPSP; c. 315 km²) was greater, ranging from 4 (MMDM) to 11 (½MMDM) individuals/100km². Although the areas sampled by Oliveira (2012) were small relative to the total area of each park, these represent the only estimates of ocelot density for the entire Brazilian Cerrado. Furthermore, the author suggests that the more conservative density estimate of 2 ocelots/ 100 km² for GSVNP is probably more accurate. Given limited results, further investigations of ocelot status need to be undertaken in the Cerrado across different fragmentation complexes in order to provide a more complete picture.

Pantanal. Although one of the smallest biomes of the country (c. 140,000 km²), the Pantanal wetlands are considered one of the most intact, retaining some 85% of its original landscapes (MMA/IBAMA2011). They are also the largest wetlands in the world, 85% of which occur in Brazil (Swarts 2000). Most of the biome is comprised of private property, which is used as"natural range" for cattle ranching; there, the conservation of wildlife and landscape is mostly dependent upon the action of landowners (Zimmerman et al. 2005). The Pantanal is composed of distinct ecoregions, which differ based on the intensity of flooding, topographical relief, and type of soil and vegetation (Silva & Abdon 1998). It also connects with four other major biomes of South America: the Amazon, Cerrado, Atlantic Forest, and the Gran Chaco, and is a natural refuge for many threatened and endangered species (Harris et al. 2005). The highlands surrounding the low-lying Pantanal plains, however, are suffering from expansive conversion to agriculture. In addition to the loss of the natural ecosystem, these crop monocultures are causing massive erosion, siltation, and an influx of pesticides into fragile, seasonal watersheds (Swarts 2000, Harris et al. 2005).

Four assessments of ocelot populations exist for the Pantanal, covering three distinct ecoregions (Figure 1, Table 1). This has resulted in a better understanding of ocelot ecology, compared with the Cerrado and Amazon Basin. Trolle & Kéry (2003) used camera-traps in the Pantanal in two different geographical regions. Their estimates in the southern Pantanal using a non-spatial approach and an *ESA* based on ½ MMDM resulted in an estimate of 56.4 ocelots/100km² (95% CI = 17.2 to 95.8). Their investigation of ocelots in the northeastern portion of the biome yielded an estimate of between 7 (MMDM) and 11 (½MMDM) ocelots/100 km² (Trolle & Kéry 2005). The authors noted that, although ecological differences between these two areas provide a partial explanation for the differences ocelot abundance, the southern study area was probably too small and did not meet criteria proposed by Maffei & Noss (2008). The latter authors concluded that the ESA should be at least 3-4 times larger than an average home range to obtain reliable density estimates; for Trolle & Kéry (2003) this was not the case, leading to a very inflated estimate. Because of their initial results in this area, we suggest that Trolle & Kéry (2005) consider revisiting their dataset using a SECR framework, which isn't reliant on this method of estimating the area sampled.

Two other studies arrived at similar estimates of ocelot density for closed forest habitat in the same study area using different methodological approaches. In one study, five ocelots (1 male and 4 females) were captured and fitted with VHF-collars and monitored from 120 to 200 days (Rocha 2006). Tracked animals had an average home range area of 3.5 km² with an average overlap of 16%, indicating an exclusive area of 2.9 km². Taking the inverse of this exclusive area, Rocha (2006) estimated a minimum density of 34 ocelots/ 100km². Using strip-transects to estimate the density of medium-large non-volant mammals, Desbiez et al. (2010) obtained a comparable result for ocelots (29 ocelots/100 km²) in the same habitat, with a lower estimate for mixed open shrub forest (7 ocelots/100 km²).

Despite comparable density estimates, we suggest that standardization of methods used in assessing ocelot populations applied to geographical regions across the Pantanal would create a baseline information for ongoing monitoring.

Pampas. The Pampas of southernmost Brazil is considered a biome that lies outside the ocelot's current distribution (Oliveira et al. 2013, Paviolo et al. 2015). However, a camera-trap record from December 2013 depicts a male ocelot 300 km south of the previously known record for the species (Peters et al. 2017; Figure 1). The authors debated whether this was an isolated dispersal event, or the beginning of recolonization of ocelots from other parts of Brazil, but the issue remains unresolved. Either way, this record highlights the importance of additional studies across the pampas.

Atlantic Forest. The Atlantic Forest once covered almost 1.5 million km² of Brazil. Today it is the most fragmented biome in the country, with <12% of its original vegetation remaining across some 245,000 fragments of different sizes (Ribeiro et al. 2009). Forty percent of the remaining area of Atlantic Forest is made of of fragments <250 ha. Over 97% of these fragments are <250 ha, with more than 80% <50 ha. Only approximately 0.03% of remaining fragments are > 10,000 ha (Ribeiro et al. 2009). This has serious implications not only for ocelots, but the survival of fauna that depend on this biome.

Because of the dire need, many studies have been initiated in recent years to advance ecological knowledge in this biome. Ocelot abundance and density estimates have occurred with disproportionately greater frequency than in any other biome in Brazil. Studies have been conducted across at least 15 sites, and estimates have varied from among the lowest in Brazil (4 ocelots/100 km²) to high estimates based on potential habitat (110 ocelots/100 km²) (Figure 1, Table 1; Goulart et al. 2009, Lima 2009).

In the southern Atlantic Forest biome, the low estimates of Goulart et al. (2009) may be explained by several key factors. For example, the authors sampled a small reserve (43 km²) that was isolated and surrounded by crops; in addition, there were signs of frequent illegal hunting over half of the area, where no ocelots were detected. A similar situation might explain low detection rates in the western portion of São Paulo State (known as 'Pontal do Paranapanema'), a region that once encompassed 3,000 km² of forests that is now highly fragmented and where only about 15% remains (Lima 2009). In the largest fragment that Lima (2009) surveyed (17 km²), the low number of camera-trap records precluded any abundance estimate. He argued that this was due to a road bordering the fragment (where at least one male road kill occurred}, illegal hunting, presence of domestic dogs, low small mammal richness, and low abundance of medium-large mammals. Three other fragments surveyed by Lima (2009) provided some of the largest density estimates for the Brazilian Atlantic Forest (Table1). Jacob (2002) estimated ocelot density to vary between 18 (MMDM) and 31 (½MMDM) ocelots/100 km² for Morro do Diabo State Park (PEMD – 360 km²). However, Lima (2009) estimated that approximately 200 ocelots occurred in the whole 'Pontal do Paranapanema,' further questioning the viability of this population unless habitat restoration and greater connectivity can be achieved. As ocelots have demonstrated some adaptability, traveling among fragments in more permeable matrices including Eucalyptus plantations (Ciocheti 2007, Lyra-Jorge et al. 2008, Massara et al. 2017), improved management of habitat matrices for ocelots in multi-use Atlantic Forest landscapes should include the integration of these agricultural options.

Massara et al. (2015, 2017) evaluated six other Atlantic forest fragments (private reserves and state parks) in Minas Gerais State (Figure 1, Table 1), with some interesting findings. First, they expected reserve size would correlate positively with ocelot density, and this was the case. Secondly, however, they expected to see a negative correlation between ocelot density and the presence of competitors or larger predators, including jaguars, and pumas. Instead they found the opposite, suggesting perhaps that the presence of all predators and higher ocelot densities may have instead been indicative of the health or biomass of prey populations.

Conclusion

Using density estimates published through 2012, Oliveira et al. (2013) evaluated the status of ocelots throughout Brazil, proposing an effective population estimate of 40,000 mature individuals and recommending an IUCN status of Least Concern (Oliveira et al. 2013) with a low risk of extinction. Although we agree with the status, we are reluctant to assign a national population number. We consider current ocelot status in the context of substantial new additional information. The Amazon Forest, previously considered *the* major stronghold for ocelots in Brazil, may not be the refuge once believed. We suggest that more studies are needed in distinct Amazonian ecoregions before revising the importance of the area to the overall status of the species (Rocha et al. 2016). In addition, other biomes with reportedly high ocelot densities in Brazil (Trolle & Kéry 2003, Lima 2009) are facing expanding threats. The Pantanal wetlands are extremely sensitive and require constant monitoring to safeguard against anthropogenic impacts (Harris et al. 2005), and the Atlantic Forest is nearly gone, and what remains is extremely fragmented. Because the latter biome supports about 70% of Brazil's human population, conservation-minded land use strategies and restoration are needed to improve the efficacy of conservation efforts there (Ribeiro et al. 2009). The Cerrado biome is currently experiencing the highest pressure for conversion to monoculture, and yet little is known about ocelot's status or of the status of most carnivores. Although the Caatinga is likely to host low ocelot densities, its uniqueness in the world warrants special conservation, whereas the Pampas could be experiencing an increase due to dispersaing ocelots and might host more suitable habitat than traditionally believed (Peters et al. 2017). Greater effort in developing standardized approaches and long-term programs to evaluate ocelot population status could yield more robust scientific insights into how land use changes across Brazil might impact the species. Conversely, because local ocelot populations might lend themselves to more robust estimates of abundance relative to other felids, they could potentially serve as an early warning system for habitats suffering negative anthropogenic impacts in Brazil.

