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COUGARS IN KANSAS

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Abstract: The presence of the cougar (*Puma concolor*) in the state of Kansas is a controversial issue. Since 1999, 234 cougar sightings have been reported to the Extension Wildlife Specialist at Kansas State University. To those who have reported such sightings, the existence of cougars in Kansas is undeniable. Others, however, question the validity of such sightings as providing evidence of cougars. After surveying other governmental agencies and organizations, we discovered that acceptable identification criteria for rare or unusual felines included things beside sightings: voucher specimens, DNA from hair or scat, tracks, prey carcasses, and photographs or videos. The cougar sightings from Kansas were plotted on a map using ArcGIS 9.1, and the Spatial Analyst Tool was used to test the 3 hypotheses of: 1) cougar sightings are located near rivers, as cover is provided; 2) sightings of cougars are located around captive felines that may be potential breeding partners; and 3) cougar sightings are located within the vicinity of cities with populations greater than or equal to 35,000 people, as the higher densities of observers may be associated with more opportunities for sightings. Our data led us to accept all 3 hypotheses.

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A wide range of environmental and behavioral factors can explain species distribution. Examination of those factors can help management agencies develop plans for species management and conservation. Unfortunately, the reliability of occurrence records when using sighting reports as evidence is highly variable. Our objectives in this paper are to: 1) provide confirmation of identification criteria for rare or unusual felines; and 2) evaluate the distribution of cougar sightings in Kansas.

IDENTIFICATION CRITERIA

Virtually all methods for providing species distributions are based on occurrence records (Ferrier 2002). In the absence of physical evidence, researchers must rely upon information provided by sightings. An observer's knowledge of the characteristics, behavior and field sign of a cougar certainly contributes to the validity of sightings when reviewed by those who are developing occurrence records. The correct identification of sighted cougars is crucial to management of the animal.

In order to compile a list of identification criteria for confirmation of cougars, we questioned Kansas governmental agencies and organizations on the criteria required to document various species of animals. For mammals, voucher specimens are the preferred source of evidence (Frey 2006). In the absence of such a specimen, however, other physical evidence, such as hair, DNA (from hair), tracks, scat, and still photographs or video, is accepted for identification by some.

Frey (2006) published a table that provided a means to evaluate the reliability of species occurrence records. In that paper, an expert's evaluation of preserved physical evidence that exhibits diagnostic characteristics is considered in the "verified" class. At the other extreme, the "highly questionable" class includes records that have a high potential for inaccuracy such as second hand reports or questionable identification. The Cougar Network (Anonymous 2006a) applies rigorous criteria when evaluating cougar incidents that may extend the cougars range. They accept only those reports supported by tangible physical evidence verified by qualified wildlife professionals. Evidence submitted by non-professionals and private individuals or groups is only recognized after it has been corroborated by "independent experts" e.g., natural resource agency or university affiliated biologists (Anonymous 2006a).

It should be noted that the Cougar Network (Anonymous 2006a) has recorded no confirmed cases of cougars in Kansas. The Cougar Network requires tangible physical evidence verified by qualified wildlife professionals or other evidence only after it has been corroborated by independent experts (Anonymous 2006a).

To clarify the characteristics and behaviors associated with cougars, we provide some details of the appearance, tracks, and scat.

Appearance

A cougar has a coat that is pale brown to tawny in color, with white/buff on the underside. The coats of juvenile cougars, however, have black spots. The points (whiskers, ears, and tail) are dark brown to black. The length of a mature cougar varies, but the body is generally 1.50-2.75 m (4.9-9.0 ft), with the tail contributing 53-92 cm (21-36 in). The hind foot is 22-31 cm (8.7-12.2 in) in length (Whitaker 1996). The senior author believes that the most common mistake made when reporting a possible sighting is the length of time the animal is under observation. Many sighting reports also occur in poor lighting or from vehicles at highway speeds.

Tracks

Cougar tracks are asymmetrical and rounded. The fore is 80-100 mm (3.1-3.9 in) in length and the hind is slightly smaller. The heel pads are lobed; the front edges are concave, whereas the rear edges are tri-lobed. No indication of claw marks is present in the tracks (Whitaker 1996) unless the cougar making the track was leaping or pouncing at which point their retractile claws may be extended. The most common mistake made when reporting cougar tracks is to confuse them with dog tracks which may not always show the presence of claw marks.

Scat

The scat of a cougar is presented in different forms, from masses to irregular cylinders to pellets. The contents of the feces include traces of hair (either from grooming or prey) and bone particles. The cougar may leave the scat exposed as a territorial marker or cover it with earth/debris (Whitaker 1996). Food habits determine the size and shape of scat and thus scat appearance is not a reliable indicator.

