WINTER 2021-2022 WEST-CENTRAL TREND MONITORING AREA MOUNTAIN LION DENSITY

Prepared Sept 27, 2022 by Molly Parks and Dave Messmer

SUMMARY: Based on 65 DNA samples from 34 individual lions, we estimated a density of 2.0 lions/100km2 (90% Credible interval: 1.4–3.1) in the West-central Trend Monitoring Area during the winter of 2021-2022.

Field season summary

Montana Fish, Wildlife, and Parks completed a third season of mountain lion population monitoring with field efforts focused in the West-central ecoregion. Hound handler crews searched and sampled lions in the permanent Trend Monitoring Area (TMA) between Lincoln and Avon from December 6, 2021–March 23, 2022. The winter conditions improved this season compared to last winter, with extensive snow cover for most of the study period. The 2021-2022 season produced the most consistent snow and tracking/trailing conditions to date and required snowmobiles for access most of the winter. While early March started with good conditions, warming temperatures led to extensive bare ground in lower elevation portions of the study area by mid-March. Access became increasingly difficult for both snowmobiles and trucks, and ultimately ended lion monitoring efforts March 23. The crew collected 19 samples in December (16 muscle samples from treed lions, 1 hair, and 2 scat), 22 samples in January (20 muscle and 2 scat), 17 samples in February (13 muscle, 2 hair, 2 scat), and 12 samples in March (11 muscle, 1 hair). Note, some of the aforementioned samples included repeated samples of the same individuals. The crew encountered less wolf activity this winter than in previous seasons, and most sets of wolf tracks encountered were in smaller groups of 2-4 wolves. With improved snow tracking/trailing conditions and less concern for wolf-hound conflicts, hound handlers were able to thoroughly search and sample most of the monitoring area.

The biggest challenge for the season was access. Several large ranches with high quality lion habitat denied hound handlers permission to search and sample lions on their property, limiting efforts around

Lincoln and west of Highway 279. The West-central TMA also contained a number of inaccessible grid cells that consisted of high elevation areas accessible only by trail (particularly along the Continental Divide), further limiting search effort. An additional note was a shared observation of several hound handlers. While searching throughout the winter, the crew noted the monitoring area appeared to have several "holes" where lion sign was rarely detected, despite high RSF values and expected lion detections. While this coincided with scarce ungulate presence in the same locations, hound handlers were surprised by lack of activity in these seemingly high-quality habitat areas.

Spatial capture-recapture model results

Winter habitat suitability in West-central trend area was generally high with 75% of grid cells having mean RSF > 0.90 (range = 0.61–0.95; Figure 1b). We searched a total of 39,754 km in the 88 grid cells from Dec–Apr (Figure 1c). Of the 70 successfully amplified DNA samples collected by crews, 57 were usable in analysis, because they represented unique encounters of independent-aged individuals for a given grid cell during each monthly sampling occasion (Table 1, Figure 1d, Figure 2). An additional 8 samples were obtained from lions harvested inside the study area, or from lions harvested outside the study area, but previously encountered inside. Of the 65 total usable samples, 34 were from unique individuals (13 males and 21 females) and the remaining 29 were recaptures or dead recoveries of those individuals in other grid cells or sampling occasions (Table 2). Based on these samples, we estimated a median density of 2.0 lions/100km^2 (90% CrI: 1.4–3.1) with 68% female (90% CrI: 47–85%) in the West-central trend area during the winter of 2021-2022 (Table 3) – this equates to 126 (90% CrI 89–195) total lions with activity centers in the state space and 44 with activity centers falling under the 88 study area grid cells. Therefore, the overall detection rate for lions with any activity center in the statespace was 27% (90% CrI: 17–38%). Of the 34 unique lions detected, 18 were first detected in December, 10 in January, 5 in February, and 1 in March–April (Figure 3).

Figure 1) a) location of study area (blue fill) and statespace (grey fill around study area) with West-central ecoregion boundary, b) average resource selection function (RSF) values for each study area grid cell – scaled 0 to 1 with 1 being highest suitability, c) total kilometers of search effort by houndsmen, d) total captures in each grid cell.

