# YELLOWSTONE COUGAR PROJECT



### 2015

## Annual Report



With the completion of a second winter field season designed to evaluate the abundance, distribution, and predation patterns of Yellowstone's cougars, biologists are gaining valuable information about this top predator in the northern portion of the park. Along with wolves and bears, cougars an important part of the native carnivore species recovery in the Greater Yellowstone Ecosystem. The following report describes this past season's field efforts and discoveries.

#### BACKGROUND

As predators, cougars play an important role in the structure and function of ecosystems. Knowledge of cougar abundance and distribution is fundamental for evaluating the ecological consequences of their presence on the landscape. Monitoring their population size and trends in a given area has proven challenging without intensive marking and radio-collaring efforts. Telemetry efforts are informative, but often labor intensive and expensive. Other methods such as helicopter snow-track counts, ground track counts, and

analyses of harvest structure are poor predictors of cougar population size. Noninvasive genetic sampling methods are growing in application as a way to (1) identify species, sex, and individuals, (2) estimate abundance and population growth rates, (3) quantify distribution, and (4)



examine patterns of genetic population structure of various carnivores. Further, developments in molecular technology provide genetic information that can be used to determine behavioral parameters such as home range size, individual habitat preferences, and even some forms of social interactions.

Cougar research in Yellowstone National Park has incorporated a variety of the aforementioned methods to understand the ecology of this top carnivore following their natural recovery to the park in the 1980s. Two phases of intensive cougar research occurred between 1987 and 2006 and provided a broad understanding of cougar ecology, predation, and population dynamics prior to and after wolf reintroduction in 1995 and 1996 (Murphy 1998; Hornocker & Negri 2010, Ruth et al. *in press*). These studies estimated the minimum number of cougars known alive by radio collaring individuals and conducting snow tracking surveys in northern Yellowstone. Prior to wolf reintroduction (1987-1993), this region was occupied year-round by an estimated 15 to 22 cougars, including adults, subadults, and kittens. There were 26 to 42 cougars after wolf establishment (1998-2005; Ruth et al. *in press*).

To evaluate the efficacy of noninvasive DNA sampling methods for monitoring Yellowstone cougars, systematic snow-tracking surveys were conducted during 2003 to 2005 to collect hair and scat samples for generating individual genotypes (Sawaya et al. 2011). Backtracking cats in snow to bed sites and natural hair snags such as branch tips and thorn bushes was an efficient, reliable method for noninvasively sampling genetics. Over a 2-year sampling period, 12 of 14 (86%) radio-collared individuals in the area were detected, proving these methods to be successful. These findings demonstrated the utility of noninvasive survey methods as a low-cost, long-term, population-monitoring tool for cougars.



Yellowstone Cougar Project field technicians Aaron Morris (left) and Marcus Bianco (right) record data using a GPS unit and iPad data logger before collecting a portion of this cougar scat for DNA analyses. (Photo by D. Stahler/NPS)

Beginning in January 2014, we initiated a new phase of cougar research in northern Yellowstone

(Stahler & Anton 2014). This study was designed to build off previous efforts to help address two important

needs for understanding cougar ecology. First, cougar population size estimates are needed so that cougar population dynamics and kill rates can be incorporated when assessing the combined effects of large carnivores (wolves, bears, and cougars) in limiting or regulating the northern Yellowstone elk population, as well as other ungulates residing in and near the park. Second, northern Yellowstone serves as a valuable source for cougars emigrating to other areas in the larger Greater Yellowstone Ecosystem (Ruth et al. 2011). Periodic estimation of cougar population size, growth, and distribution, in conjunction with continued monitoring of wolves and bears, will enable biologists and managers to monitor important demographic and genetic population parameters within the ecosystem. This report summarizes the findings from our 2015 winter field season, as well as provides information on the genetic data collected in the 2014 field season.

#### STUDY AREA

This season we sampled cougars in the same area of northern Yellowstone surveyed during the previous non-invasive study (2004-2005; Sawaya et al. 2011) and during the 2014 winter season. This area is characterized by steep, rocky slopes along the Yellowstone River corridor (Fig. 1). Elevations range from 5,300 to 9,500 feet, although most of the surveys were limited to elevations below 7,200 feet due to snow accumulation and cougar habitat use. Vegetation consists primarily of grasslands interspersed with patches of Douglas fir (*Pseudotsuga menziessi*) and juniper (*Juniperus occidentalis*). This region experiences cold, dry winters and provides critical winter range for many of the park's ungulates, including elk (*Cervus elaphus*), mule deer (Odocoileus hemionus), and bison (*Bison bison*). Cougars (Puma concolor) compete for ungulates year-round with gray wolves (Canis lupus) and seasonally with grizzly bears (Ursus arctos) and black bears (Ursus americanus). Prominent scavenger species such as coyote (*Canis latrans*), red fox (*Vulpes vulpes*), marten (*Martes americana*), bald eagle (*Haliaeetus leucocephalus*), golden eagle (*Aquila chrysaetos*), raven (Corvus corax), and black-billed magpie (*Pica hudsonia*) are found at ungulate carcasses.



