Tracking a Self-Tagged Unidentified Species in the Ouachita Highlands

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Abstract

The North American Wood Ape Conservancy (NAWAC), a 501(c)3 non-profit research organization, developed and implemented a novel technique for attaching radio telemetry devices without first capturing, manually tagging, then releasing the target species. This self-tagging technique was specifically designed to track the locations and movement of a hypothesized, as yet scientifically unrecognized, primate species inhabiting the Ouachita Mountain Ecoregion. One tag was successfully activated in August 2015. Locational information acquired over the ensuing months using airborne and ground search teams indicated the tag was attached to a highly mobile individual ranging over an area of extremely rough and mountainous terrain encompassing approximately 115 km^2. This study represents the first time quantifiable data can be applied to issues pertaining to movement and home range of the putative species. This method provides a significant advance that is applicable to studies of relictual hominoids elsewhere.

Introduction and background

The North American Wood Ape Conservancy (NAWAC) exists to facilitate scientific recognition, protection, and conservation of what it proposes is an undescribed anthropoid native to remote regions of North America. We call this species—more commonly referred to as the sasquatch or bigfoot—the North American wood ape (Colyer et al., 2015), which best captures the leading hypothesis of its phylogenetic classification (Bindernagel, 1998) and avoids the unscientific baggage evoked with its more common names. Pursuant to its mission, the NAWAC has been investigating, since 2000, a specific area in the Ouachita Highlands Ecoregion of southeastern Oklahoma, a region known for its dense forests, rugged mountains, and numerous historical and recent reports of reputed wood ape activity (Colyer et al., 2015).

Part of the NAWAC's protracted investigations, referred to in general as the Ouachita Project, involved an intense five-year study (2006-2011) utilizing upwards of 25 camera traps. The photo-capture endeavor, Operation Forest Vigil, failed in verifying the presence of any previously undocumented species of wildlife (Colyer & Higgins, 2008, rev. 2012); nevertheless, other events and observations that occurred during this period encouraged NAWAC members to increase their level of commitment to research in the region.

Recognizing that a specimen of the enigmatic species would be required to generate a definitive, scientific description, the NAWAC shifted its documentation emphasis from photo-capture to one focused on securing a holotype specimen. During the 2011-2015 field seasons, NAWAC investigators reported a number of visual contacts in the study area; however, these sightings were typically very brief or took place at night, making collection efforts and/or hand-held photography exceedingly difficult. Although the NAWAC's organism of focus remains undescribed, due to lack of a specimen, the observational field study yielded intriguing results, documented in weekly after-action reports submitted by each team. Many of these observations and experiences were compiled and published in the *Ouachita Project Monograph* (Colyer et al., 2015).

Suppositions derived during the Ouachita Project field study supported and augmented an unofficial description of the species, generated from eyewitness accounts by explorers, native tribes, and European-American settlers dating back centuries. Similar sighting accounts have continued to this day, derived primarily from motorists, hunters, hikers, campers, and others who spend time in the outdoors. Such reports generally describe the hypothetical species as ape-like, covered from head to toe with thick hair, and exhibiting a bipedal, upright stance. Colors reportedly vary from slate grey or black to reddish brown. Putative observers consistently describe the species as very large, bulky, muscular, and much taller than an average human male. NAWAC member observations have reinforced this description.

Mainstream academia and the scientific community at large generally remain publicly dubious; moreover, serious protracted inquiries into the possibility of a novel or relict anthropoid species in North America are lacking. Those few scientists who have publicly expressed interest in the subject often find themselves relegated to pariah status by colleagues, journalists, or self-described "skeptics" ("Bigfoot Research Embarrasses Faculty," 2006; Barker, 2016), although the more accurate term would be "uninformed skeptics" (Bindernagel, 2010). Attempts by amateur and citizen scientist groups to document the species by means of photographs, track casts, or other forms of evidence, have proven deficient and unsuccessful. Even putative DNA evidence (e.g., Ketchum et al., 2013; Sykes et al., 2014) has been disputed, in part due to the poor protocols in terms of analysis, interpretation, or publication of the results.