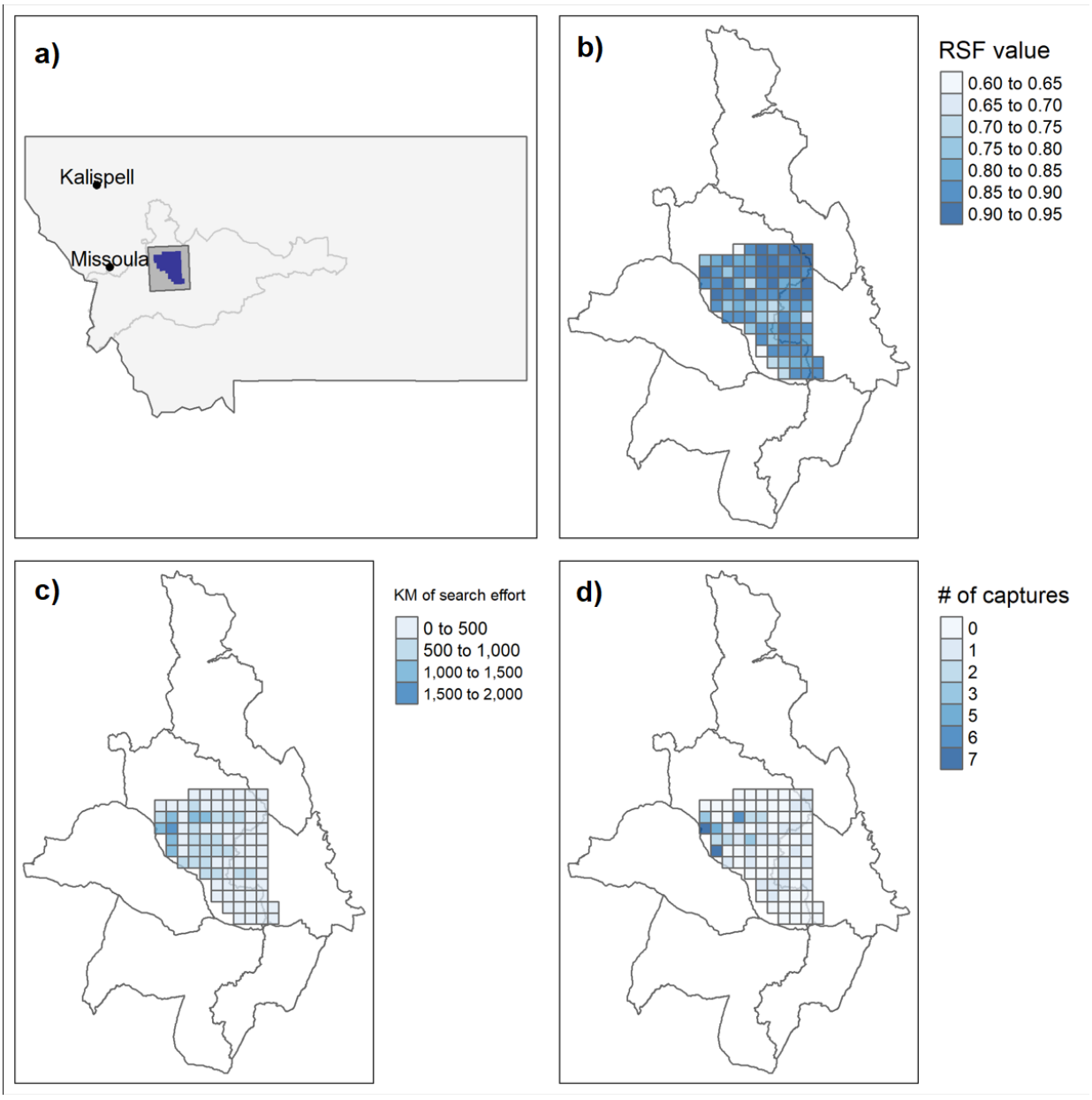
a)
Kalispell
Missoula
b)
RSF value
0.60 to 0.65
0.65 to 0.70
0.70 to 0.75
0.75 to 0.80
0.80 to 0.85
0.85 to 0.90
0.90 to 0.95
c)
KM of search effort
0 to 500
500 to 1,000
1,000 to 1,500
1,500 to 2,000
d)
# of captures
0
1
2
3
5
6
7

Figure 2. Locations of captures in West-central trend area, winter 2021-2022. Trapping grid cells (5 x 5 km, n = 88) are shown in light purple. Yellow dots are successfully amplified DNA from live captured lions or samples of their hair or scat. Purple dots are samples from harvested animals.