METHODS

The geographical study area was Kansas. We chose to use physical features including all rivers in the state and their associated lakes and the cities with populations greater than or equal to 35,000 people (Manhattan, Shawnee, Hutchinson, Leavenworth, Salina, Olathe, Lawrence, Overland Park, Topeka, Kansas City, and Wichita). Since Kansas requires owners of captive wild felines to be permitted, the locations of captive-held felines was obtained from Kansas Department of Wildlife and Parks.

Since 1986, cougar sightings reported the Wildlife Extension Specialist at Kansas State

University have been entered into a database and provide information on observer contact information, observation location and duration, and animal characteristics. Locations described in the sighting reports were plotted onto a paper map of Kansas. The latitudes and longitudes of the points were measured in degrees, and the coordinates were entered into the database. The degrees were converted to decimal degrees by separating the degrees, minutes, and seconds into individual cells using the Text to Columns function and inputting the separated values into the equation ((degrees) + (minutes/60) + (seconds/3600). We saved the converted coordinates and relevant observation data as a dBase IV file to be used in ArcGIS Desktop (Anonymous 2006b) to evaluate spatial distribution of the cougar sightings throughout Kansas. A spatial analysis of mapped points was then performed.

The data needed to construct the maps using ArcMap (Anonymous 2006b) were counties, major rivers and their associated lakes, and cities with populations greater than or equal to 35,000 people in Kansas. The chosen geographic coordinate system was North American Datum 1983 (NAD83) with UTM (Universal Transverse Mercator) Zone 14N. We set the coordinate system of the Data Frame and added our acquired layers. The cougar sightings and captive feline databases were opened in ArcMap as tables and converted to layers.

Hawthstools (Beyer 2004) was used to create a random sample of 300 points within the Kansas state boundary. Points were then plotted on the map as a layer. Hawthstools was again used to calculate the distance between all points and distance to nearest neighbor.

With the map (Fig. 1) constructed, we used the ArcToolbox (Anonymous 2006b) to measure the spatial statistics and analyze the data. The statistical test was high/low clustering. We made a joined layer of the counties and cougar sightings and began a high/low clustering spatial analysis, using the joined layer as the input feature class and counts attribute as the input field.