Where are the ocelots (*Leopardus pardalis*)? Reconsidering their distribution across the Gran Chaco

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The ocelot (*Leopardus pardalis*) is distributed from the southernmost borders of Texas and Arizona, south through northernmost Argentina and southern Brazil. A generalist mesopredator, the ocelot is designated as "Least Concern" by the IUCN Red List (Paviolo et al. 2015). Prior to the past 10-15 years and outside of Texas, ocelots have not been the subject of many direct or detailed ecological studies, where jaguars were not the primary focus. This prompted critical questions relating to ideal study designs specifically for the small felid (Dillon & Kelly 2007, Maffei & Noss 2008). In the Dry Chaco of Bolivia, the ocelot is the most abundant and frequently-detected felid (Maffei et al. 2005) as it commonly is at many localities across the Neotropics. For this study, our primary objective was to conduct the first camera-trap survey of medium-large mammals in the transitional "Low" Gran Chaco of Paraguay using an occupancy modeling sampling framework (i.e., following Mackenzie et al. 2006). A secondary objective was to shed light on the distribution of a few key species, including the ocelot, for which distribution and abundance data are lacking (Giordano et al. 2014). We report on our partial findings relevant to the ocelot's distribution in Paraguay and the Gran Chaco ecoregion, a biome across which ocelots are believed to be widely distributed (Maffei & Noss 2008, Paviolo et al. 2015).

Figure 1. Relative general location of our study sites in the lower Paraguayan Chaco.

Study Area & Methods

The Dry Gran Chaco is the second largest ecoregion in Latin America, covering almost 800,000 km^2 from southern and eastern Bolivia, through Paraguay into northern Argentina (Olson et al. 2001, Clark et al. 2010). The region includes the largest continuous Neotropical Dry Forest (Eva et al. 2004) and some of the most rapidly-disappearing tropical forests in the world (Kuemmerle et al. 2017). In Paraguay, the "Transitional" Chaco is an extensive zone of contact between the Dry or Semi-arid Chaco (400-500 mm/ year precipitation) and the Wet or Humid Chaco (800-1300 mm/ year precipitation) (Batrina 2007). Most of the Humid Chaco in Paraguay occurs in the political departments of President Hayes, although some occurs in Boqueron and east of the Paraguay River. The "transitional" ecotone consists of dry forest and brush alternating with open and semi-open floodplain and non-floodplain regions across President Hayes and parts of Boqueron. For this study, we established three geographically and ecological distinct study areas: two can be characterized as mixed transitional and Dry Chaco (40 km^2, 180 km^2), whereas the third is most representative of intact Humid Chaco (400 km^2) and was closest to the capital of Asuncion (< 30 km) (Figure 1). In contrast to many prior camera-trap investigations, all of our study areas consisted of private property where cattle-ranching was the primary economic land use. Furthermore, although the majority of each ranch was comprised of extensive tracts of intact, native vegetation (~50-75%), cattle often ranged openly across most of each site, and no ranch occurred in close proximity to a national park or other federal protected area.

We conducted surveys over two distinct spring sampling periods in consecutive years, one each in 2011 (2 August – 16 November) and 2012 (6 September – 30 November) using 64 unbaited, single-unit camera-trap stations across all three areas in the Humid and Transitional Gran Chaco of Paraguay. To avoid biased estimates of detection probabilities (Mackenzie et al. 2002, 2006), individual camera sites were not based on historical records or recent indirect sign (e.g., tracks, scat or previous photographs) of wildlife occurrence and activity. Instead, camera-traps were deployed uniformly on trails and roads following random selection of the first camera-trap location in each study area. The spacing of camera-trap station intervals ranged from 0.5 – 3 km according to the size of each study area we sampled (40 – 400 km^2). All cameras had a minimum reset interval of one minute and operated continuously across all sites and during each sampling period until the survey was complete. To our knowledge, there were no interruptions in camera performance and operation during our survey periods.

Results & Discussion

We logged 5790 camera-trap days across all three sites for both years, approximately half in each year (2011, 2012). In addition to numerous birds, small mammals, and reptiles, we detected 11 medium-large mammal species, including maned wolf (*Chrysocyon brachyurus*), giant anteater (*Myrmecophaga tridactlya*), collared peccary (*Pecari tajacu*), Geoffroy's cat (*Leopardus geoffroyi*), puma (*Puma concolor*), tapir (*Tapirus terrestris*), white-lipped peccary (*Tayassu pecari*), Chacoan peccary (*Catagonus wagneri*), jaguarundi (*Puma yagouarondi*), jaguar (*Panthera onca*), and ocelot (*Leopardus pardalis*). Unexpectedly, ocelots were not recorded at two of our three distinct study sites, including the two sites with largest proportion of mixed

Figure 2. Single independent ocelot record from our southernmost site in the Humid Chaco.

Semi-arid Chaco vegetation, which have understory and thick cover superficially consistent with ocelot habitat associations elsewhere (Paviolo et al. 2015; Jackson et al. 2005). From our largest study site (i.e., typical of Humid Chaco and relatively close to Asuncion), we obtained only a single independent record of an ocelot across both sampling occasions (Figure 2). In comparison, we recorded at least 61 independent records of Geoffroy's cats across all three sites, and 39 independent records of pumas. We recorded only four independent records of jaguars, all at one site in the transitional Chaco, a result which suggests their distribution needs further investigation in the Humid Chaco of Paraguay (Giordano et al. 2014).

The Gran Chaco is commonly believed to represent a geographical region where the ocelot is continuously distributed from its northernmost edge, through the southern range limit for the species in Argentina (Paviolo et al. 2015). In the largest protected area in the Bolivian Chaco, Maffei et al. (2005) identified at least 145 individual ocelots across four study sites over 12,615 camera-trap nights. At a fifth site, they failed to detect an ocelot after 960 camera-trap nights. In comparison, they detected very few Geoffroy's cats (n = 39) despite more than twice our sampling effort. Maffei et al. (2005) also identified more than twice as many individual ocelots as pumas (30:12). In the Dry Chaco of northern Paraguay, ocelots have been detected at Chaco Defensores National Park with relatively little sampling effort (< 1000 camera-trap nights) at camera-trap stations established well off roads and trails, as well as in native Dry Chaco habitat in private ranches > 100 km to the south (A. J. Giordano, unpub. data). Similarly in the gallery forests along the Paraguay River watershed along the eastern edges of the Humid Chaco, ocelots also appear to be relatively common and easy to detect via camera-trap (A. J. Giordano, unpub. data). In the Argentine Chaco however, the geographical region due south of our study sites, camera-trap surveys of three areas of intact Chaco habitat and limited land use transformation (e.g., national park, aboriginal reserve, unprotected area) yielded a very low ocelot detection rate of 0.05/100 camera-trap days at one site, and a failure to detect ocelots at the other two (Quiroga 2013). These very low detection rates, particularly for restricted use and protected areas, would be equivalent to approximately 2.8 independent total ocelot detections based on our own sampling effort, and so were consistent with our findings. Moreover, detection rates for pumas (1.4 – 5/ 100 camera-trap days) and Geoffroy's cats (1.66 – 3.62/ 100 camera-trap days) in the Argentine Chaco were relatively high (Quiroga 2013) compared to ours (Geoffroy's cats: 1.05/100 camera-trap days; pumas: 0.67/ 100 camera-trap days), possibly due to the relative protected status of the Argentine study sites.