Figure 1. Map of survey routes in the northern portion of Yellowstone National Park.

#### NONINVASIVE SAMPLING METHODS

We conducted snow-tracking surveys from January through March 2015 along 18 survey routes (10 primary, 8 secondary). The routes were designed to increase the probability of encountering cougar sign based on long-term knowledge of cougar habitat use, while also allowing us to maximize travel efficiency and address safety concerns pertaining to length and terrain of travel. We attempted to walk the 10 primary survey routes each week, but only surveyed the secondary routes opportunistically throughout the season. When cougar tracks were detected, we followed them as long as feasible until discovering hair, scat, or blood (from nicks and scrapes on feet) as a potential DNA source. Hair was primarily collected from bed sites or caught on natural hair snags (e.g., thorns, branches, rocks), while fecal and/or blood samples were collected at scent-mark scrapes, from cougar latrines at ungulate carcasses, or opportunistically in the snow. We recorded sign (tracks, scat, visuals, etc.) of bears and wolves along each survey route, and classified the presence of ungulates (species, group size, age/sex class) observed within 0.5 kilometer of each transect. Presence and abundance indices for these species will be used to evaluate the potential competitive

environment that cougars face from other large carnivores, as well as the availability of prey within their home ranges. All data collection was done electronically on Apple® iPad mini tablets loaded with FileMaker® Go database management software while Garmin® Map62s GPS units tracked our travel. We also used the GPS units to determine locations of carnivore sign, DNA samples, and ungulate groups. In addition to our track surveys, we deployed 30 remote cameras. We used Bushnell® Trophy Cam video cameras opportunistically along travel routes and at fresh carcasses and cat scent-mark scrape sites. We attempted to maintain at least one camera station on each primary survey route.



(LEFT) Field technicians Wes Binder and Kira Powell record data at an adult male cougar's fresh scrape in the snow. Cougars, especially males, make these shallow depressions with their hind feet and deposit urine and/or scat as a visual and olfactory communication station. (Photo by D. Stahler/NPS) (RIGHT) Ledges, steep slopes, and deep watershed ravines characterize common habitat preferences by cougars in northern Yellowstone. (Photo by A. Morris)

#### RESULTS

#### **Snow Tracking**

From January 5 to March 18, 2015, we surveyed approximately 1,300 miles (2,090 kilometers) and 330,000 feet of elevation gain along designated routes (Fig. 2). The mean transect length was 10 kilometers, which took an average of 7 hours. A notable characteristic of the 2015 winter was the low snowfall that occurred in northern Yellowstone during our field season. Compared to the previous winter, these conditions made it difficult to detect fresh cougar tracks due to significant portions of survey routes being snow free. This

hampered the effectiveness of snow tracking as a method for track and DNA sample detection. Regardless, cougar use of the landscape was found to be similar to the previous winter, with the Black Canyon of the Yellowstone River and affiliated drainages being prominent habitat use (Fig. 3).



Figure 2. Map showing each survey transect (in red) for the 2015 winter season.



**Figure 3.** Map showing distribution of detected cat tracks from different age, sex, and family groups of cougars during the 2015 winter season.

We discovered cougar tracks on 79 of 134 surveys (59%) and collected at least 1 DNA sample on 65 surveys (49%). During 134 transect surveys, we collected 107 hair samples, 82 of which were natural hair snags (77%) and 25 from bed sites (23%; Fig. 4). We identified species for each sample through visual inspection of the hair and classification of nearby tracks. In addition to hair, we collected 54 scat and 2 blood samples (believed to have dripped into the snow from nicks and scrapes incurred by traveling through crusty snow).



Figure 4. Map showing distribution of possible DNA samples from either natural hair snags, bed sites, or from collected scat and urine during the 2015 winter season.