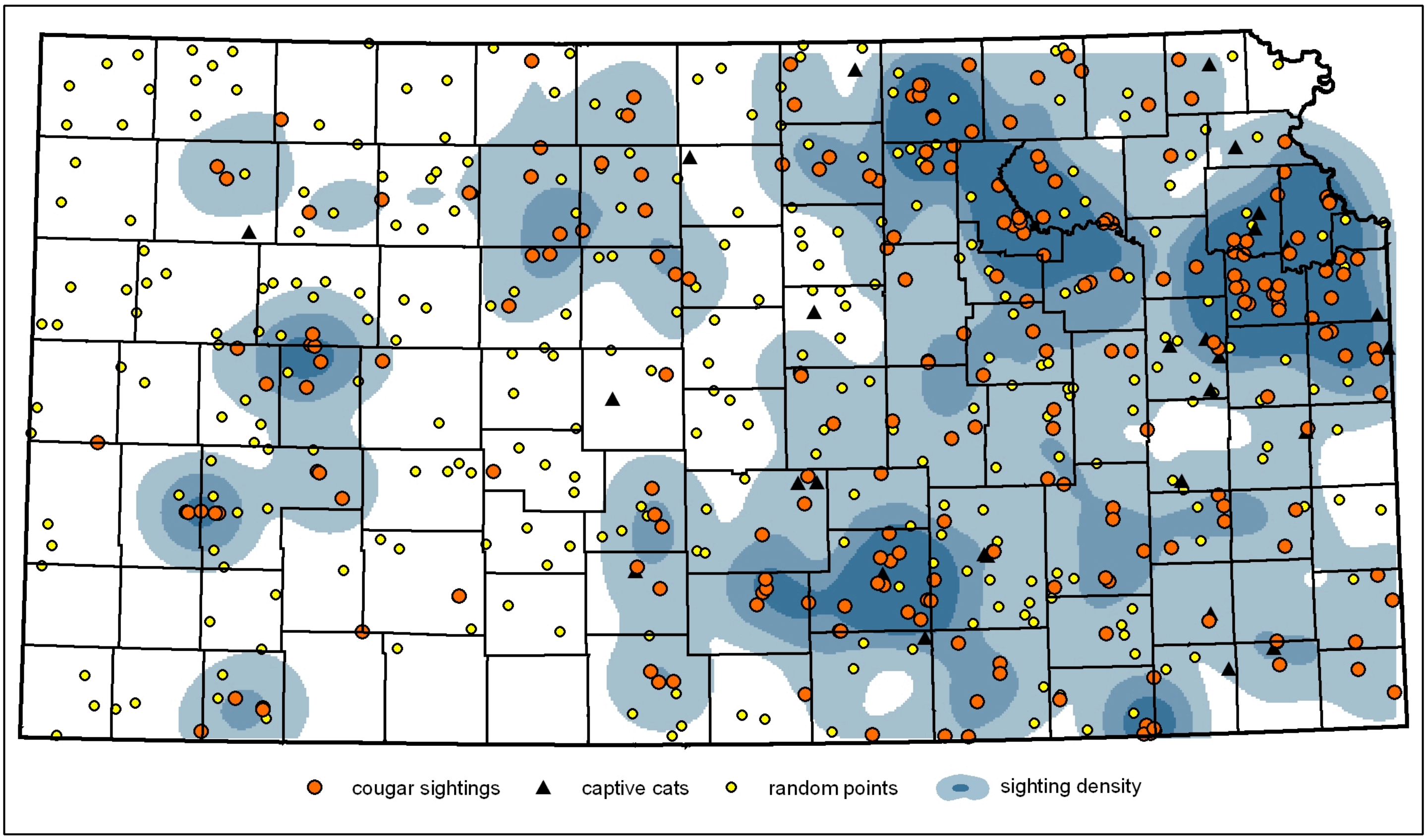

Fig. 1. Distribution of cougar sightings reported to Kansas State University 1999- 2006. Captive cats may include cougars, bobcats and other felids not native or indigenous to Kansas. The sighting density was determined using the cluster analysis procedure found in ArcGIS.

RESULTS

We calculated difference between the means using z-scores. We examined all tests of significance at $\alpha = 0.05$. The high/low clustering statistical test provided a graphic output that suggested the cougar sightings were highly clustered. It was with < 1.0% likelihood that the clustering of high values could be a result of random chance. A 2-sample *z*-test was used to compare the mean distances between random points and known locations of sightings and physical features. The average straight line distance of sightings to cities was 86.3 km (53.6 mi) and the average distance to random points was 141.3 km (87.8 mi). The *z*-score for that comparison was -6.83 ($P < 0.0001$). The average distance from sightings to all rivers was 2.5 km (1.6 mi) and the average distance to random points was 3.5 km (2.8 mi) with a *z*-score of -3.86 ($P < 0.0001$). The average distance from all sightings to the nearest location of a captive feline was 47.7 km (29.6 mi) and the average distance to random points was 60.6 km (37.6 mi) with a z-score of -3.61 ($P < 0.0003$).

The land cover occurring at the point locations of cougar sightings, captive felines and random points was assessed which revealed some interesting patterns. The random points appear to capture the general abundance of the different land cover classes across the state, but the frequency of cougar sightings in forested areas is much greater than what occurred randomly (Fig. 2).

DISCUSSION

Our initial hypothesis was that cougar sightings in Kansas would have an association around rivers, captive felines, and cities with populations greater than or equal to 35,000 people. We assumed that cougars would travel along rivers due to the large amount of cover protection provided by trees and shrubs, in addition to available prey. We also