That our sampling occurred entirely on private land where extensive cattle production is the primary land use may have played some role in our failure to detect ocelots. Given, however, that ocelot detection rates in the northern Gran Chaco and elsewhere frequently exceed those of pumas and even Geoffroy's cats, it is likely that other factors may also be involved. This may include a potential reconsideration of the ocelot's distribution near the southern end of their range, and those factors most relevant to its occupancy and ecology there. We believe our results are consistent with the findings of Quiroga (2013), who detected ocelots at a very low rate across relatively protected areas further south of where we sampled, and where other wildlife species were abundant. We recommend additional surveys focused on the ocelot across broad parts of the southern Gran Chaco, including both Dry and Humid Chaco, the various transitional ecotones, and the frequently interspersed gallery forest habitats. We further suggest that investigators conducting general camera-trap surveys in the region at least report on ocelot detection rates in the context of total sampling effort. Although not sufficiently robust for estimating ocelot occupancy, such detection rates may permit relative comparisons across areas that could prove useful in further delineating this small cat's presence and distribution in this part of the southern cone.

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Local population status, activity, and habitat associations of the ocelot (*Leopardus pardalis*) in northern Quintana Roo, Mexico

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Although the ocelot (*Leopardus pardalis*) is widespread across the Neotropical biogeographical region, many local populations face the same anthropogenic threats as more threatened species. Habitat loss and fragmentation, illegal hunting and trade, changes in land use patterns, and an increase in regional tourism, are all contributing to the gradual reduction of the ocelot's geographic grange in Mexico (Aranda 2005, Servín 2013, SEMARNAT-059 2010). Some states such as Quintana Roo are also susceptible to the impact of periodic natural phenomena like hurricanes, ten of which have impacted the state in the past two decades (CONAGUA 2006, 2012). Fires have also been part of the ecological stochasticity of Quintana Roo, and have affected more than 1000 km^2 of suitable forest habitat over the past 30 years (CONAFOR, 2016). Knowledge of the status of local ocelot populations could potentially shed light on how they and other local mesocarnivore populations that are now relatively abundant might be impacted in the future by activities exacerbated by climate change. Here our objectives were to gain a better understanding of the minimum home range areas for individual ocelots in Quintana Roo; report on the activity and habitat use of ocelots; and, estimate the population abundance and density of a local ocelot population in a tropical forest context typical of the northern Yucatan Peninsula.

Figure 1. Camera-trap photo of adult female ocelot (top) and camera-trap photo of adult male ocelot (bottom) in El Eden Ecological Park.

Methods & Techniques

Our study occurred in The Eden Ecological Reserve, a small (3,077 ha) ecological reserve, which is located in the Municipality of Lázaro Cárdenas (21° 13'N, -87° 11'W; Lazcano-Barrero et al. 1995), approximately 48 km northwest of Cancun in northern Quintana Roo, Mexico. Eden was founded in 1993 as the first private ecological reserve in Mexico dedicated to research, conservation, management, and restoration of biodiversity. It has an annual average temperature of 24.7°C and an average rainfall of 1,200 mm (Allen and Rincón 2003). Eden encompasses seven major tropical ecosystem types: primary semideciduous forest, secondary semideciduous forest, savanna, seasonally flooded forest, palm grove, cenote, and other wetlands.

We conducted a systematic camera-trapping survey over a 60-day period between the third week of July and the second week of September 2008. Following Chávez et al. (2007), we used grid cells of 3x3 km² to establish 27 independent digital camera-trap stations (Cuddeback-expert 3.0 Mpx® and Moultrie-D40 4.0 Mpx®) along forest trails; 18 stations consisted of a single camera-trap, and nine stations consisted of two camera-traps on opposite sides of the trail to identify both flanks of individual ocelots. Stations were spaced approximately 1 kilometer apart and covered three of the tropical habitat types most representative of the study area: (1) primary semideciduous forest (27 km^2), (2) secondary semideciduous forest (45 km^2), and (3) savanna (9 km^2).

Each individual ocelot was identified by their unique pelage patterns and markings as recorded in photographs (Figure 1). In addition, we used the presence or absence of testicles at angles when they should be visible, as an indicator of "apparent sex" for individual animals. We calculated the relative abundance index (*RAI*) using the formula suggested by Sanderson (2004): *RAI* = (*C/EM*) x 1,000 days/trap, where C = the number of independent capture events, and EM is the total sampling effort, or "camera-trap nights" (number of trap cameras multiplied by the sampling days). To avoid overestimatingg*RAI*, we considered consecutive records independent only if they occurred at least one hour apart. To compare the RAI for ocelots in each habitat type, we used a chi-square distribution test (X^2) (Krebs 1998). We also evaluated sex-specific differences in activity patterns using independent records grouped in two hour-intervals over 24-hour periods. To test for differences in the activity patterns of male and female ocelots and among habitats, we used the Wald test in the *Activity* module of Program R (Rowcliffe 2015). Following Karanth & Nichols (1998), we used the software *Capture* to estimate ocelot population abundance (*A*), then estimated density by dividing abundance (*A*) estimates by the effective sampling area (*ESA*). We estimated the *ESA* by integrating a buffer area based on the minimum observed home range (*MOHR*) of ocelots into the minimum convex polygon (*MCP*) of the camera-trap sampling array (*MCP* = 54 km^2; Kernohan et al., 2001). Here we define the *MOHR* as the average minimum home range for individual ocelots recorded at > 2 camera-trap stations using the *MCP* for each. Finally, we used a chi-square goodness-of-fit test (X^2) to evaluate for sex-related differences in *MOHR*.

Results & Discussion

We registered 2,160 camera-trap nights for our total sampling array. We recorded 69 photos of ocelots overall: 40 in primary tropical forest habitat (2:3 males to females), 25 in secondary forest growth (3:2), and only 4 in the savanna habitat (1 female and one of undetermined sex). Our estimates of ocelot *RAI* were greatest for tropical forest (1.85 ± 0.27), followed by secondary forest (1.11 ± 0.22), and were very low for savanna (0.185 ± 0.09). Early works (e.g., Emmons 1989; Sunquist & Sunquist 2002; Jackson et al. 2005) concluded that ocelots prefer dense cover for resting places, den sites, and hunting, and our findings that savanna habitat was least frequented are at least consistent with this idea. However, this idea doesn't explain why ocelot detections were so low in secondary forest relative to primary forest, particularly given the relatively greater size of the former. It is possible that primary forest in this region provides greater resistance or resilience to stochastic events, including fires and hurricanes; in contrast, secondary growth might be more seasonally more important to females with kittens (Emmons 1988; Sunquist 1991).

Both male (n=44) and female (n=38) ocelots were predominantly nocturnal (Figure 2). and were significantly more active at night than at other periods, including twilight (W = 3.74, $p<0.05$). Females were never recorded between 1000 and 1600 hours, a 6-hour period of inactivity. Interestingly, males exhibited a 10-hour period during which no records occurred (0800 and 1800 hours). Activity peaks for male ocelots occurred between 2000 and 2200 hours (n=10), whereas female activity peaked between 0200 and 0400 hours (n=10). Our findings are consistent with most prior studies; Di Bitetti et al. (2006) and Maffei et al. (2005) both concluded that while ocelots were active both day and night, they were significantly more nocturnal. Ocelot nocturnality is also consistent with when many ocelot prey species are either active or vulnerable (e.g., rodents, reptiles and small mammals and birds; Murray and Gardner 1997).

We identified 12 individual ocelots, including five confirmed males, six "apparent" females, and one individual of indeterminate sex. Of these, six ocelots (4:2) were detected by at least three camera-trap stations, yielding an *MOHR* and permitting us to calculate an *ESA* of 107.22 km². The average MOHR of male ocelots (4.63 km²) was significantly larger (2.57x) than that of females (1.80 km²) ($X^2=259.47$; gl=1; $p <0.05$), although there was overlap among individuals of the same and different sexes. Whereas we detected MOHR overlap between males and females, we did not detect such overlap among adjacent males. Emmons et al. (1989) also found similar disparities among *MOHR* areas across a wider range in Peru (3.5 km² - 17.7 km² for males; 0.7 km² and 14.6 km²). Navarro (1985) found male ocelot home ranges in Texas averaged 2.52 km² and females 2.07 km², whereas Martínez-Meyer (1997) reported that average female ocelot home ranges (5.68 km²) were actually larger males (5.23 km²) in the coastal dry forests of Mexico, though not significantly so.