The NAWAC study area for the period covered in this paper encompassed approximately 50 mi², or 130 km², of private and public land within the Ouachita Highlands Ecoregion of southeastern Oklahoma**.** The broader Ouachita Highlands Ecoregion spans approximately 75 miles, or 120 kilometers, from north to south, with the Arkansas River roughly running along its northern perimeter and forming a natural boundary between the Ouachita region and the adjacent Ozark region to the north. From its easternmost margin in Arkansas to its farthest reach to the west in Oklahoma, the Ouachita Highlands Ecoregion stretches approximately 235 miles, or 380 kilometers (Figure 1).

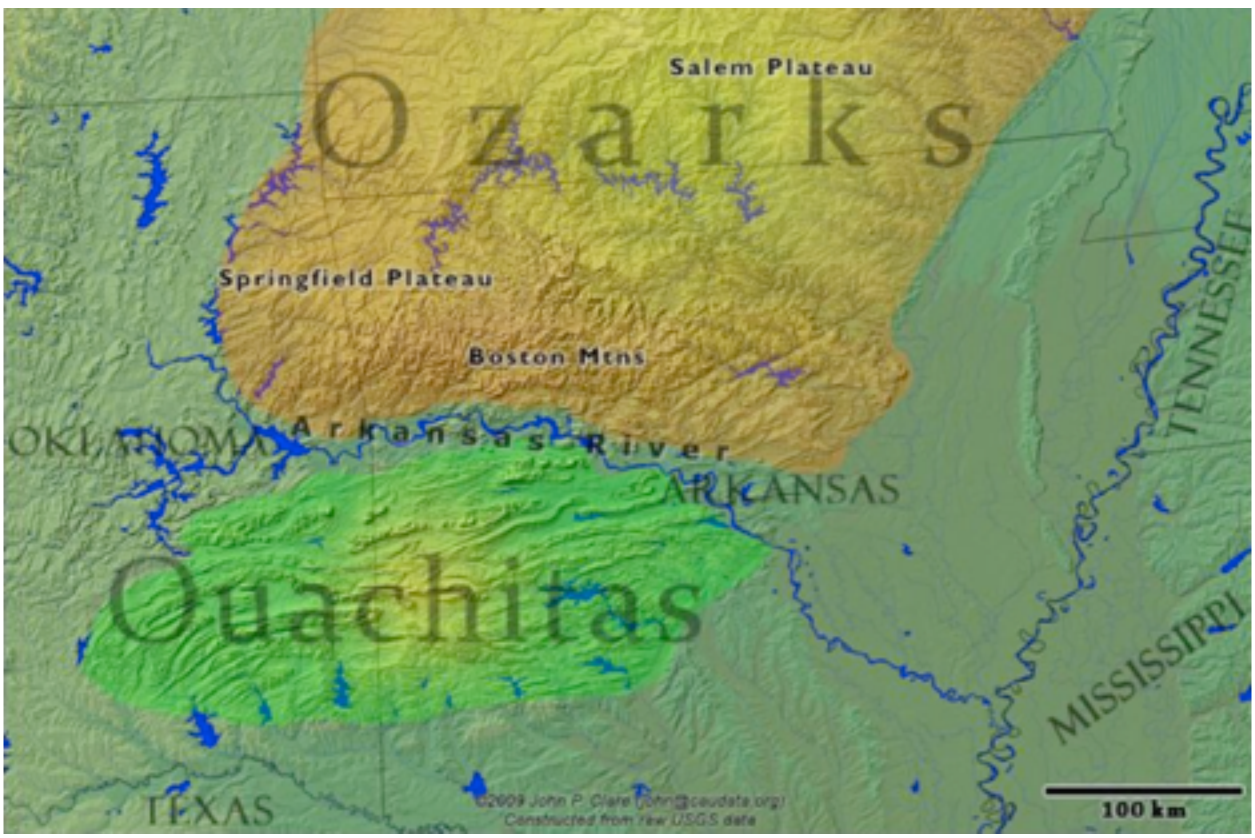

Figure 1. The Ouachita Mountains in SE Oklahoma and SW Arkansas.

