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TECHNICAL NOTE

Bobcats Do Not Exhibit Rub Response Despite Presence at Hair Collection Stations

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Abstract

We evaluated the detection rate for hair snare sampling for bobcats (*Lynx rufus*) using colocated hair snares and infrared-triggered cameras at 20 locations on private property in eastern Texas. Hair snares and cameras were placed together at survey stations that included both visual and olfactory attractants. In 1,680 trap-nights we photographically documented 15 visits by bobcats but collected only one bobcat hair sample. Our observations suggested limited rubbing behavior by bobcats at hair snares despite presence at hair collection stations. The explanation for this behavior remains unclear but is consistent with observations of low and variable hair trap success for this species. Although presence of other carnivores, especially gray fox, may inhibit rub response of felids, we did not document gray foxes at our hair collection stations. Low rub frequency may limit the utility of these techniques for bobcats and we suggest that alternate techniques such as camera surveys or fecal DNA collection may be more suitable.

Introduction

Due to their low population densities, large home ranges, and secretive natures, mammalian carnivores present special challenges in designing effective survey techniques. Difficulty and expense encountered in direct observation or capture has produced an extensive literature examining the use of noninvasive techniques to survey mammalian carnivores [1]. Noninvasive survey techniques use a variety of animal sign, including photographs, tracks, scat, and hair, to document species presence and infer abundance and other population demographics. With the advent of genetic analysis techniques, certain types of noninvasive samples (e.g., hair, scat) can be used to obtain DNA, permitting individual identification, gender determination, and analysis of population genetic structure and other parameters [2]. Noninvasive genetic techniques have been used with varying degrees of success to estimate

abundance and distribution of several carnivore species, including ursids [3, 4, 5], felids [6, 7], mustelids [8, 9] and canids [10, 11].

A variety of designs have been used to collect hair samples for genetic analysis, including wire brushes, glue pads, barbed wire, barbed rub pads, and natural rub objects (e.g., trees with rough bark [12]). For felids, the barbed rub pad first described by McDaniel and coworkers [13] to survey for Canada lynx (*Lynx canadensis*) has become a standard design. These stations consist of a carpet pad nailed to a tree or post at or near eye level and treated with an olfactory lure [13]. Nails or wires are driven through the carpet pad to capture hairs; thus, hair collection is reliant on natural face-rubbing behavior by felids. This design has proven effective for some felid species, including Canada lynx [13], European lynx (*Lynx lynx* [14]) and ocelot (*Leopardus pardalis* [6, 15]). However, less consistent results have been obtained in surveys for other species such as cougar (*Puma concolor* [16, 17]), margay (*Leopardus wiedii* [16, 17]), and bobcat (*Lynx rufus* [16, 18]). In particular, bobcats present an interesting case due to their abundance and wide distribution in North America. Although some studies have reported success in sampling bobcats [15], others report mixed results [7] or near failures with this species [18, 19].

Despite widespread use of the rub pad for hair collection from felids, the reasons for the wide variation in success with bobcats and other species remain unknown. Rubbing behavior and the factors that may influence it in bobcats and other wild felids have not been studied thoroughly. Sympatry with a small canid, the gray fox (*Urocyon cinereoargenteus*) has been associated with reduced capture success of bobcats in several studies [16], although this effect has not been documented in all studies where gray foxes occur [17]. If it is a significant factor, this interference could be of particular concern in the southern and eastern United States due to the wide range of sympatry between these common species. With widespread and increasing interest in effective survey techniques for carnivores, it is important to understand the potential limitations of any survey technique. In light of this, we evaluated the efficacy of hair snares to survey bobcats in eastern Texas. Using infrared-triggered cameras, we documented presence of bobcats at hair collection stations and determined the frequency of rub response. Despite multiple photographs documenting presence at collection stations, we experienced low success in obtaining hair samples from bobcats.