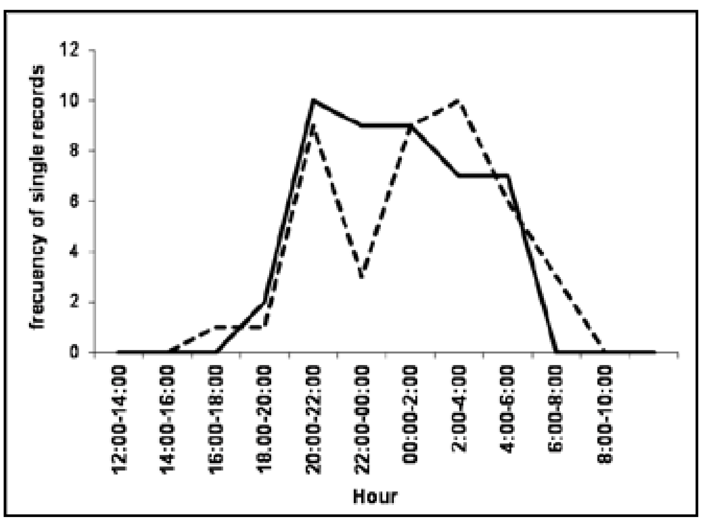

Figure 2. Activity pattern of the ocelot (males and females) in the northern Quintana Roo, Mexico. The black lines correspond to male ocelots (solid)and female ocelots (dashed).

We estimated overall ocelot abundance (*A*) to be 15. Based on the *ESA* of 107.22 km², this is approximately 0.14 ocelots/ km², or 14 ocelots/ 100 km². We estimated the sex ratio to be even (1:1), or male and female density each at 7 individuals/100 km². Our estimates are similar to those recorded from other sites, including the Upper Parana Atlantic Forest of Argentina (13.36/100 km²; Di Bitetti et al, 2006) and Guatemala (14.70/100 km² ; Moreira et al. 2007). However, they are much lower than those from many Neotropical study areas, including Costa Rica (23.57/100 km²; Salom 2005), Bolivia (30-56/ 100 km²; Maffei et al. 2005), Texas (30/100 km²; Haines et al. 2006), Belize (22.85/ 100 km² and 25.88/100 km²; Dillon and Kelly 2007, 2008), and Los Chimalapas in Mexico (22-38/ 100 km²; Pérez-Irineo and Santos-Moreno 2014). Still, our density estimate is reason for cautious optimism regarding the health of the ocelot population in the northern Yucatan Peninsula. Conservation Areas in this region include Ría Lagartos Reserve Natural Park, Yum Balam Flora & Fauna Protection Area, El Zapotal Protected Natural Area, Bocas de Dzilam State Reserve, El Eden Ecological Reserve, and the Yalahau region, which combine to protect 400,000 ha of protected rainforests (Faller et al. 2006). Based on our findings, this could mean habitat for upwards of 560 individual ocelots.

In recent years, the Yucatan Peninsula and other regions of far southern Mexico have been subject to moderate and more severe anthropogenic factors with the potential to negatively impact ocelots and many other wildlife species. The construction of new major roads in southeastern Mexico, including the Cancún-Mérida and Ideal-Cancún Freeways, could directly influence connectivity of ocelots and other wildlife populations between the northern Yucatan, and larger protected areas further south in the Peninsula such as Calakmul Biosphere Reserve, Balam Ka´ax Ecological Park, Balam Ku Archaelogical & Ecological Park, Balam Kim Ecotourism Forest, and Sian Kaan Biosphere Reserve. As our study was only a snapshot of the relative health of one local ocelot population, we contend that the highly biodiverse ecosystems in the Yucatan, particularly conservation areas, parks, and other protected areas, could benefit from a widespread, state-sponsored, long-term monitoring program. We were able to provide here baseline information on the status of ocelots that could serve as a reference for comparing future population estimates in El Eden Ecological Park, and in other parts of the Yucatan Peninsula, useful in advance of expected land use and climatic changes. More optimistically, we hope consideration of studies like ours can be integrated into land use development planning to maximize the protection of tropical forest ecosystems, and minimize the human footprint on habitat connectivity.

Ocelot (*Leopardus pardalis*) population density in 7 study sites over multiple years in Belize, Central America

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Ocelots (*Leopardus pardalis*) are medium sized wild cats with unique coat patterns comprised of variations of dappled markings and streaks (Figure 1). The ocelot currently occupies stretches of habitat ranging from southern Texas to northern Argentina including Trinidad and the island of Isla de Margarita, Venezuela. Ocelots are listed as least concern by the IUCN Red List of Threatened Species, however, long-term monitoring is essential due to range loss, demand for recreational hunting and fur trade, and human-wildlife conflict (e.g., poultry depredation) (Hunter, 2015).

Figure 1. Photo captured ocelot in Belize, Central America showing distinct coat pattern.

In Belize, we sampled ocelot populations across a wide range of elevations and habitat types. Lowland sites included broadleaf moist evergreen seasonal forests, saltwater swamp, freshwater swamp, and pine savanna. Upland sites included broadleaf forests, evergreen and semi-evergreen broadleaf tropical moist rainforests, and native tropical pine forest (*Pinus carribea*). We set up camera-trapping grids across 7 field sites, using 2 remotely-triggered infrared game cameras at each station, with a total of 20 to 50 stations depending on site and year (Figure 2). Since ocelots commonly use roads and trails (Dillon and Kelly 2007), we chose locations where the probability of capture was highest (e.g., logging roads, trails, game trails, and main roads) and spaced camera stations (1.5 – 3 km apart) to ensure that each individual had a non-zero probability of being captured. Survey lengths were no longer than 3 months to meet the assumption of demographic closure.

We ran spatial capture-recapture models in R package secr, incorporating likelihood models with a half-normal detection function (Efford 2012). In secr models, probability of detection at the home range center is defined by parameter (g0), and the movement parameter sigma (σ), is defined as the spatial scale over which detection probability declines from the home range center. We used "sex" as an individual covariate to account for potential heterogeneity in capture probability due to differences in the ecology of males and females on the landscape. This also allowed us to estimate the sex ratio at the

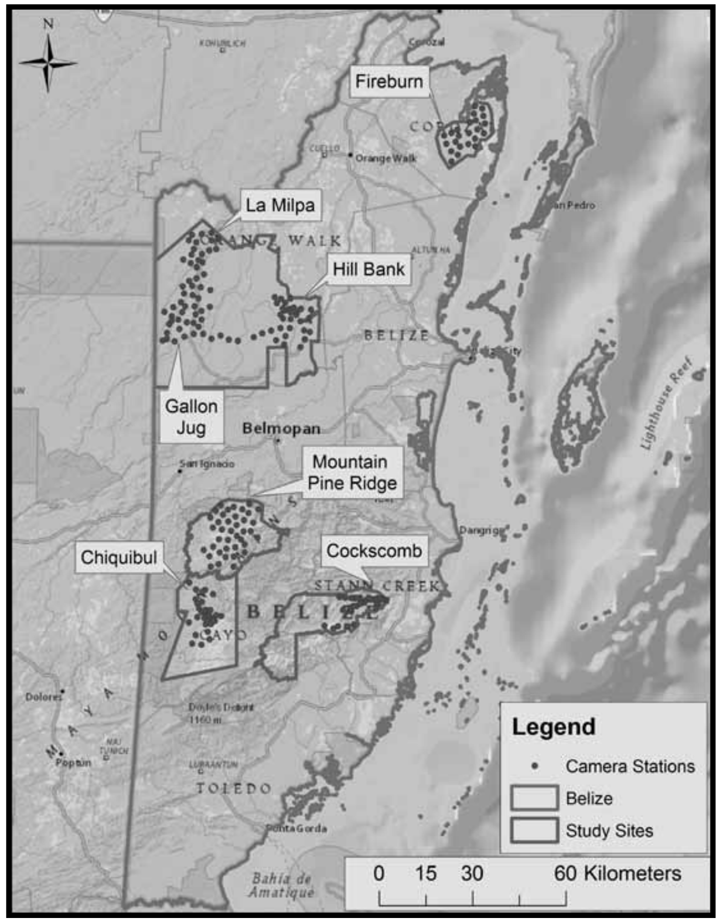

Figure 2. Areas where camera trapping grids were established in Belize.

study sites. To estimate density for sites over multiple years we first estimated density for each year independently and then produced a single density estimate using an inverse variance weighted average of the yearly estimates (Borenstein et al. 2010). In addition, in data-sparse sites we ran multi-session models to improve precision by sharing parameters (i.e. g0 and σ) across years and surveys.