The landscape is dominated by a mixed hickory/oak/pine forest (*Carya*/*Quercus*/*Pinus*). The rocky mountainous terrain features several watersheds and riparian systems (Abell et al., 2000). On an annual basis, the area receives an average rainfall total of approximately 60 inches, or 1,325 millimeters (Weakley et al., n.d.); the average temperature is 59°F, or 15°C

(U.S. Climate Data, 2015).

To build upon the findings of over fifteen years of research in the study area, the NAWAC sought to explore new methods and techniques that might contribute to the documentation of the species autecology. The decision was made to pursue radio tag and radio telemetry tracking technology at the recommendation of NAWAC investigator John Perry of Maine. As a wildlife biologist, Perry had come to appreciate the use of radio telemetry and radio tags, widely used for tracking animal movements. Perry wondered whether the technology could be used toward improving our understanding of wood ape ecology and behavior. Upon reading the *Ouachita Project Monograph* and subsequently joining the NAWAC, Perry had discussions with retired wildlife biologist and NAWAC Chairman Alton Higgins regarding the possible implementation of radio tag transmitters. Both were convinced that the technology had the potential to greatly advance NAWAC objectives or, at the very least, aid in the collection of significant ancillary data if a means of deployment could be devised. Fortunately, a platform for successful deployment appeared to be at hand.

Higgins first began to deploy what he referred to as string-traps in June 2012. Inspired by the camp perimeter alarms combat veterans constructed out of lengths of cordage, Higgins used strings as a means of determining if wood apes had moved through narrow areas between trees or other locations. During extended periods within the study area, Higgins noted places where NAWAC members reported visual observations of wood apes or where indicators of travel had been identified (e.g., tracks and vocalizations). Higgins deployed black sewing thread at heights of six to eight feet, with one end tied and the other end wrapped around a limb or tree on the opposite side of the opening. The purpose of locating thread at these heights was to essentially eliminate the likelihood that species such as white-tailed deer, black bears, etc., could come into contact with the trap setup. As designed, the wrapped/untied end of the string would unravel when encountered and then stretch out, indicating the direction of travel. The black thread proved to be practically invisible in the dense forest, even during daylight hours (Figure 2). Checking the traps daily, Higgins and others found from time to time that they had indeed been compromised. Higgins was convinced the strings were encountered by individuals of the target species, often very near the cabin out of which Higgins and his teams were based at the time (Colyer et al., 2015; A. Higgins, personal communication with Daryl Colyer, November 2016).

Figure 2. Even in daylight, the radio tags and string traps presented an organic, natural appearance of leaf litter stuck in spider webs, and they were often difficult to see at all.

Radio tags and string-traps, two seemingly disparate methods for assessing animal movements, formed integral parts of a novel research tactic of possibly historic significance in primatology. As described in the following sections, an animal became tagged, enabling its movements to be tracked using radio telemetry. The argument put forth here is that the tagged animal was a large representative of a scientifically unrecognized anthropoid species referred to as the North American wood ape. During the ensuing ten-month period, NAWAC members engaged in a mentally and physically demanding pursuit, searching through densely forested valleys and steep boulder-strewn mountain ridges choked with nearly impenetrable vegetation for the enigmatic carrier of the transmitter.

This paper details the development and deployment of the tagging and tracking operation and discusses tentative conclusions based on the data collected by teams of volunteer biologists and citizen scientists of the North American Wood Ape Conservancy.