Study Area

We conducted our study on a 1,318-ha private tract approximately 15 km west of Nacogdoches, Texas. The tract, known locally as the Hayter Estate, consisted of actively managed loblolly pine (*Pinus taeda*) plantations of varying ages (66% of area) intermixed with hardwood lowlands (22%), natural mixed pine-hardwood stands (6%) and open rights-of-way for roads and oil and gas development (6%). This area is in the heart of the Pineywoods ecoregion of eastern Texas, characterized by extensive managed and natural pine forests on uplands and hardwood forests in bottomlands. The climate was humid and subtropical with average annual rainfall of 119 cm; summers were long and hot (mean July temperature was 28°C) and winters were mild (mean January temperature was 9°C). At the time of our study, a concurrent population survey estimated bobcat density to be 0.29 bobcats/km^2 [20].

Methods

We systematically established 20 bobcat survey stations on a 65-ha block grid over the entire study area. Survey stations were placed subjectively to maximize visitation potential within a 200-m diameter circle at the center of each grid cell. We placed survey stations in areas of perceived high bobcat activity based on tracks or scats or along probable travel corridors such as logging roads or utility rights-of-way. Most stations were in densely forested habitats, but several ($\leqslant$5) were along the edges of recent timber harvest sites with little overstory canopy. We performed surveys for 12 weeks from 6 September to 28 November 2005. Stations were checked twice weekly to maintain film in camera systems and collect hair samples.

Each survey station consisted of two parts: a Trailmaster 1500 active infrared remote camera system (Goodson and Associates, Lenexa, KS) and a post-mounted hair collection station. We placed the transmitter and receiver parts of the Trailmaster active detection system approximately 3 m apart, 30 cm above the ground and in a north to south alignment to reduce false triggers [21]. Midway between the transmitter and receiver, we placed a chemical attractant (bobcat urine) on a 20 cm post wrapped in a clean rag attached by twine [20]. We also hung a visual attractant consisting of a bundle of large feathers approximately 2-3 m above the ground near the survey station.

We constructed hair collection stations using the design of McDaniel and coworkers with a few modifications [13]. Because several of our stations were located in recent clearcuts or rights-of-way with few available trees of appropriate size, we mounted the carpet pads on 40-cm posts. We also added a wire brush to the reverse side of the post as an additional rubbing surface. Hair collection posts were placed within the detection zone of the camera system near the midway point between transmitter and receiver. We treated both the carpet pad and the wire brush with a mixture of 100% pure catnip oil and glycerin (4 ml glycerin to 2 drops catnip oil) and sprinkled both the carpet pad and brush with dried catnip [13, 22]. We removed all animal hairs from the brush or carpet pad during twice-weekly visits, placed them in unused paper envelopes, and stored them at -20°C.

We used a combination of macroscopic and microscopic visual analyses to identify bobcat hair samples. First, we identified hair color banding patterns characteristic of felids [23]. All samples containing at least one hair with the appropriate banding pattern were considered potential bobcat samples. We then confirmed our identification using cuticular scale pattern [24]. Photographs from colocated camera stations were digitally analyzed to determine species and individual identity for bobcats [20].

Results

We collected one bobcat hair sample over 1,680 trap nights during this study. We also collected one hair sample identified as coyote (*Canis latrans*) and three samples identified as raccoon (*Procyon lotor*). The one bobcat sample was deposited on the wire brush side of the hair collection station while the remaining samples were from the carpet pad or the nails pushed through it.

Over the same time period, we photographically recorded 15 bobcat visits by seven different individual bobcats [20]. We also obtained 112 photographs of visits by other forest carnivores, including 12 coyote, 81 raccoon, 17 Virginia opossum (*Didelphis virginiana*) and 2 striped skunk (*Mephitis mephitis*). We did not observe photographic or hair evidence of gray foxes.