Across most of the sites, density estimates ranged from 8.5 to 13.0 ocelots/100 km^2 but there were 2 exceptions: the tropical pine forest site of Mountain Pine Ridge (MPR) had only 0.9 ocelots/100 km^2, and the upland broadleaf forest site of Chiquibul (CFRNP) had 2.3 ocelots/100 km^2 (Figure 3). In the MPR, despite a well-spaced camera grid with up to 50 camera stations, ocelot occurrences were very low, and due to the sparseness of the data we were unable to use a sex covariate. Tropical pine forest is apparently not preferred habitat for ocelots. In the CFRNP, on the other hand, broadleaf habitat may be preferred, but the survey suffered from high levels of camera theft, which decreased sample size of usable camera stations and shortened many surveys. Therefore, ocelot densities for the Chiquibul should be treated with caution, and more research is needed to determine if low numbers were simply due to the sparseness of the data set caused by camera theft.

Across all sites we found that the sex ratio was roughly 50:50 males:females. For sex-specific detection and movement estimates, confidence intervals (CIs) overlapped in most years and within sites. However, point estimates for male detection and movement were generally larger than for females. In most years males had ~1.3 to 2.9 times larger movement estimates than females and were ~ 1.5 to 7.4 times more likely to be detected at their home range center. Thus if males are more detectible due to larger movements relative to females, then this is consistent with previous research demonstrating that up to 50 – 90% of males had a home-range encompassing more than one female (Dillon and Kelly 2008) .

Tracking populations through time is beneficial to management of a species by teasing out potential sampling versus environmental variability. Ocelot populations appear to be stable over time (e.g. La Milpa and Hill Bank –Figure 4), as we found no evidence that population densities varied within or among sites, the exception being MPR where ocelot densities were very low, with a CI that did not overlap the other sites. However, due to large-scale habitat loss and degradation, and increasing human populations in Belize, long-term research that tracks populations through time is useful for understanding population stability.

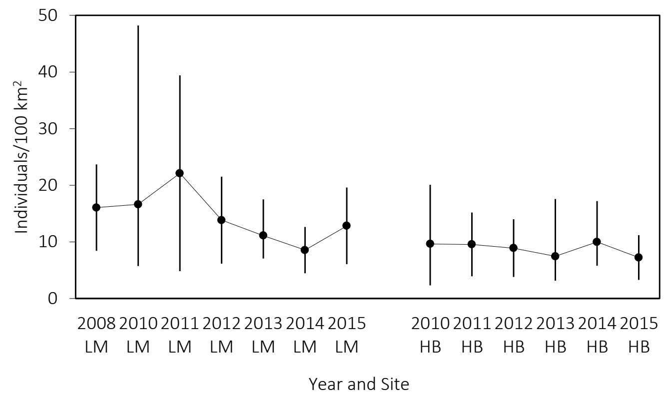

Figure 3. Density estimates and 95% confidence intervals estimated using an inverse variance weighted average for sites with yearly estimates, and densities produced by multi-session models. Survey period lengths varied across sites as listed here: Fireburn (1 year), La Milpa (7 years), Hill Bank (6 years), Gallon Jug (4 years), Cockscomb (12 surveys over 11 years), Mountain Pine Ridge (14 surveys over 12 years), and Chiquibul (9 surveys over 5 years). Figure adapted from Satter et al., in-review.

Brad McRae **August 13, 1966 - July 13, 2017**

Brad McRae, ecologist and conservationist, beloved husband, father, brother, and friend, passed away on July 13 from stomach cancer. Born in Rochester, New York, in 1966, Brad was the youngest child of Oscar Brents and Phyllis McRae. He grew up enjoying windsurfing on Lake Ontario. Brad earned a degree in electrical engineering from Clarkson University, but after only a few years as an engineer, discovered a passion for the outdoors and for conservation. He earned his master›s degree in Land Resources from the University of Wisconsin at Madison, and his PhD in Forest Science from Northern Arizona University. Brad was a postdoctoral fellow at the National Center for Ecological Analysis and Synthesis, and worked for the remainder of his career for The Nature Conservancy. Professionally, Brad leaves an impressive legacy. Brad pioneered the use of circuit theory to model connectivity and gene flow across fragmented landscapes, which is now used in conservation planning around the world. His work garnered coverage in media outlets like Wired Magazine and Conservation Magazine. His software packages that help conservation planners design wildlife corridors and healthy landscapes are downloaded more than 500 times a month, and his more than 30 peer-reviewed publications have been cited thousands of times. Brad was also an avid outdoorsman and naturalist. He passionately loved all forms of skiing -backcountry hut trips, downhill telemark skiing, cross country and skate skiing. He was always happy to play in the snow in any form. He also loved surfing, and especially catching waves on the stand-up paddleboard. He spent countless days backpacking and hiking throughout the United States, as well as mountain biking, canoeing, trail running, and any other activity that brought him out into nature, where he unfailingly interrupted his sports for impromptu birding and botanizing sessions. Everyone who knew Brad was impressed with his intelligence, humor, thoughtfulness, integrity, and steadfast commitment to family, friends and conserving the natural world. He leaves us too soon and will be dearly missed by the many friends who had the good fortune to know him. He is survived by his wife and two children. A memorial was held at his home in Fort Collins on August 13th. Theresa has established a graduate scholarship in conservation science in Brad's name. The website for donations is: *https://www.youcaring.com/scholarshipforgraduatestudentinconservation-878987* .

Ocelot conservation status (*Leopardus pardalis*) in the Laguna Madre region: preliminary results of a survey in coastal Tamaulipas, Mexico

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The ocelot (*Leopardus pardalis*) occurs from extreme southern Texas and the Sky Islands of Arizona, south to northern Argentina (Paviolo et al. 2015). Although overall the ocelot is a species of "Least Concern" (Paviolo et al. 2015), it is officially listed as endangered in the U.S. (USFWS 1982) and Mexico (Secretaría del Medio Ambiente y Recursos Naturales 2010). The northeastern limit of their current range includes populations in the northern Mexican states of Coahuila, Nuevo Leon, and Tamaulipas (Grigione et al. 2009). In the southern Rio Grande Valley of Texas, ocelots have been the subjective of detailed ecological investigations (e.g., Harveson et al. 2004; Jackson et al. 2005; Haines et al. 2005a,b), whereas to date the status of local ocelot populations in northern Mexico have not been thoroughly evaluated. Texas ocelot populations have been found to be increasingly at risk from threats of habitat fragmentation and urbanization, road-caused mortalities, genetic isolation, and declining genetic diversity (Haines et al. 2005a; 2006a, b; Janečka et al. 2011). In part due to the genetic challenges, Texas ocelots face a high risk of extinction in less than 40 years (USFWS 2016). Because genetic "rescue" or augmentation has been advanced as necessary to improve the reduced genetic health and fitness of Texas ocelot populations (Haines et al. 2006 a,b; Janečka et al. 2011; USFWS 2016), it has become important to evaluate the status of ocelot populations from which likely source individuals from adjacent populations might be translocated. The northernmost ocelot populations in Tamaulipas, Mexico represent the closest populations geographically to those individuals currently isolated in Texas (USFWS 2016).

In 2016, we helped launch a binational, multi-institutional collaboration to investigate the local status of ocelot populations in a natural protected area in coastal Tamaulipas, the "Area de Protección de Flora y Fauna Laguna Madre y Delta del Río Bravo" (henceforth "Laguna Madre"). This restricted use area is a 5,728 km^2 UNESCO Biosphere Reserve occurring approximately 150 kilometers south of the Texas-Tamaulipas border, relatively close to the isolated populations in Texas. Our short-term objectives were to (1) understand how ocelots were distributed with respect to potentially suitable habitat as defined by previous regional studies (Harveson et al. 2004; Jackson et al. 2005), and (2) identify one or more potentially promising "source" ocelot populations (e.g., high relative local abundance and absolute density; stable λ through time) from which individuals might theoretically be translocated to Texas. Between June of 2016 and March of 2017, we established 25 camera-trap stations across two parts of the Laguna Madre (Figure 1), each with two opposite-facing cameras less than a few meters apart, using white flash digital camera-traps. These cameras were placed on roads and trails transecting natural vegetation (e.g., seasonal forest, riparian forest)at distance intervals ranging from 0.7 – 2.0 km, depending on field conditions, terrain, and local access. These sampling units (e.g., camera-trap stations) arestill currently active so that we might estimate the density and trajectory of the population using spatially-explicit estimators in the future.