Materials and methods

EQUIPMENT:

- Two ATS (Advanced Telemetry Systems, Inc.) Model R410 scanning receivers
- 3-element Yagi antenna
- 5-element Yagi antenna
- Seven R1680 Glue-On radio tag Transmitters
- Omni-directional Yagi antenna

MATERIALS:

- Split and halved cocklebur fruit (*Xanthium strumarium*)
- Rat trap glue from Tomcat® Glue Traps
- Black sewing thread (used to construct "string-traps")

Beginning in March 2015, NAWAC member Mark McClurkan directed a series of trials to devise a method for radio tag deployment that would enable field teams to capitalize on identified travel lanes of the target species. The basic concept was to incorporate radio tags into Higgins's string-traps. The goal was to develop a technique to attach a radio tag to hair, a contrivance by which an animal would tag itself and, hopefully, stay tagged. If successful, the subject could be tracked and ultimately located, possibly generating a wealth of attendant information, including identifying broader movement patterns, home range, seasonal variance in habitat, hair samples (if the tag fell off or was removed), and possibly even positive identification and specimen procurement, leading to scientific recognition and protection.

McClurkan contrived a two-part attachment strategy. The first part involved gluing the very small ATS R1680 transmitters (designed for reptiles) to spiny fruits from a cocklebur (*X. strumarium*)—an annual plant in the Sunflower family found across the continent—to facilitate attachment and entanglement in thick hair (Figure 3). Cocklebur fruits are approximately the same size as the transmitters and are notorious for becoming deeply tangled and embedded in the coats of long-haired mammals. Once entangled, it is often necessary to shear the hair to remove the ensnared stiff-spined fruit.

Figure 3. A close view of an NAWAC radio tag/cocklebur device. The black rectangle is the magnet. The transmitter activates when the magnet detaches.

The inspiration for the radio tag/cocklebur fruit combination came from McClurkan's first visual encounter with a wood ape in July 2011, when he noted matted hair in the animal's shoulder area. When deliberating about possible designs, he recalled this detail and thought the hair might be long enough, particularly in the upper torso/shoulder area, to provide the necessary conditions for successful tag attachment. When his testing was completed, he was confident the device could work. With the prototype completed and approved, the frequencies for the radio tags were programmed into the tracking system receiver, and by June 2015 the traps were ready for deployment. (For a detailed accounting of how McClurkan conducted the testing for the device, see Appendix 1.)

Seven of the radio tag/cocklebur combos were provided to the field team responsible for setting up the devices. McClurkan gave instructions for the second part of his attachment strategy, the application of a coating of rat trap glue to the spiny cocklebur fruit once each trap was properly assembled and ready to go. The rat trap glue, an adhesive that retains its extreme stickiness for months, even when exposed to the elements, was added to facilitate the initial adhesion of the transmitter to the animal and ensure a greater opportunity for the transmitter/cocklebur fruit combination to become thoroughly entangled in hair, with the goal that it could not be removed without significant effort.

Both parts of the tag apparatus, magnet and transmitter, came from the manufacturer; McClurkan had to construct and attach metal loops for each piece (Figure 3). McClurkan's system required two separate lengths of thread. The longest piece ran through the loop on the transmitter and arranged as a normal string-trap, tied on one end and wrapped on the other so as to come loose when an animal walked into it. A second thread, shorter than the first, the length determined by where the team wanted the radio tag to hang, was tied to a tree or branch on one end, and tied to the loop on the magnet at the other end (Figures 4, 5). This meant the magnet would simply swing down and hang by the side of the tree when it separated from the transmitter.

Figure 4. A close view of an NAWAC radio tag/cocklebur string-trap.

