

Wild Cats of the Sky Islands: A Summary of Monitoring Efforts Using Noninvasive Techniques

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Abstract—A variety of efforts are taking place to detect, inventory, and monitor the wild felids (pumas, bobcats, jaguars, and ocelots) of the Madrean Archipelago. Researchers are using a suite of noninvasive methods, including infrared-triggered photography, DNA analysis of scat and hair (collected from “hair snares”), and old-fashioned tracking and sign searches. These efforts are being conducted by a variety of academic, government, and non-governmental organizations in the United States and Mexico. We briefly outline the various projects including their results to date, discuss threats to native felids in the region, and provide recommendations for further research, monitoring, and conservation.

Introduction

The region known as the Madrean Archipelago in the Southwestern United States and Northwestern Mexico is, in many ways, unique. It crosses the boundary between two nations and is influenced by two major climatic regimes, tropical and temperate. It is extraordinarily diverse ecologically and is home to 4, possibly 5, species of native wild cats. Two felid species, the bobcat (*Lynx rufus*) and puma (*Puma concolor*) (also known as cougar, mountain lion, and panther) are relatively common throughout the region. The other 3 cat species, endemic to Latin America and known as neotropical cats, i.e., jaguar (*Panthera onca*), ocelot (*Leopardus pardalis*), and jaguarundi (*Herpailurus yagouaroundi*), reach their northern limit in the United States-Mexico border region.

Bobcats range from the United States-Canada border to Southern Mexico. Pumas are distributed throughout most of the Americas. However, other than a small, isolated population in Florida known as the Florida panther, they are considered extirpated in the eastern half of the United States. Jaguars historically ranged as far north as the Grand Canyon in Arizona (Brown and Gonzalez 2001; Hatten et al. 2003) but were considered close to extirpation in the United States in the last half of the 20th Century. In 1996, however, photographs taken of 2 live jaguars by houndsmen Warner Glenn (1996) and Jack Childs (1998) in separate areas of southern Arizona led to a resurgence of interest in the species in the United States and northern Sonora, Mexico. The ocelot historically ranged into the Southwestern United States and is extant in southern Texas. The last recorded sighting (photograph) in Arizona was in 1964 in the Huachuca Mountains (Girmendonk 1994). Although the jaguarundi had been reported in Arizona (Little 1938), its existence in Arizona and even Sonora is questionable (Brown and Lopez Gonzalez 1999).

A combination of factors—the 1996 photographs of jaguars, the advent of new, noninvasive research techniques, and increasing concern regarding human-caused threats to

wildlife—all contributed to a recent flurry of activity to gather information on the wild cats of the Madrean Archipelago. In this paper we briefly describe the techniques, summarize wild cat-related projects in the region, and discuss management and conservation implications. We emphasize noninvasive techniques, since they are more commonly used in these projects; however, we briefly mention standard capture/radio telemetry efforts, where applicable.

Techniques

Infrared-Triggered Cameras

The development of infrared-triggered or “trip” cameras has greatly increased biologists’ ability to obtain information on wildlife in the field (Wolf and Swann 2002). These units emit an infrared beam or series of beams, and when an animal crosses the beam the camera photographs the animal. With trip cameras we can gather such data as presence/absence, activity patterns, habitat use, and, for the spotted cats, even home range and population information, based on unique coat patterns of individuals.

Molecular Genetics

Cutting-edge techniques utilizing DNA extracted from scat (feces) and hair (from “hair snares”) have created new tools for gathering information (Ernest et al. 2000; McDaniel et al. 2000) heretofore impossible without invasive and expensive animal capture and radio telemetry. With DNA we can identify species and individuals, estimate populations, delineate home ranges, and determine sex ratios and relatedness. Hair snares are small carpet pads imbedded with protruding tacks. Another type is a spiked “tie” plate (normally used in housing construction) backed by a carpet pad. Both types are baited with commercial trapper’s lure and catnip. Cats rub on the snares and leave their hair, which is later analyzed in the genetics lab.

Tracking and Sign Searches

Old-fashioned tracking and sign searches are still being used today but in the modern context of recording trends in tracks found over time in a specific area or documenting wildlife use of critical areas and corridors. Tracking efforts now have specific protocols and procedures to ensure data consistency and to maximize the value of effort expended. Tracking has limitations in terms of distinguishing individuals, determining gender, or estimating populations; however, it is still an effective, low cost method of gathering data in certain well-defined situations (Beier and Cunningham 1996; Smallwood and Fitzhugh 1995).

Habitat Mapping

In this summary we also include efforts to map habitats and felid distribution using Geographic Information Systems (GIS) and similar techniques.