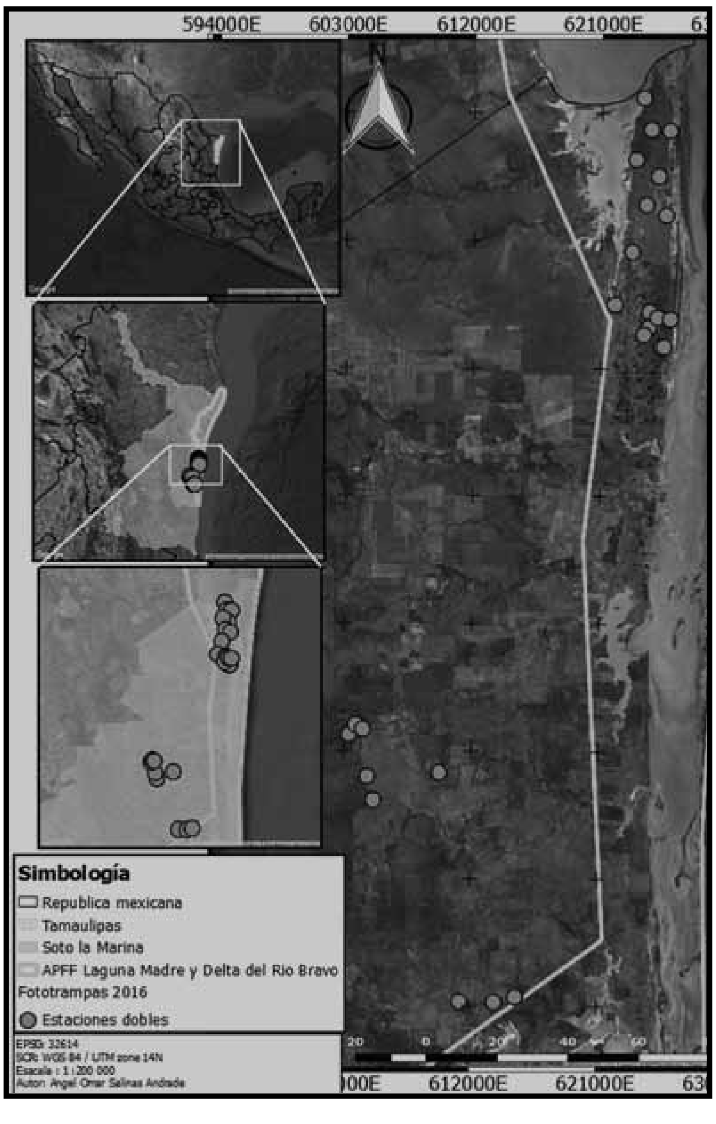

Figure 1. Map of our study area in the Laguna Madre, showing the location of two distinct sampling arrays of two-camera stations

After a full year of camera-trapping, we recorded a total of 590 independent ocelot pictures (i.e., >60 minutes apart for each station) over 7,250 sampling days or "camera-trap days", where a single sampling day is equivalent to one station of two cameras operating for a full 24-hour period. To date we have been able to conclusively distinguish 88 individual

Figure 2a. One of 98 individual ocelots camera-trapped at our study area in Laguna Madre.

Figure 2b. A rare daytime photo of an ocelot at our study area in Laguna Madre.

ocelots. Although data collection and analyses are still under way, our preliminary results indicate the presence of a robust ocelot population in Laguna Madre and further suggest a relatively high abundance of the species very close to Texas. We are hopeful that our continued monitoring of this population might help us more conclusively identify this region as a potential source for animals to translocate, with minimal veterinary care and time in captivity, and release into the Lower Rio Grande Valley of Texas. Our early findings from Laguna Madre not only suggest that live removal of individuals may be possible without negatively impacting the local population, but they underscore the value in establishing cooperative transboundary initiatives willing to undertake the next critical step in the restoration of a species near the limit of its distribution. Moreover our collaborative efforts, which integrate the participation of numerous state, federal, and private institutions and their resources, have implications not just for ocelot recovery, but for other wide-ranging species inhabiting the U.S.-Mexico borderlands. In turn, a proposed border wall or fence would have serious implications on these and similar efforts, as well as disrupt ecoregional connectivity and the movements of threatened and endangered species (Cohn 2007; Flesch et al. 2010; Lasky et al. 2011).

Acknowledgements : We thank the private landowners for their assistance, patience, and access to their ranches. Thank you to David Lerma-Quiroga (CONANP), Mercedes Alejandra Salinas-Camarena, Julio Cesar Moreno-Nájera, and Adán González-Gómezfor their assistance. Funding was provided by the James A. "Buddy" Davidson Foundation, Friends of Laguna Atascosa NWR, U.S. Fish and Wildlife Service, Gladys Porter Zoo and San Antonio Zoo.

Cougar DNA samples available– A call for abstracts

Since 2003, Washington Department of Fish and Wildlife (WDFW) has collected muscle tissue DNA from all known cougar mortalities in conjunction with ongoing long-term research projects. Several publications have resulted from these DNA collections, including assessing the ability of hunters and agency staff to determine cougar gender (Beausoleil and Warheit, 2015); using biopsy darts to estimate cougar density (Beausoleil et al. 2016); and quantifying the effect of landscape resistance on genetic distance in Washington (Warren et al. 2016).

Since 2013, when the primary DNA project came to a close, we have continued to collect samples statewide, but these have simply been archived at WDFW's Genetic Laboratory. We have collected about 2,100 samples and have performed a microsatellite (18 loci for felids) and gender ID analysis on just over 1,300 samples. We want to reach out to Wild Felid Association members with an offer to partner on a research project with WDFW and put these DNA samples to use, so please consider this a call for abstracts with potential project ideas. This is another benefit of being a WFA member as this announcement is being made here first. There are considerable opportunities with a DNA database of this size and the only guideline being provided is that project objectives be applicable to cougar management. This could be an outstanding graduate student project, but all interests are welcome. Ideally, interested individual(s) would demonstrate the potential to co-fund this endeavor. If you are interested, please submit an abstract with your ideas to the contact information provided above by **February 15, 2018**. Thank you in advance.

Contact: Richard A. Beausoleil, Bear & Cougar Specialist, Washington Department of Fish and Wildlife,
3515 State Highway 97A, Wenatchee, WA 98801, USA ***richard.beausoleil@dfw.wa.gov.***

Estimating ocelot (*Leopardus pardalis*) survival in two sites with 6 more years of data in Belize, Central America

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In our related article titled "Ocelot (*Leopardus pardalis*) population density in 7 study sites over multiple years in Belize, Central America" (page 18) we focused on population density estimates across Belize. In this study we implemented open, robust design models to estimate survival in two sites in Belize, with multiple years of data.

Outside of southern Texas, survival estimates are rare for ocelots. One study in southern Texas estimated ocelot survival to range from 57% (transients) to 87% (residents) (Haines et al. 2005). A more recent study conducted in Sonora, Mexico estimated average apparent survival of males at 65%and average apparent survival of females at 63% (Gómez-Ramírez et al. 2017). To our knowledge there are no other survival estimates for ocelots outside the US and Mexico. Although ocelots are currently listed as Least Concern by the IUCN Red List of Threatened Species, both anthropogenic and ecological pressures threaten their long-term survival. For example, habitat loss and fragmentation, low reproductive rates, long inter-birth intervals, long gestations periods, and small litter sizes of 1-2 kittens are all factors that may impact population stability or ability to recover from human disturbance (Hunter and Barrett 2011, Sunquist and Sunquist 2002).

We used a long-term data set from 2 sites located in the Rio Bravo Conservation Management Area of northern Belize (RBCMA). Data were collected over 7 years in the upland broadleaf forest site of La Milpa, and 6 years in the lowland broadleaf forest, freshwater swamp, and pine savannasite of Hill Bank. We estimated the probability of true survival using a Robust Design model that splits the sampling periods into secondary periods (population is closed, i.e., no migration or births and deaths), separated by primary sampling periods (population is open, i.e., migration, births and deaths are likely to occur) (Pollock 1982). In each secondary sampling period-capture and recapture probabilities are estimated, and by incorporating closed capture-recapture models population size is estimated for each primary period (Otis et al. 1978; White et al. 1982; Bailey et al., 2004). The data area repooled within each primary period to estimate the probability of annual survival, and both primary and secondary period information are used to estimate emigration rates (Kendall and Nichols, 1995; Kendall et al. 1997; Kendall 1999; Bailey et al. 2004).