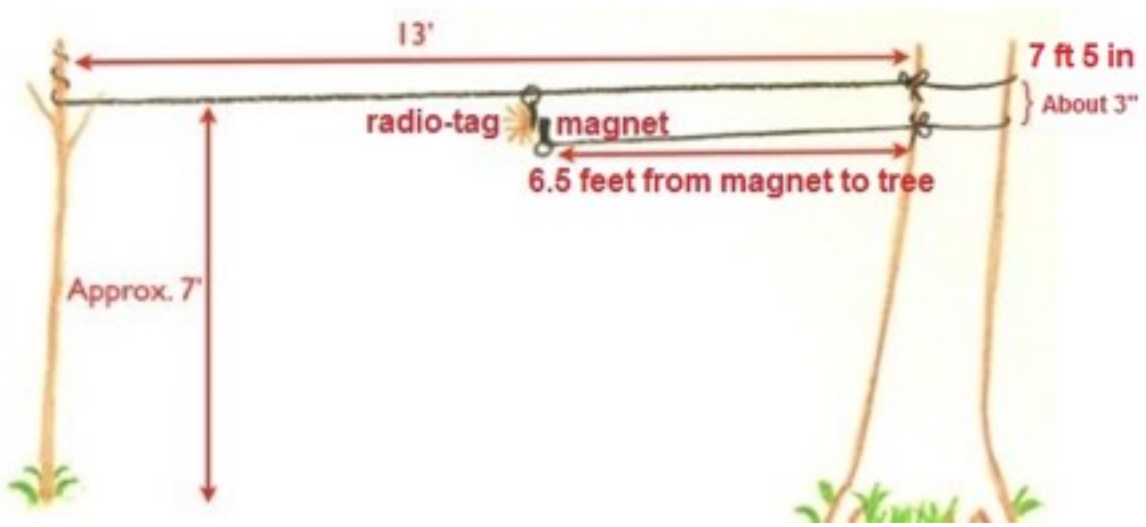

Figure 5. Original string trap set-up for radio tag 7, looking south.

As manufactured, once a transmitter becomes separated from its magnet it begins to send a radio signal on a pre-set frequency, allowing tracking of the tag by the ATS Model R410 scanning receiver and directional antenna. The approximate battery life of the transmitters is 300-350 days, with a range of 5-8 kilometers in flat unobstructed terrain. However, range is significantly reduced in mountainous and/or forested terrain, contingent on the elevation and position of the transmitter and receiver. For example, if a tagged animal moved behind a rock outcropping or down into a gulch, or if a mountain ridge lay between the transmitter and receiver, the electromagnetic wavelength would almost certainly be undetectable by the receiver (Lomax, 2007).

As Higgins had done when deploying the string-traps, the radio tag/cocklebur traps were placed at heights of seven feet or more to minimize the chances of incidentally tagging animals, other than the target species, indigenous to the region (Figure 6). There was concern that even if an individual self-tagged, there remained the possibility that it could simply remove the tag by hand, have the tag groomed off, or have the tag removed when moving through tight quarters. The hope was that, given the arrangement of the string-traps, the string would wrap around the individual and the sticky transmitter/cocklebur device would adhere to and become entangled in hair on the back of the animal. If this happened, given the small size of the transmitter/cocklebur combination, it was thought the individual might never know it had been tagged, it might be missed in any mutual grooming, and it would withstand movement through tight quarters.

Figure 6. The radio tag 7 string trap was deployed at approximately 7 feet 5 inches.

Once all the tags were deployed, field protocols had teams conducting scans via the ATS receiver at a minimum of twice per day when in camp. Teams also executed daily visual inspections of each transmitter unit in situ to observe and document any disturbances of the surrounding areas and radio tag string-traps, and to effect repairs if needed.

The tracking technique to be employed by the NAWAC, once a tag became activated and carried by an animal, is referred to as discontinuous radio-tracking, where a tagged animal is located at random time intervals throughout the study period. In addition to other reasons pertaining to logistics and manpower availability, making a regularly scheduled or continuous monitoring regimen impossible, the employment of the discontinuous radio-tracking technique was appropriate for this exercise because any carrier of a radio tag was considered likely to travel long distances quickly, making this technique apropos for calculating a range for the carrier of a radio tag (Harris et al., 1990).

On July 25, 2015, Higgins, Ken Helmer, Paul Bowman, Jr., and Ken Stewart deployed seven radio tag/cocklebur devices attached to string-traps in areas of repeated observations and presumed activity of the target species. Each of the seven devices was designated numerically as “radio tag 1,” radio tag 2,” “radio tag 3,” and so on. After the initial setup of the string traps and radio tags, a monitoring period took place lasting approximately one month.

Location data were analyzed using Ranges9, software designed for the analysis of tracking and location information (http://www.anatrack.com/home.php). Three methods were chosen to calculate home range, including the simplest, most traditional, and straightforward of range calculation methods, the Minimum Convex Polygon (MCP) Method, along with the Adaptive Kernel Method and the Ellipse Method.