Discussion

The results of our evaluation were similar to those of Harrison [18] and Downey *et al*. [16] in that we obtained few hair samples from bobcats despite direct photographic evidence of several in the area and multiple visits to the hair collection stations. Of 15 visits by bobcats to the collection sites, only one resulted in successful collection of a hair sample. The reason for limited and variable rubbing behavior by bobcats in this and other studies is unclear. Because hair snares are a preferred survey method for many felids [7, 17] and have distinct cost advantages over other methods (e.g., detection dogs and camera surveys [17, 18]) understanding the factors that affect hair deposition at survey stations is important. These factors could include scent lure used [13], length of survey [17], season [15], habitat, and presence of sympatric gray fox [16].

Previous studies have shown that catnip and/or catnip oil-based scents (including proprietary lures like Weaver's Cat Call [16]) are the most effective scents in eliciting the rub response [13, 17]. The amount of catnip oil applied to scent stations varies considerably, with our formulation having a low concentration [18, 22] compared to some studies [17]. The low concentration may have affected our detections; however, domestic cats respond to catnip oil at extremely low concentrations (<1 ppm [25]). We also sprinkled the hair snares liberally with dried catnip. We felt bobcats close enough to be photographed at the collection station were sufficiently close to respond to the scent and that the impacts of the lower catnip concentration were minimal.

Although east Texas is within the range of the gray fox, they were not photographed or otherwise detected at any of the survey stations. Numerous studies have documented that gray foxes readily visit hair collection sites [7, 16], and our results suggest their abundance at the site was very low or negligible. While the influence of gray foxes on our results cannot be ruled out, it was not apparently through direct interference at the survey stations. In a concurrent study conducted at the same location where Downey *et al*. [16] noted interference by gray fox, gray fox presence did not affect felid rub response [17]. Survey length was the most important factor determining detection of felids regardless of gray fox presence [17].

The response to catnip is similar to sexual behavior in domestic cats [25] and it may be that rub response would be greater during the breeding season when bobcats are more actively marking. The influence of season on success has not been examined thoroughly, but studies that encompassed both breeding and nonbreeding seasons have not noted any seasonal trends in response [15, 18].

In general, hair trapping for bobcats has been more successful in habitats with dense vegetation and defined trails, perhaps because bobcat movements are limited and they are more likely to encounter survey stations located along these movement

paths [18]. Most of our stations were in densely forested habitats and we observed considerably higher visitation rates at these survey stations than at stations located in clearcuts or other openings. Habitat is more likely to affect visitation than rubbing behavior and we documented visitation in several habitat types at multiple sites with the infrared-triggered cameras.

We suggest that bobcats exhibit individual variation in their response to rub pads or catnip-based olfactory lures, perhaps more so than other felid species such as lynx and ocelot. We photographically recorded bobcats sniffing or otherwise showing interest in the hair collection station on two occasions at different stations - the one instance when we collected bobcat hairs and one time when we did not collect hair. Based on spot pattern, it was the same individual on both occasions. In the study by Shinn [15], deemed a success for the use of hair snares for bobcats [12], bobcats recorded on camera did not leave hair at colocated hair snares 16 times (compared to 29 total hair samples obtained). The reason for this apparent heterogeneity in response to rub pad hair snares remains unclear; however, it may reflect heterogeneity in response to catnip.

Response to catnip and catnip oil is a genetically determined trait in domestic cats, the only species for which the response has been well studied (*Felis catus* [25]). Up to 30% of domestic cats do not exhibit any response to catnip, and some, particularly kittens, exhibit an avoidance response [25]. A similar genetically determined response in wild felids could bias detection with hair snares. In a study of captive wild felids, bobcats and cougars did not respond to catnip or catnip extract while lions (*Panthera leo*) and jaguars (*P. onca*) responded strongly and leopards (*P. pardus*) and tigers (*P. tigris*) were partial responders [26]. Although this study used small numbers of animals and captive animals may not behave like free-ranging individuals, it is nonetheless illustrative that bobcats and cougars have both demonstrated low and variable response to hair snaring by standard methods. Other scent lures, including commercial fragrances, have been effective in eliciting rub response in some species [17]; however, catnip lures remain the standard for hair collection. In a pilot survey for this study, we did not document any response to Obsession™ cologne at camera stations by bobcats; however, we did not test this fragrance on hair snares.