We estimated the following parameters:

S – annual survival;

γ′ – gamma-prime, the probability that an individual stays away from the study area in *i*, given that it was a temporary migrant in *i*-1;

γ′′ – gamma-double-prime,the probability that an animal in the study area in period *i*-1 moves out of the study area in *I*;

p and c-- capture and recapture probabilities (Cooch and White, 2006).

We applied 'random movement' and 'no movement' multi-session models and ran every possible combination of the parameters outlined above for a total of 8 candidate models for both sites. For both sites, models with the survival parameter held constant across years had the most support while all other parameters either varied by year or remained constant over all years. Given that we were most interested in whether ocelot survival rate was different between the logged and unlogged sites in our study system, we present only survival rates in this article.

In La Milpa, our top ranking model was a 'random movement model' holding the survival parameter constant across all years but allowing capture probability (p) to vary by year. This model estimated an annual survival rate of ~71% (Figure 1). In Hill Bank, our top ranking model was also a 'random movement model' that held all parameters constant across years, and produced a survival rate estimate of ~79% (Figure 1). Survival of ocelots do not differ between sites considering that both sites have overlapping confidence intervals. Our ocelot survival estimates appear higher in Belize than in Mexico and for transients in Texas, but are potentially lower than resident Texas ocelots.

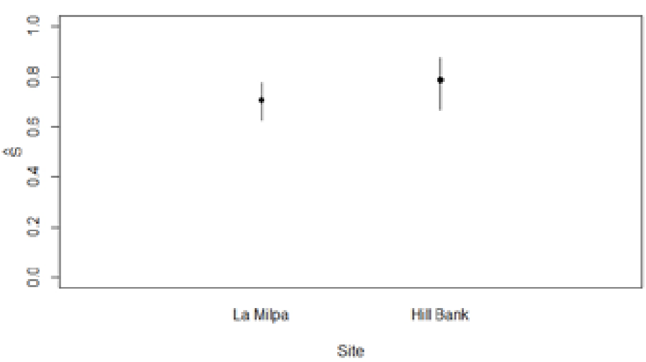

Figure 1. Robust Design survival estimates for ocelots in the unlogged La Milpasite (7 sampling years) and the logged Hill Bank (6 sampling years) site of the Rio Bravo Conservation and Management Area in northwestern Belize, Central America.

We provide the first estimates of ocelot survival in Belize by implementing camera-trapping methodology in a Robust Design framework. In addition, we've provided sound survival estimates for ocelots, which can aid in monitoring ocelot populations in Belize. Survival probability for ocelots appears to be relatively high and constant within the privately protected area of the RBCMA, which is interesting given that in La Milpa, logging is prohibited within the interior of the reserve while Hill Bank has selective logging. Like many other countries, Belize is under threat from expanding human populations, agricultural expansion, and infrastructure development, therefore research and conservation efforts devoted to better understanding wildlife population dynamics are key to effective management and long-term population sustainability.

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Message to readers about the 'Recent Publications' Hello everyone! My name is Robert (Bob) Fitak, and I have been putting together the list of recent publications for the Wild Felid Monitor since the Winter 2014 issue. I normally make an extensive search using the Web of Science database with the various scientific and common names of felids native to the Western Hemisphere. I then trim the list of publications down to those most relevant and partition them into four categories: i) Conservation and Management, ii) Genetics and Disease, iii) Ecology, and iv) Research Methodologies. Not every publication fits within a category and many overlap multiple categories. My goal is around 65 publications. Over the last 4 years, I have noticed a marked increase in the number of wild felid publications. This is a good thing, but makes it difficult to trim down the list. For example, I had a list of over 100 publications for this issue, but settled on 65. Therefore, I encourage readers who want to ensure that a publication is included (e.g., from journals not indexed in Web of Science) contact me at my email address to submit relevant literature. I will continue to do my best to provide a comprehensive list, and your help can make it better. Keep up the great research! ***~Bob Fitak (rfitak9@gmail.com)***

Conservation and Management

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Clinging to survival in the borderlands: ocelots face dwindling habitat and growing isolation.
Michael Tewes. 2017. Wildlife Professional 11:26-32.

Summary – Fewer than 80 ocelots are believed to reside in the United States. Only two verified breeding ocelot populations occur in the U.S., both in extreme South Texas in habitats isolated and threatened by human development. The Cameron population occurs in small undisturbed patches in and around the Laguna Atascosa National Wildlife Refuge. The Willacy population occurs on private lands further north and may account for at least 80% of all U.S. ocelots. Survival of the Texas populations has been greatly assisted through a private landowner's (Frank Yturria) establishment of conservation easements as well as the work of the East Foundation, an organization working towards wildlife conservation, land stewardship and ranching. Research has indicated both a demographic and genetic vulnerability (genetic drift, inbreeding) in the populations. Ocelots prefer dense thorn-scrub communities but less than 1% of South Texas supports this cover type.The Willacy population occupies larger habitat patches with much better connectivity and permeability than the Cameron population. Human population growth and habitat destruction continue to trend upward at a rapid rate, further threatening the Cameron population. Vehicle strikes are the most important proximate cause of ocelot mortality. Although landscape corridors have been designated throughout the ocelot's remaining range, there is little evidence they have improved habitat connectivity for ocelots. Evidence also indicates that no effective trans-border linkage between US and Mexican ocelot populations has existed in at least the last 40 years. Efforts at recovering the species is rife with challenges, including exponential human population growth, energy development, the impending border fence and related lighting and construction, and even a proposed causeway from South Padre Island. Although habitat restoration and connecting corridors are often cited as the way to achieve population viability, they are extremely costly and difficult to attain. Alternatively, programs that engage key Texas ranchers who support the primary breeding ocelot populations may be the primary and most effective strategy to recover ocelots in the US. Additionally, the establishment of a third population in a different South Texas location would greatly increase the ocelot's long-term survival prospects.

Ocelots thrive in a non-typical habitat of northwestern Mexico.
Gomez-Ramirez, M. A. et al. 2017. Endangered Species Research 32: 471-478.

Abstract – Ocelots *Leopardus pardalis* are legally protected in Mexico as an endangered species. The main threats throughout the species' range are habitat loss and fragmentation. The ocelot population that inhabits Sonora, Mexico, is at the northern limit of the species' distribution and knowledge about it is still scarce. We used remote camera data from 2010-2012 and spatially explicit capture-recapture (SECR) models for density estimation, and the Barker robust design mark-recapture model to estimate survival, abundance, and density of ocelots in an arid region in northeastern Sonora. Average apparent survival was 0.65 for females and 0.63 for males; abundance estimates (mean ± SE) ranged from 2.02 ± 0.13 to 7.06 ± 0.24 ocelots. Average (±SE) density was 0.63 ± 0.06 females 100 km^{-2} and 0.95 ± 0.08 males 100 km-2 using Barker robust design, and 0.51 ± 0.26 females 100 km-2 and 0.77 ± 0.25 males 100 km-2 using the SECR. Our survival and density estimates are the lowest reported. However, due to the low human population density in our study area, we consider that our findings must be associated with natural processes rather than human-caused disturbance, without dismissing an additive factor by the latter. Arid environmental features could have a negative influence on primary productivity and consequently on prey availability, limiting ocelot survival and density in this region. Large tracts of unpopulated wildlands over a non-fragmented landscape favor ocelots in this area, and it is important to maintain current habitat conditions for this Neotropical species to continue thriving in this region of North America.

Knowledge about big cats matters: insights for conservationists and managers.
Engel, M. T. et al. 2017. Wildlife Society Bulletin 41: 398-404.

Abstract – Jaguars (*Panthera onca*) and pumas (*Puma concolor*) are declining in the Brazilian Atlantic Forest because of anthropogenic threats (e.g., habitat loss, depletion of prey, human persecution). We assessed the influence of local people's factual knowledge about jaguars and pumas on fear of these big cats, attitudes toward big cats, and the acceptability of big cats. We also examined the influence of demographics (i.e., age, gender) on knowledge. We collected data from 326 rural residents adjacent to 2 protected areas located in a pristine fragment of the Atlantic Forest: Alto do Ribeira State Park and Intervales State Park. Although factual knowledge did not influence attitudes, knowledge was related to fear of big cats and acceptability of these species in the wild. Individuals that were more knowledgeable about big cats were less afraid and more tolerant of jaguars and pumas. Males and adults were more knowledgeable about big cats than were females and younger individuals. Our findings provide evidence that local knowledge can affect tolerance for big cats in the region and potentially reduce people–big cat conflict. Our findings also suggest that conservation efforts should focus on women and youth. © 2017 The Wildlife Society.