Results

A few activations and downed string-traps had been noted during the week of 22-28 August 2015, but without any successful radio tag deployments. However, on Friday evening, August 28, at 20:50, the field team discovered during a visual inspection that "radio tag 7" was missing. When the ATS receiver was turned on it registered a strong signal from the activated tag. The evidence was clear that something had passed through the string and stretched it out to the south. As it turned out upon later inspection, the string had been broken near the tied end (Figure 7). Hampered by nightfall, the team decided to delay pursuit of the tag until the following morning to improve chances of observation and collection. Unfortunately, when the team arose the next morning, the signal from the transmitter was no longer detected.

Figure 7. String trap after radio tag 7 was discovered missing, looking south.

All subsequent attempts to restore contact with the missing tag over the next several weeks proved unfruitful, despite search teams hiking an area of several square kilometers within the watershed and adjacent mountains.

Although many in the organization were convinced the missing tag had malfunctioned, Maine biologist John Perry strongly urged the use of an airborne team to restore contact with the missing tag. At the time the NAWAC included at least five pilots among its membership, but getting a team in the air proved challenging. Issues included obtaining the proper antenna to use with an aircraft, securing access to a suitable aircraft, matching pilot schedules (they typically do not work five days with weekends off) and aircraft availability, and coordinating all that with favorable weather conditions, which proved to be problematic.

On 10 December 2017 two NAWAC pilots conducted an aerial reconnaissance flight of the study area in search of the activated radio tag 7, constantly scanning the area for contact signals using ATS equipment. After a thorough search over the original valley proved fruitless, the team widened the search to include the two valleys north of the original activation point. At approximately 14:00 hours they began receiving strong pulse signals from radio tag 7 roughly five kilometers north-northeast of the original string-trap site. The airborne team continued to receive strong pulsing contact signals from the tag as they repeatedly flew in a "figure 8" pattern over the contact point, confirming that the signal was indeed that of radio tag 7.

In subsequent months NAWAC teams documented another 24 contacts with the radio tag 7 signal, as described in Appendix 2. Shortly after the last signal was monitored on 29 June 2016, all the radio tags remaining in hand ran out of battery life, as did, presumably, radio tag 7. The distribution for 25 points where radio tag signals were detected is illustrated in Figure 8.

Figure 8. Spatial distribution of data points for radio tag 7.

Home Range Calculations

The Ranges9 software was used to provide home range calculations for the tagged animal, based on the 25 tracking data points. Although 25 data points is at the low end of acceptable sample size for home range assessments, considering the circumstances under which the animal was tagged and tracked, 25 data points were considered adequate (Walter, Onorato, &

Fischer, 2015). Using the 25 location points and the minimum convex polygon (MCP) method, a range of 18.75 mi² or 48.57 km² was estimated. It should be noted that some researchers have determined that the MCP method can be less accurate than Kernel and other methods for estimating home range (Seaman et al., 1999). .

The Ranges9 software produced a 42.71 mi² or 110.64 km² home range estimate for the tagged animal using the Adaptive Kernel Method (Figure 9).