Projects

Mexico—Carlos Lopez Gonzalez, Northern Jaguar Project, Naturalia

The 1996 photos of jaguars in Arizona prompted biologists Carlos Lopez Gonzalez and David Brown to travel in northern Sonora to investigate the possible existence of a source population of jaguars. They found an extant population in the region around the confluence of the Yaqui and Aros Rivers (Brown and Lopez Gonzalez 2001), approximately 140 miles south of Douglas, Arizona. Lopez Gonzalez then initiated field projects to gather much needed information on jaguars and the general ecology of jaguar habitat. Using trip cameras, he and his colleagues have obtained numerous photographs of jaguars and in some cases were able to estimate home ranges. They have also documented ocelots, bobcats, and pumas as well as other wildlife. They have conducted prey surveys, analyzed scat, and radio collared several pumas. Also, with the support of Sky Island Alliance and Defenders of Wildlife, a new non-profit organization known as the Northern Jaguar Project has been formed to support conservation and research efforts in this region, including working with local ranchers. Lastly, a Mexican non-profit conservation group, Naturalia, has purchased a ranch to form the nucleus of land-based conservation efforts in this biologically critical region.

Mexico—Octavio Rosas-Rosas, Louis Bender, Raul Valdez, New Mexico State University, Wildlife Conservation Society

Since 2000 Octavio Rosas-Rosas has been studying habitat partitioning and prey relations of sympatric jaguars and pumas in northeastern Sonora, in the northwestern portion of the Sierra Madre Occidental. Multiple photos of jaguars, pumas, ocelots, and other small carnivores have been acquired

using double-sided trip camera stations. Researchers are using tracking as well as telemetry to gain more insight into activities of pumas and jaguars in this unique area. Scat is being analyzed to determine overlap in diet of jaguar and puma. Recently the study of smaller carnivores including ocelots has been undertaken. Rosas-Rosas is also working with the local ranchers to create a multiple use area that does not infringe on land use and landowner rights.

United States, Arizona—Jack Childs, Matt Colvin, Borderlands Jaguar Detection Project

After Jack Childs, his partner Matt Colvin, and others treed and photographed a jaguar in 1996 (in the Baboquivari Mountains west of Nogales, Arizona), Childs and Colvin obtained primary funding from the Wildlife Conservation Society to conduct track surveys and place trip cameras and hair snares along the United States-Mexico border. Their study area is a 10-mile strip of land along United States side of the border, from the Baboquivari in the west to the San Rafael Valley in the east. In 2001 and again in 2003 they obtained photos of a male jaguar, and careful analysis of spot patterns revealed the 2 photos were of the same jaguar. Hair from hair snares and scat samples will be analyzed in the genetics lab run by Melanie Culver, University of Arizona. In addition, Childs and Colvin obtained funding from the Phoenix Zoo to travel to Brazil to document tracks and sign of all the neotropical cats so that they could recognize signs in the United States should the opportunity occur. They published a book describing tracks and signs of borderland cats (Childs 1998).

United States, Arizona—Lisa Haynes, Melanie Culver, Zoe Hackle, National Park Service Border Cats Project

Using noninvasive methods, i.e., trip cameras, track surveys, and DNA analysis of scat and hair (from hair snares), we are gathering baseline data on native felids (as well as feral domestic cats) in four National Park Service sites in southeastern Arizona. The Park Service is mandated to conserve and protect the native species endemic to those sites. The Service is also interested in gathering information on mountain lions, which are increasingly coming into contact with visitors and park neighbors as development increases near park borders. We will summarize occurrence records, especially those of the rarer neotropical cats, and develop management plans for each species. The sites are Coronado National Memorial, at the southern tip of the Huachuca Mountains; Chiricahua National Monument, on the west side of the Chiricahua Mountains; Fort Bowie National Historic Site, in Apache Pass between the Chiricahua and Dos Cabezas Mountains; and Saguaro National Park, in the Rincon and Tucson Mountains. In a related project, we have been noninvasively monitoring the small, isolated population of pumas in the Tucson Mountains (Saguaro National

Park-West). These estimated 2-5 pumas are surrounded by development and may be cut off from other populations (Haynes and Swann 2003).

United States, Arizona and New Mexico—Sky Island Alliance Volunteer Tracking Program and Ft. Huachuca Puma Track Count

Sky Island Alliance (SIA) is conducting two efforts to non-invasively monitor wild cats and other wildlife using volunteer trackers. In recent years, they have organized the annual puma track count on Ft. Huachuca Military Reservation in southeastern Arizona, now in its 15th year. Under the guidance of experienced trackers and lion biologists, groups of volunteers document tracks on specific routes distributed across the Fort to document trends in tracks observed over time. In addition, SIA is training volunteers to document tracks and signs of pumas, bobcats, jaguars, and 3 other focal carnivore species in four potentially critical wildlife corridors: the Tumacacori-Santa Rita corridor, the Cienega Creek Watershed, the Dragoon-Whetstone corridor, and the north/south spine of the Peloncillo Mountains. The routes are designed to document wildlife use of corridors and valuable habitats, which are threatened by urban development and/or highways. These data are then used in land use planning efforts and to advocate on behalf of open space and conservation. Volunteers undergo a rigorous training program and must commit to monitoring their routes every 6 weeks. Finally, SIA, in conjunction with Arizona Department of Transportation, is using trip cameras to document wildlife use of highway culverts and bridges.