We agree that hair snare surveys should be used with caution to survey for bobcats, particularly if accurate abundance estimates are needed. Rub response to catnip apparently is quite variable and poorly understood, and significant potential for bias exists. Scent station surveys or other more traditional survey methods may be sufficient to determine distribution or detect coarse changes in abundance [27]. For research or management questions requiring precise estimates of abundance for bobcats, remote camera surveys [20, 28] and fecal DNA surveys [7, 18, 19] may be more consistent and effective techniques for these common but cryptic carnivores.

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References

Five "key references", selected by the authors, are marked below (*Three recommended* (●) *and two highly recommended* (●●) *papers*).

1. MacKay, P., W.J. Zielinski, R.A. Long, and J.C. Ray. 2008. Noninvasive research and carnivore conservation. In: Long, R.A., MacKay, P., Zielinski, W.J. and Ray, J.C. (eds.), Noninvasive Survey Methods for Carnivores. Island Press, Washington, D. C., pp. 1–7.
2. Piggot, M.P. & Taylor, A.C. 2003. Remote collection of animal DNA and its applications in conservation management and understanding the population biology of rare and cryptic species. Wildlife Res 30: 1–13. doi:10.1071/WR02077
3. Woods, J.G., Paetkau, D., Lewis, D., McLellan, B.N., Proctor, M. & Strobeck, C. 1999. Genetic tagging of free-ranging black and brown bears. Wildlife Soc B 27:616–627.
4. Mowat, G. & Strobeck, C. 2000. Estimating population size of grizzly bears using hair capture, DNA profiling, and mark-recapture analysis. J Wildlife Manage 64:183–193. doi:10.2307/3802989
5. Boerson, M.R., Clark, J.D., & King, T.L. 2003. Estimating black bear population density and genetic diversity at Tensas River, Louisiana, using microsatellite DNA markers. Wildlife Soc B 31:197–207.
6. Weaver, J.L., Wood, P., Paetkau, D., & Laack, L.L. 2005. Use of scented hair snares to detect ocelots. Wildlife Soc B 33:1384–1391. doi:10.2193/0091-7648(2005)33[1384:UOSHST]2.0.CO;2
7. Ruell, E.W. & Crooks, K.R. 2007. Evaluation of noninvasive genetic sampling methods for felid and canid populations. J Wildlife Manage 71:1690–1694. doi:10.2193/2006-061
8. Mowat, G. & Paetkau, D. 2002. Estimating marten *Martes americana* population size using hair snares and genetic tagging. Wildlife Biol 8:201–209.
9. Riddle, A.E., Pilgrim, K.E., Mills, L.S., McKelvey, K.S., & Ruggiero, L.F. 2003. Identification of mustelids using mitochondrial DNA and noninvasive sampling. Conserv Genet 4:241–243. doi:10.1023/A:1023338622905
10. Kohn, M.H., York, E.C., Kamradt, D.A., Haught, G., Sauvajot, R.M., & Wayne, R.K. 1999. Estimating population size by genotyping faeces. P Roy Soc Lond B BIO 266:657–663. doi:10.1098/rspb.1999.0686
11. Lucchini, V., Fabbri, E., Marucco, F., Ricci, S., Boitani, L., & Randi, E. 2002. Noninvasive molecular tracking of colonizing wolf (*Canis lupus*) packs in the western Italian Alps. Mol Ecol 11:857–868. doi:10.1046/j.1365-294X.2002.01489.x
12. Kendall, K.C. & McKelvey, K.S. 2008. Hair collection. In: Long, R.A., MacKay, P., Zielinski, W.J. and Ray, J.C. (eds.), Noninvasive Survey Methods for Carnivores. Island Press, Washington, D. C., pp. 141-182.
13. ● McDaniel, G.W., McKelvey, K.S., Squires, J.R. & Ruggiero, L.F. 2000. Efficacy of lures and hair snares to detect lynx. Wildlife Soc B 28:119–123.
14. Schmidt, K. & Kowalczyk, R. 2006. Using scent-marking stations to collect hair samples to monitor Eurasian lynx populations. Wildlife Soc B 34:462–466.