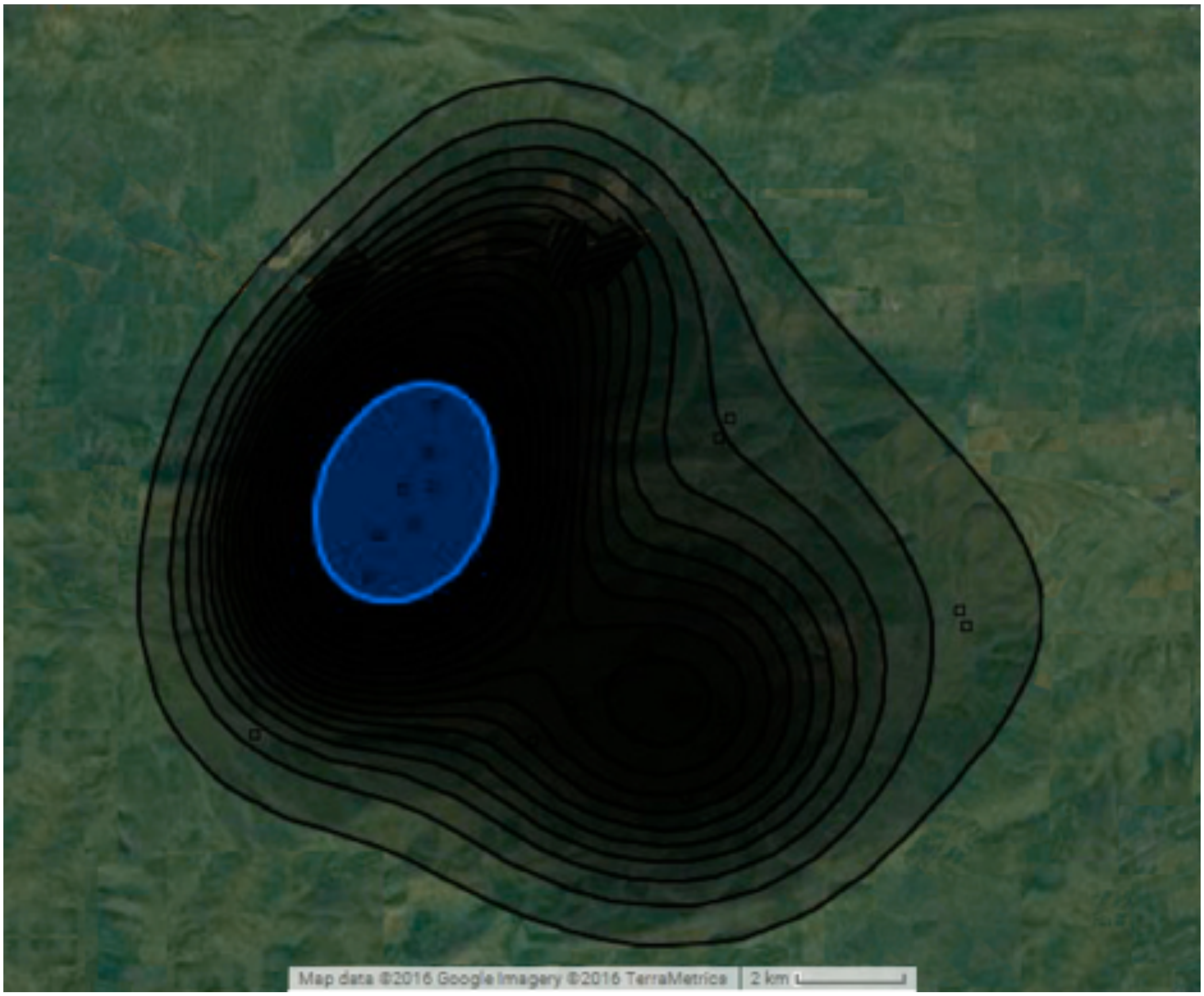

Figure 9. Ranges9 software calculated the home range using the Adaptive Kernel Method at 42.71 mi² or 110.64 km². Distinguishing topographic features are obscured.

A third method, the more traditional Ellipse Method (with 99% cores), also provided by Ranges9 software, predicted a home range of 71.52 mi² or 185.24 km² (Figure 10).