United States, Arizona and New Mexico—Jaguar Conservation Team (JAGCT)

After the 1996 jaguar sightings, a conservation team was organized that is comprised of Arizona and New Mexico State wildlife agency personnel, U.S. Fish and Wildlife Service biologists, and other agency representatives. In addition, private individuals and stakeholder groups (environmentalists, ranchers, hunters, etc.) who have an interest in jaguar conservation issues, are members of and participate in JAGCT meetings and activities. Meetings are held twice a year near the Arizona-New Mexico border. Both Arizona and New Mexico State Game and Fish Departments, in collaboration with other members of JAGCT, have mapped potential jaguar habitat in each State using Geographic Information Systems (GIS). Classifications were based on historic sightings, areas now identified as unsuitable due to human development, and habitat characteristics such as ruggedness, vegetation, perennial water sources, etc. Each State now has a map delineating areas with the highest potential for jaguars (Hatten et al. 2003; Menke and Hayes 2003). In addition, the JAGCT conducts other valuable activities, such as environmental education in relation to jaguars, evaluating current sightings, and conducting field checks of potential jaguar/livestock depredation incidents.

United States and Mexico—Defenders of Wildlife Bordercats Working Group

This group is in the process of publishing the results of a GIS-based habitat conservation map for ocelots, jaguars, and jaguarundis in the border region. Several years ago they started to compile sightings for all three species and also initiated a pilot field study in southeastern Arizona, which included track surveys, trip cameras, and interviews. They combined this sightings database with results from the field studies and then held an expert mapping workshop in order to develop a “blueprint” of high priority areas and corridors for each species across the entire border region. The results will be published in 2004. The defined areas will then provide a focus for conservation efforts, which includes working with private landowners in Mexico.

Discussion

The above-described efforts are important for two primary reasons. One is to assess the current status of the native felids of the Madrean Archipelago. In Mexico, we now know there are extant populations of the native assemblage of cats in the region, although occurrences and distribution of the rarer, neotropical cats are probably much reduced from historic levels. In the United States, there is considerable interest in assessing the possibility of the current existence of the rarer cats and of potentially reestablishing their presence as members of the historic fauna of the Southwest.

The second reason such data are critically needed now is the threat from development and human activity in the region. Urban development, highway construction, and habitat loss are the most significant risks to wild cats. The possibility of genetic isolation due to loss of connectivity across the landscape is especially threatening to the wide-ranging larger cats, i.e., puma and jaguar, as well as the smaller species. Also of tremendous concern are impacts related to border immigration. Migrant traffic degrades habitat in many of the same areas used by wild cats and their prey and may also disturb nocturnal hunting activities of the cats. Of even greater concern is U.S. Border Patrol’s plan to significantly expand its current efforts to stop illegal immigration by building impenetrable fencing along some of the Arizona/Mexico border, constructing towers for stadium lighting, grading roads along the border, and driving those roads with OHVs and other vehicles. If these impacts continue, all efforts to maintain or manage for carnivore connectivity between the United States and Mexico will be for naught. In addition, biologists are still concerned about poaching and illegal killing of wild cats. In Mexico, despite legal protections, ocelots are still poached for their fur and jaguars are killed as predators of livestock. In the United States in 1986, a rancher/lion hunter killed a jaguar near Willcox, Arizona, and eventually was prosecuted. It is unknown how many incidents such as this may occur, unknown to authorities. Finally, prices for bobcat pelts are dramatically increasing again, after a twenty-year decrease, possibly adding to other pressures on that species.

There should be a dramatically increased effort to assess the status of the neotropical cats on both sides of the border and in potential corridors between known populations in Mexico and the United States. Noninvasive techniques are ideal for this purpose. We also need to know basic information about these species such as home range size, activity patterns, social organization, and resource/habitat partitioning in the unique biomes of Northern Mexico. Previous research of the neotropical cats has been conducted in tropical areas, and most research on pumas and bobcats has been conducted in temperate habitats. Data are needed to understand the unique situation of the Madrean Archipelago, and both noninvasive and standard radio telemetry methods will be needed.

In addition, we need to continue to gather baseline genetic information on wild cats in the region to address impacts of development, border immigration, and highway construction. Loss of connectivity and gene flow is probably the single greatest threat in the long run, followed closely by loss of habitat. The example of the highly inbred Florida panther, complete with deformities and other abnormalities, is a likely scenario for wild cat populations in this region. The information gathered then needs to be translated by agencies, government, and landowners in both countries into meaningful management prescriptions on the ground. Continued efforts should be made to work with landowners and ranchers to conserve valuable habitat and to eliminate illegal killing of wild cats.

This is a critical time if we want to ensure the existence of the wild cats of the Madrean Archipelago into the future. What transpires in the next 5 to 20 years could make the difference between continued existence versus extirpation of these species in the region. We hope this summary and our recommendations result in increased interest in, funding for, and conservation of these fascinating and ecologically important species.

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