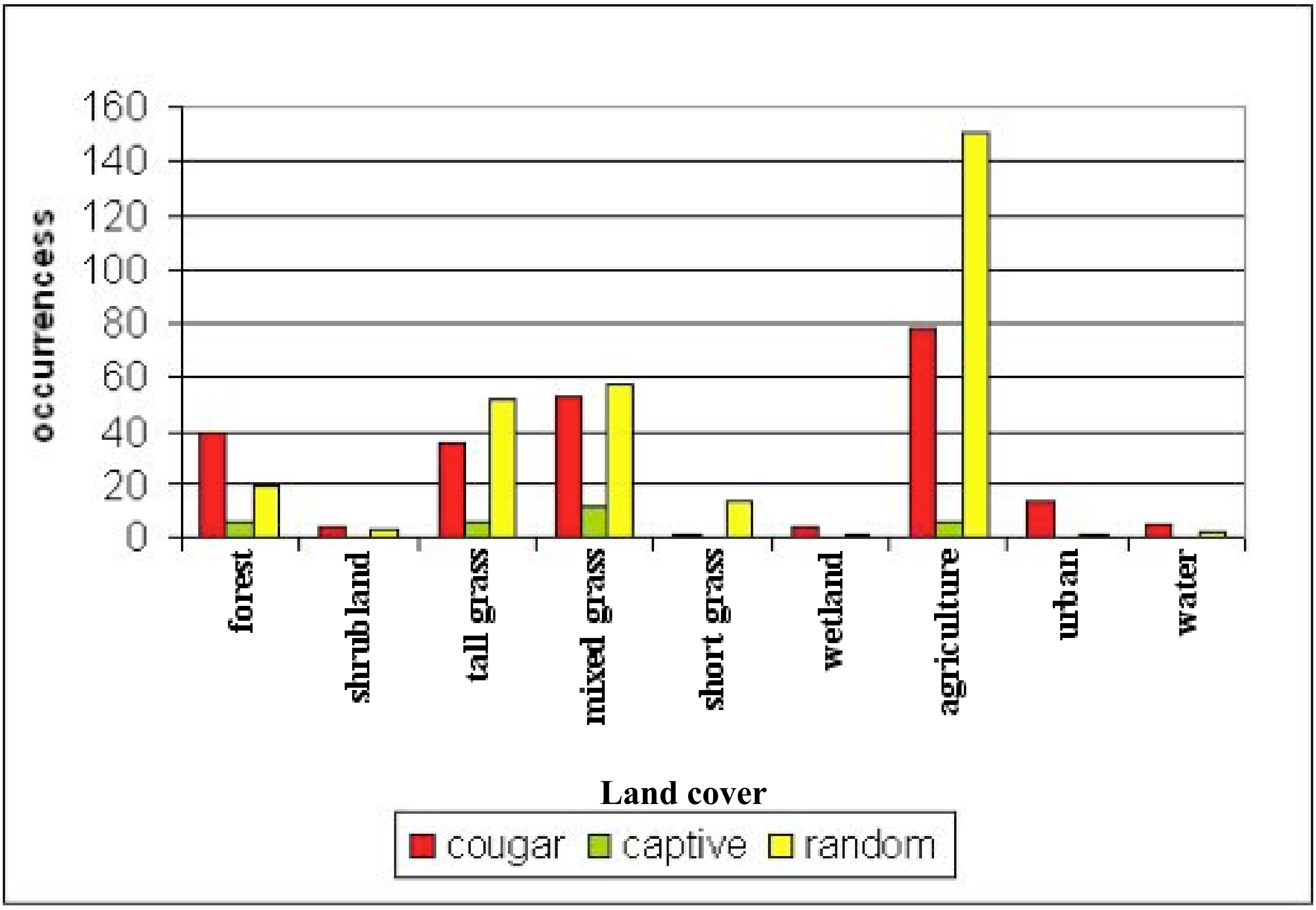

Fig. 2. Land cover associations and cougar sighting reports in Kansas 1999-2006.

believed that cougar sightings should concentrate around captive felines since transient cougars entering the state may be seeking potential breeding partners or occasionally captive felines would be accidentally or intentionally released. In the cities with populations greater than or equal to 35,000 people, we believed that the greater number of humans (thus more observation opportunities) would increase the number of sightings of cougars.

The high/low clustering statistics, though not specific in location, indicated that clustering of cougar sightings was evident. When viewing the map, it was clear that sightings clusters did appear along the major rivers and their associated lakes, perhaps due to the protection and shelter provided by vegetation. The z-scores calculated from the straight distance line analyses to nearest neighbor showed that cougar sightings were more likely to be observed along rivers in Kansas. When frequency of sightings information was compared with land-cover data, the frequency of cougar sightings in forested areas was double the frequency of sightings found near random points.

The association of cougar sightings and large cities was also strong. More observers in an area should see more cougars if they are present. The mean distance from random points to captive felines when compared to the mean distance from sightings to captive felines indicated that the means were not equal and thus an association existed. Given the uncertainties associated with observer sighting reports, we believe that more credence could be given to those sightings that are in close proximity to rivers, cities with > 35,000 population and sightings closer to captive held felines.

The closest known established populations of cougars to Kansas are those found along the front range of Colorado. If natural dispersal from that population was the source of the cougars being sighted we should see more reports from that part of Kansas. The lack of sightings of cougars in the western part of Kansas does not imply cougars are not present in that part of the state. With the majority of the reports in Kansas coming from eastern Kansas, this may indicate that the cougars that are being sighted in Kansas would be coming from somewhere other than Colorado, perhaps South Dakota. Another interpretation could be that the sightings are simply erroneous.

MANAGEMENT IMPLICATIONS

Reviewing criteria that establishes the occurrence records and thus the range of rare or unusual species shows a lack of formal guidance as to what constitutes "official" criteria. In some cases voucher specimens are required but other species may only require a sighting done by an expert. Authors suggest that professional biological organizations develop written criteria that can be used to establish occurrence records. Cougar sightings continue to be reported. Agencies have a difficult time ranking those sighting reports as valid or not. A written set of what each state will accept as evidence would reduce controversy.

Sighting reports are important in wildlife management. The public at large can help establish occurrence records. Some sighting reports are more credible than others. In the absence of physical evidence such as voucher specimens, hair, DNA, track casts or images, professionals must use their best judgment when evaluating the validity of the sighting reports.

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