doi:10.2193/0091-7648(2006)34[462:USSTCH]2.0.CO;2

15. ● Shinn, K.J. 2002. Ocelot distribution in the lower Rio Grande Valley National Wildlife Refuge. M.S. Thesis, University of Texas-Pan American, Edinburg, Texas.
16. ●● Downey, P.J., Hellgren, E.C., Caso, A., Carvajal, S. & Frangioso, K. 2007. Hair snares for noninvasive sampling of felids in North America: do gray foxes affect success? J Wildlife Manage 71:2090–2094.
doi:10.2193/2006-500
17. ●● Castro-Arellano, I., Madrid-Luna, C., Lacher, T.E. & Leon-Paniagua, L. 2008. Hair-trap efficacy for detecting mammalian carnivores in the tropics. J Wildlife Manage 72:1405–1412.
doi:10.2193/2007-476
18. ● Harrison, R.L. 2006. A comparison of survey methods for detecting bobcats. Wildlife Soc B 34:548–552.
doi:10.2193/0091-7648(2006)34[548:ACOSMF]2.0.CO;2
19. Long, R.A., Donovan, T.M., Mackay, P., Zielinski, W.J. & Buzas, J.S. 2007. Comparing scat detection dogs, cameras, and hair snares for surveying carnivores. J Wildlife Manage 71:2018–2025.
doi:10.2193/2006-292
20. Symmank, M.E., Comer, C.E. & Kroll, J.C. 2008. Estimating bobcat abundance in east Texas using infrared-triggered cameras. Proceedings of the Southeastern Association of Fish and Wildlife Agencies 62: 64–69.
21. Hernandez, F., Rollins, D. & Cantu, R. 1997. An evaluation of TrailMaster® camera systems for identifying ground-nest predators. Wildlife Soc B 25:848–853.
22. Young, S.P. 1978. The bobcat of North America: its life habits, economic status, and control with list of currently recognized subspecies. University of Nebraska Press, Lincoln, Nebraska, USA.
23. Harrison, R.L. 2002. Evaluation of microscopic and macroscopic methods to identify felid hair. Wildlife Soc B 30:412–419.
24. Hilton, H. & Kutscha, N.P. 1978. Distinguishing characteristics of the hairs of eastern coyote, domestic dog, red fox, and bobcat in Maine. Am Midl Nat 100:223–227.
doi:10.2307.2424793
25. Todd, N.B. 1962. Inheritance of the catnip response in domestic cats. J Hered 53:54–56.
26. Hill, J.O., Pavlik, E.J., Smith, G.L., Burghardt, G.M. & Coulson, P.B. Species-characteristic responses to catnip by undomesticated felids. J Chem Ecol 2:239–253.
doi:10.1007/BF00987747
27. Ray, J.C. & Zielinski, W.J. 2008. Track stations. In: Long, R.A., MacKay, P., Zielinski, W.J. and Ray, J.C. (eds.), Noninvasive Survey Methods for Carnivores. Island Press, Washington, D. C., pp. 75-109.
28. Heilbrun, R.D., Silvy, N.J., Peterson, M.J. & Tewes, M.E. 2006. Estimating bobcat abundance using automatically triggered cameras. Wildlife Soc B 34:69–73.
doi:10.2193/0091-7648(2006)34[69:EBAUAT]2.0.CO;2