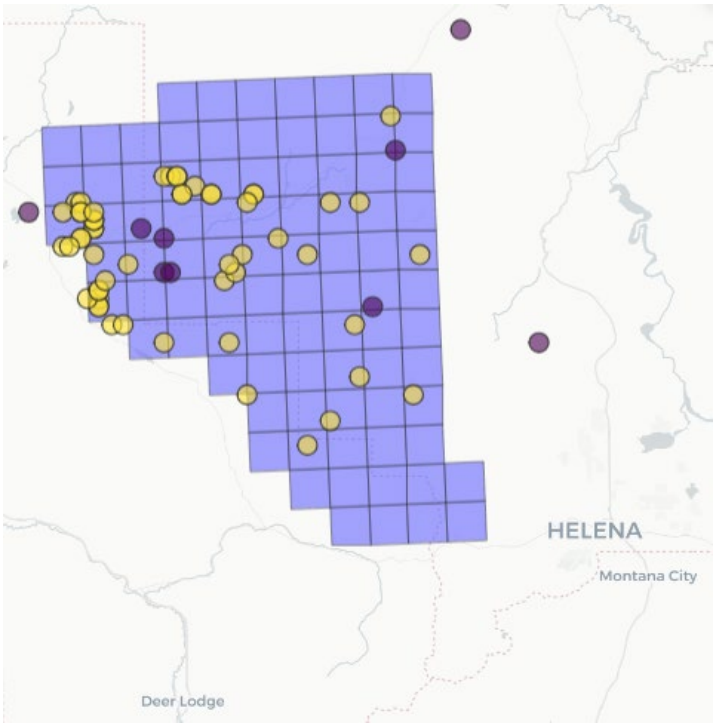

Figure 3. Cumulative unique lion detections over the duration of the study

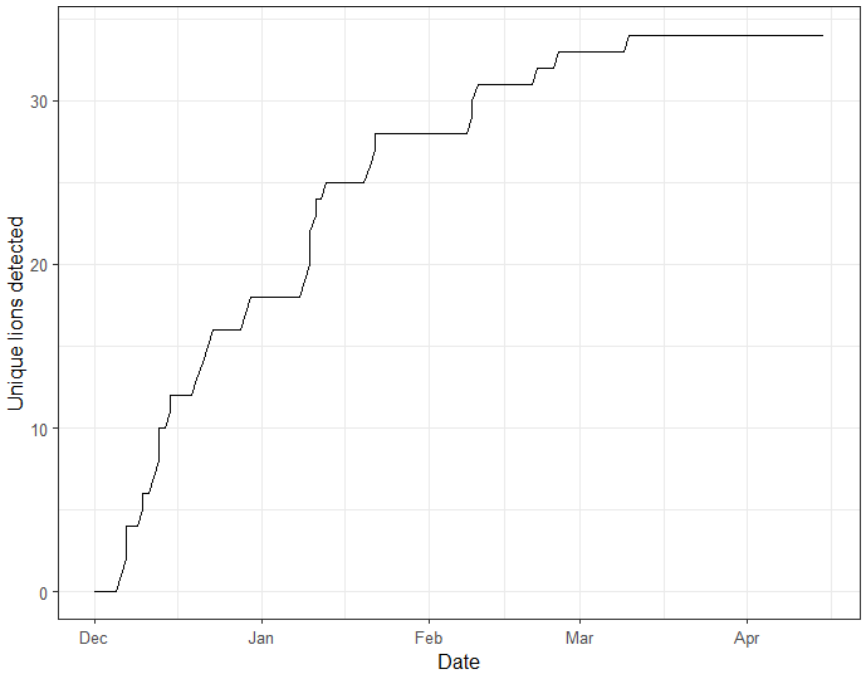

Table 1. Summary of DNA sample types used in density estimation for winter 2021-2022 in the West-central.

Type	***n***
Muscle	53
Hair	2
Scat	0
Tissue (from dead lion)	8

Table 2. Frequency of capture for 60 individuals detected during winter 2021-2022 in the West-central trend area.

Times captured	***n* individuals**
1	16
2	9
3	7
4	2

Table 3. Density estimate from analysis of spatially explicity capture-recapture data for the winter 2021-2022 in the West-central trend area. The model incorporating search effort and sex as covariates for the detection probability model and allowed home range size to vary by sex. The model for density of lion activity centers used resource selection function (RSF) values as covariates.

Model	**Median density (per 100km^2)**	**90% CI**
$\boldsymbol{Effort + RSF + Sex + \sigma_{sex}}$	2.0	1.4–3.1

Methods

We followed the spatial capture recapture (SCR) data collection and analysis methods described by Proffitt et al. (2015) and the MTFWP Mountain Lion Monitoring and Management Strategy (2018). These methods estimate the density of independent-aged (i.e., legally harvestable) mountain lions in the

study area (including transient lions). The detection model included covariates for search effort and sex and it allowed expected home range size to differ by sex. The model for the density of activity centers included a covariate for habitat quality, indexed by the resource selection function developed with radio-collar data (MTFWP Mountain Lion Monitoring and Management Strategy [2018]). We fit the model using the R package 'SCRbayes' (Royle et al. 2013). We ran 1 Markov-chain Monte Carlo chain run for 130,000 iterations with the first 13,000 iterations discarded as burn-in.

Literature Cited

Royle, A., R. Russell, C. Sutherland, and J. Goldberg. 2013. SCRbayes R package. https://rdrr.io/github/jaroyle/SCRbayes/man/SCRbayes-package.html *accessed* June 29, 2021.

Proffitt, K., J. Goldberg, M. Hebblewhite, R. Russell, B. Jimenez, H. Robinson, K. Pilgrim, and M. Schwartz. 2015. Integrating resource selection into spatial capture-recapture models for large carnivores. Ecoshpere 6:239, https://doi.org/10.1890/ES15-00001.1