#### Prey remains and carcass detection

We detected 12 carcasses that were definitely or probably killed by cougars while conducting snowtracking surveys. Kills were determined by the presence of cougar tracks, chase tracks with a blood trail, latrines with cougar scat, and/or evidence of caching. Cougars cache their kills by covering them with snow, vegetative debris, and/or hair pulled from the prey in an effort to conceal carcasses from scavengers and lessen the effects of freezing or decomposition of the meat. Six of the carcasses were elk (50%; 4 calves, 2 unknown age/sex due to few remains that were but likely calves), 3 mule deer (25%; 2 fawns, 1 unknown age/sex), 1 whitetail deer (8.3%; 1 fawn), 1 porcupine (8.3%; unknown), and 1 coyote (8.3%; unknown). Most of these carcass sites provided cougar hair or scat samples. In addition to cougar-killed carcasses, we documented 6 wolf kills (3 elk, 1 coyote, 2 wolves), 6 winter-caused deaths (4 elk, 2 bison), and 5 carcasses with unknown cause of death (3 elk, 2 deer).



(LEFT) Remains of a killed porcupine were found by tracking an adult male cougar near Pebble Creek. Cougars are one of the few predators adept at killing and consuming this formidable prey. (Photo by D. Stahler/NPS) (RIGHT) Cougar Project team members and research hound Sula inspect the remains of a cached elk calf killed by an adult female cougar with two kittens. Attempts were made to capture the female to deploy a GPS collar but were unsuccessful this day. (Photo by D. Stahler/NPS)

#### **Cougar Capture**

Part of this study's objectives includes the capture, collaring, and monitoring of 6 adult cougars (4 females and 2 males) with Global Position System (GPS) collars. These individuals will allow us to evaluate current sex and age-specific habitat use and predation patterns. The collars also have built in accelerometers

that continuously monitor activity level and body position. Coupled with predation information, this data will be used to measure the energetics of cougars across different seasons, habitats, and levels of foraging success. This data will be compared to 6 wolves wearing the same type of collar in the study area. Additionally, this information will be used to test the efficacy of noninvasive methods conducted simultaneously and help shape future monitoring efforts of large carnivores that would not require handling and marking individuals. Attempts to collar cougars were unsuccessful in February and March due to little to no snow cover needed to locate and tree cats with specially trained hound dogs. However, on December 29<sup>th</sup>, 2015, an adult male cougar (3-4 years old, 140 pounds) was successfully captured and fitted with a GPS collar. The remaining five collars will be deployed during the 2016 winter season.



(LEFT) Research hounds Sula and Junior rely on their noses to locate scent left behind by passing cougars in hopes of treeing one for GPS collaring purposes. (Photo by D. Stahler/NPS) (RIGHT) Dan Stahler finishes the field examination of the newly GPS-collared adult male M198 before reversing the immobilization drug from which the cat got up and walked away. (Photo by W. Binder)

#### **Genetic results**

A primary goal of this study is to distinguish Individuals by their DNA found in hair, scat, and blood left behind on the landscape. Detections of known individuals on one or more sampling occasions, along with the location of each detection, provide data that will be integrated into spatially explicit capture-recapture statistical models for estimates of population size and density at the end of the study. Additionally, individual genetic profiles (genotypes) will be used to evaluate genetic structure of the population including parentage, relatedness between individuals, and dispersal patterns. Preliminary genetic testing has been conducted through the U.S. Forest Service's Wildlife Genetics Laboratory in Missoula, Montana.

During the 2014 winter season, approximately 25% (54/214) of the noninvasively collected cougar hair, scat, and blood samples yielded enough quality DNA to be genotyped for sex and individual identity. With these 54 successful genotypes, the laboratory identified 15 unique individuals including all age and sex classes (8 females, 7 males). During the 2015 season, 36% (55/153) of the noninvasively collected cougar samples had enough quality DNA for genotyping. Of these, 12 unique individuals were identified (6 females, 6 males), with 5 of the same cougars (1female, 4 males) detected from both years and a total of 22 unique individuals. Until data validation and appropriate capture-recapture statistical methods are conducted, we are unable to estimate population size at this time. However, preliminary results suggest a robust population inhabits the study area similar to what was found in the mid-2000s.



This imprint of an adult female cougar lying in the snow yielded enough hair stuck in the melted snow for DNA collection. (Photo by A. Morris)



(LEFT) Field Technician Ellen Beller uses forceps to collect hairs that have been snagged by thorns from a passing cougar. Even a few hairs with follicles can yield enough DNA that can be amplified and analyzed in a lab for unique individual identification. (Photo by A. Morris) (RIGHT) National Geographic photographer and study collaboration Drew Rush sets up a remote camera trap for cougars. (Photo by D. Stahler/NPS)

#### Ungulate and other carnivore detection

In addition to cougar detection, our surveys provide opportunities to assess other species' occupancy and use of cougar habitat as an index of competition and prey availability. There were 141 wolf detections (129 unique tracks sets involving one or more wolves, 9 vocalizations, and 3 sightings), 3 grizzly bear track detections, and 5 sets of bobcat tracks along the survey routes. Coyotes and red foxes were common throughout the study area and present at most cougar-killed prey. In addition to documenting carnivore sign, we counted and classified over 600 ungulate groups from 7 different species (Table 1). These counts will be used to measure abundance of prey species within the cougar study area. Although a cougar-killed bison has yet to be detected, their increasing presence in cougar habitat is notable compared to previous phases of cougar research in Yellowstone.