Small protected areas as stepping-stones for jaguars in western Mexico.
Luja, V. H. et al. 2017. Tropical Conservation Science 10: 1-8.

Abstract – The jaguar (*Panthera onca*) is one of the most endangered felids in the world. Its distribution has been reduced by 50% globally, and the species continues to be hunted illegally. We provide data on jaguar abundance, sex ratio, seasonal and daily activity, and site fidelity in La Papalota—a 368-ha natural protected area in Nayarit, western Mexico. La Papalota is located between two areas with high priority for the conservation of the jaguar: Marismas Nacionales Biosphere Reserve and the San Blas-San Juan area. Over a period of 4,240 trap nights (14 months), we collected 130 independent photos of six different individuals (one adult male, three adult females, one subadult female, and one cub). Jaguars use La Papalota all year round, and we were able to document three pregnancies. We suggest that, although a small protected area like our study site cannot provide an entire home range for even a single jaguar, it and similar reserves can play a crucial role as stepping-stones for jaguars moving across highly modified landscapes.

Characterization of puma–livestock conflicts in rangelands of central Argentina

María de las Mercedes Guerisoli et al. 2017 Royal Society Open Science 4: 170852.http://dx.doi.org/10.1098/rsos.170852

Abstract – Livestock predation is one of the major causes of conflictsbetween humans and pumas (Puma concolor). Using datafrom interviews with ranchers and kill-site inspections,we characterized puma–livestock conflicts in Villarino andPatagones counties of central Argentinean rangelands.Depredation was considered the major cause of livestocklosses, and puma attacks were reported in 46.6% and35.4% of ranches in Villarino and Patagones, respectively.The majority of ranches underwent losses smaller than1000 USD. The proportion of livestock lost to predation (0.1–10.4%) and financial losses (5.3–1560.4 USD) per ranch/yearvaried across ranches, and small sheep ranches in Villarinowere affected the most. Depredation was recorded onlyat night and preferentially in grassland with shrubs andcropland habitats. Although nocturnal enclosures appearedto decrease sheep losses, puma hunting was consideredthe most effective form of reducing depredation and wasimplemented by most ranchers. Mortality rates were 3.7 and1.1–1.56 individuals/year per 100km2 for sheep and pumas,respectively. Nocturnal fencing, shepherding and spatial separation from predators may efficiently reduce sheep losses. However, the poor association between the intensity of puma persecution and puma-related livestock losses suggests that conflict mitigation in central Argentina is not only about reducing damage but also about increasing tolerance.

Stage-dependent puma predation on dangerous prey.
Elbroch, L. M. et al. 2017. Journal of Zoology 302: 164-170.

Abstract – Predators likely assess their risk of injury with regards to hunting different prey types, while deciding whether to initiate an attack or to avoid dangerous prey. Risk-taking is age-, stage- and state-dependent, and foraging theory predicts that juvenile predators, individuals of lower social rank, and less-experienced predators that are hungry are among those most likely to engage dangerous prey. In carnivores that optimally hunt prey larger than themselves, however, juveniles may also select for smaller, suboptimal prey as they refine their hunting skills. Thus, in the case of predators that exhibit age-specific prey selection, there may be multiple factors influencing decision-making about prey selection. We compared puma (*Puma concolor*) predation on dangerous adult ungulates and safer juvenile ungulates, as well as two similar-sized rodent species: the more dangerous North American porcupine (*Erethizon dorsatum*) and the more vulnerable American beaver (*Castor canadensis*). We found that dispersing, subadult pumas with limited hunting experience and without territories avoided dangerous but optimally sized adult ungulates, and instead hunted dangerous, suboptimal porcupines more than resident, territorial adults. In contrast, there was no difference in puma predation on beavers between dispersers and residents. Small prey (e.g. not ungulates) formed a large portion of dispersing puma diets of both sexes, and this stage-dependent foraging pattern might be important in describing the ecology of the species, as well as in modeling potential dispersal habitat that could see puma expansion east in North America across hostile matrices where their primary prey has been reduced through anthropogenic effects.

Modeling landscape connectivity for bobcats using expert-opinion and empirically derived models: how well do they work?
Reed, G. C. et al. 2017. Animal Conservation 20: 308-320.

Abstract – Efforts to retain ecological connectivity have become a conservation priority to permit animal movements within home ranges, allow dispersal between populations and provide opportunities for animals to respond to climate change. We used expert-opinion and empirically derived models to investigate landscape connectivity at two spatial scales among bobcats *Lynx rufus* in New Hampshire, USA. Paths of marked bobcats were compared to random movements in the context of program CircuitScape. At the local scale (within home ranges), the empirical model (based on observations and telemetry locations) performed better than the expert-opinion model. At the regional scale (state of New Hampshire), both models identified urban development as a potential barrier; however, the models differed in predicting how specific natural features (e.g. mountains and large water bodies) and some roads affected bobcat movements. When compared with bobcat population structure based on genetic information, the expert-opinion model overestimated the influence of roads. Alternatively, the empirical model overestimated the influence of snow. Our findings indicate that the empirically based resistance model was better at describing landscape-scale effects, whereas the expert-opinion model provided a good understanding of gene flow at a regional scale. As such, both models may be considered complementary. Bobcats were sensitive to disruptions imposed by habitat fragmentation and thus may be a suitable focal species for evaluating the consequences of land-use changes on the regional suite of mesocarnivores.

Logging and indigenous hunting impacts on persistence of large Neotropical animals.
Roopsind, A. et al. 2017. Biotropica 49: 565-575.

Abstract – Areas allocated for industrial logging and community-owned forests account for over 50% of all remaining tropical forests. Landscape-scale conservation strategies that include these forests are expected to have substantial benefits for biodiversity, especially for large mammals and birds that require extensive habitat but that are susceptible to extirpation due to synergies between logging and hunting. In addition, their responses to logging alone are poorly understood due to their cryptic behavior and low densities. In this study, we assessed the effects of logging and hunting on detection and occupancy rates of large vertebrates in a multiple-use forest on the Guiana Shield. Our study site was certified as being responsibly managed for timber production and indigenous communities are legally guaranteed use-rights to the forest. We coupled camera-trap data for wildlife detection with a spatially explicit dataset on indigenous hunting. A multi-species occupancy model found a weak positive effect of logging on occupancy and detection rates, while hunting had a weak negative effect. Model predictions of species richness were also higher in logged forest sites compared to unlogged forest sites. Density estimates for jaguars and ocelots in our multiple-use area were similar to estimates reported for fully protected areas. Involvement of local communities in forest management, control of forest access, and nesting production forests in a landscape that includes protected areas seemed important for these positive biodiversity outcomes. The maintenance of vertebrate species bodes well for both biodiversity and the humans that depend on multiple-use forests.

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About the Wild Felid Research and Management Association

The Wild Felid Research and Management Association is open to professional biologists, wildlife managers, and others dedicated to the conservation of wild felid species, with emphasis on those species in the Western Hemisphere. The Wild Felid Association acts in an advisory capacity to facilitate wild felid conservation, management, and research, public education about wild felids, and functions among various governments, agencies, councils, universities, and organizations responsible or interested in wild felids and their habitats.

Our intention is to:

1. Provide for and encourage the coordination and exchange of information on the ecology, management, and conservation of wild felids;
2. Provide liaison with other groups; and,
3. Provide a format for conducting workshops, panels, and conferences on research, management and conservation topics related to wild felids.

Our goal:

The goal of the Wild Felid Association is to promote the management, conservation and restoration of wild felids through science-based research, management, and education.

Our objectives:

1. Promote and foster well-designed research of the highest scientific and professional standards.
2. Support and promote sound stewardship of wild felids through scientifically based population and habitat management.
3. Promote opportunities for communication and collaboration across scientific disciplines and among wild felid research scientists and managers through conferences, workshops, and newsletters.
4. Increase public awareness and understanding of the ecology, conservation, and management of wild felids by encouraging the translation of technical information into popular literature and other media, and other educational forums.
5. Encourage the professional growth and development of our members.
6. Provide professional counsel and advice on issues of natural resource policy related to wild felid management, research, and conservation.
7. Maintain the highest standards of professional ethics and scientific integrity.

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