Table 1. Ungulate groups cl	assified while snow	v tracking cougars.	We only counter	d groups visible	within 0.5
kilometer of survey routes.					

		Total	Mean Group
Ungulate Species	Ν	Counted	Size
Bison	330	4,219	12.8
Elk	147	1,922	13.1
Deer (Mule and Whitetail)	67	330	4.9
Bighorn sheep	51	303	5.9
Pronghorn	13	186	14.3
Moose	5	6	1.2
Totals	613	6,966	

#### **Remote Camera Trapping**

We placed cameras at 30 different locations from January5 to March 13, totaling 2,010 camera trap-nights. These locations produced 43 successful capture events of cougars and yielded 277 videos of cougars traveling past, bedding, or scent-marking at a camera station. Additionally, we identified 21 other species, including grizzly bear, wolf, red fox, coyote, western striped skunk (*Spilogale gracilis*), marten, elk, bison, mule deer, whitetail deer (Odocoileus virginanis), bighorn sheep (Ovis canadensis), moose (Alces americanus), short-tailed weasel (Mustela ermine), river otter (Lontra canadensis), red squirrel (Tamiasciurus hudsonicus), bald eagle, golden eagle, raven, black-billed magpie, and ruffed grouse (Bonasa umbellus). Interestingly, many of the cougar scent-marking scrape sites were visited by wolves, red fox, coyote, and marten - all of which scent marked at these sites.

#### **Education and Outreach**

The Yellowstone Cougar Project staff gave talks throughout the year about cougar ecology and their role in Yellowstone ecosystem, along with research objectives and preliminary findings. Dan Stahler, Colby Anton, and Quinn Harrison collectively gave 26 lectures to a variety of audiences including local and national high school and university students, NPS interpretative and Xanterra concession employees, and park visitors. Additionally, the project's Instagram feed (@yellowstone\_cougar\_project) gained nearly 12,000 followers

by the end of 2015, sharing regular photographs and updates about the project's findings throughout the field season.

The project also began working with Montana-based non-profit organization, Ecology Project International, which aims to produce the next generation of conservation leaders through place-based ecological education programs that target high school students from local and national communities. We worked with 2 groups of 12 students from Moscow, Idaho and Oakland, California. During these programs, students learned basic ecological concepts and their applications in scientific study. To reinforce these conceptual frameworks, each group spent two days conducting field research with Ecology Project International instructors and our field biologists snowshoeing along designated transects and collecting cougar genetic samples. This provided students with a unique science- and conservation-based educational experience with real biologists working in a national park.



(**LEFT**) Field Technician Ellen Beller teaches a student from Ecology Project International how to set a remote camera trap for cougars. (Photo by D. Stahler/NPS). (**RIGHT**) The field crew tracks a family group as they wandering along the banks of the icy banks of Yellowstone River. (Photo by D. Stahler/NPS)

#### THE YELLOWSTONE COUGAR PROJECT TEAM

The Yellowstone Cougar Project represents a collaboration between the National Park Service and several conservation organizations. Dr. Daniel Stahler, Wildlife Biologist in the Yellowstone Center for Resources was the principal investigator and on-site lead for the study. Dr. Toni Ruth, High Divide Coordinator for Backcountry Hunters and Anglers and previous project leader of the Yellowstone Cougar Project Phase II study, Dr. Michael Sawaya, Research Ecologist and Co-Founder of Sinopah Wildlife Research Associates, and Howard Quigley, Panthera's Executive Director of the Jaguar Program and Director of Teton Cougar Project, were co-principal investigators. Colby Anton is enrolled as a Dissertation student at the University of California, Santa Cruz working with major advisor Dr. Chris Wilmers. Colby's research will focus on estimating cougar population parameters, predation and energetics, as well as evaluating the effects of outdoor science education in young adults. The core field technician team was led by Quinn Harrison and included Ellen Beller, Marcus Bianco, Wes Binder, Aaron Morris, and Kira Powell. Tony Knuchel was our houndsman.



2015 Yellowstone Cougar Project Team – (from left) Ellen Beller, Colby Anton, Dan Stahler, Quinn Harrison, Mike Sawaya, Kira Powell, Aaron Morris, Marcus Bianco, and Wes Binder.

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