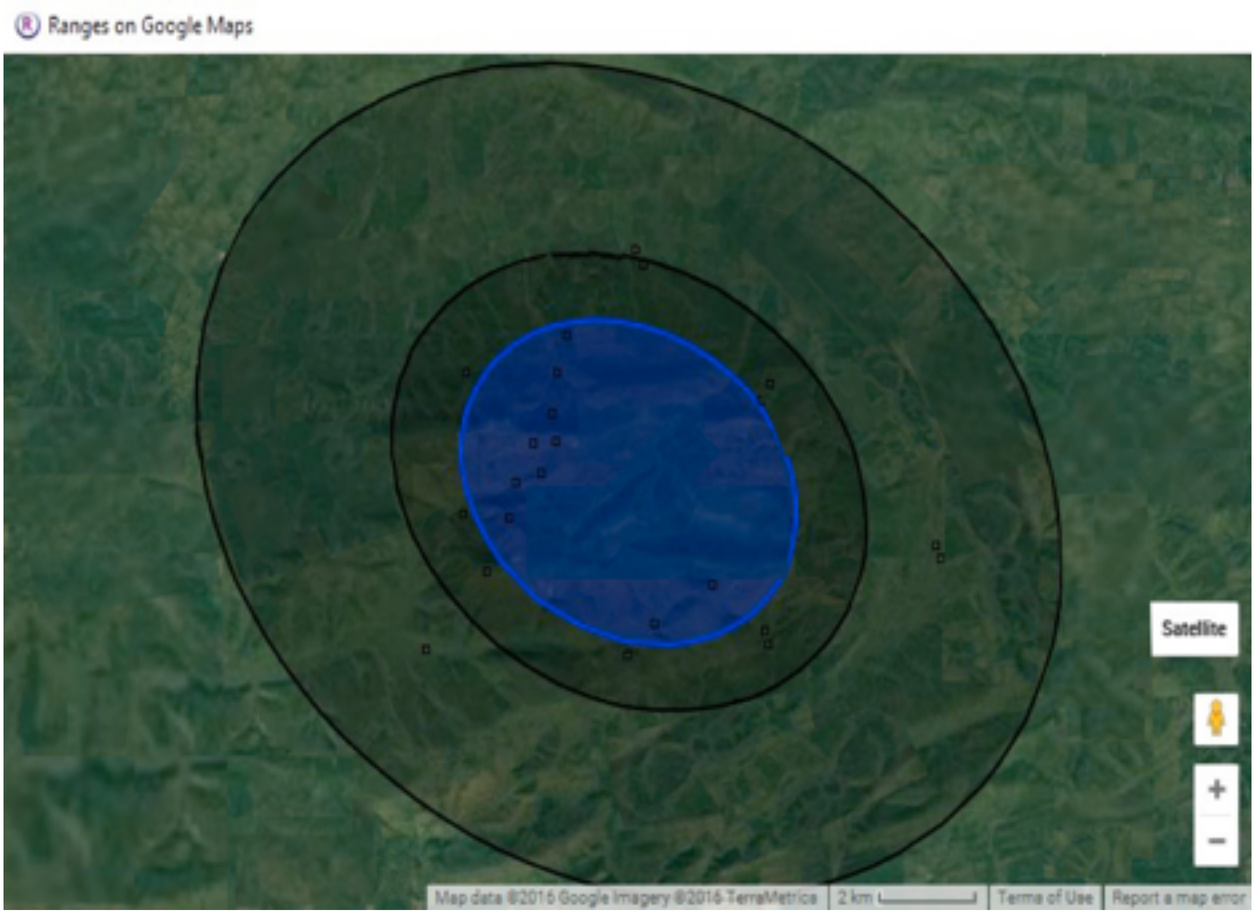

Figure 10. Ranges9 software calculated the home range using the Ellipse Method at 71.52 mi² or 185.24 km². Distinguishing topographic features are obscured.

We should note that the terms home range and territory are not synonymous. Territory is defined as the area a species is willing to actively defend against what is perceived as interspecies and/or intraspecies encroachments, often using "signposts" and ritualized aggression. Territory is smaller than home range. The home range of a species is the area where the species spends most its time but will not necessarily defend; the home range area may well overlap with home ranges of other groups within the species, and in the overlapping areas, the groups will simply avoid each other rather than defend (Powell & Mitchell, 2012). The NAWAC's range calculation is an estimation of home range, not territory—which likely is a much smaller area, if such exists in the first place—for the tagged individual.

There is no way to know if the distribution of location data points documented by NAWAC teams over a ten-month period for the tag 7 animal are representative of the behavior of other members of the same species. Likewise, even if one of the home range estimates in the present study accurately reflects movement patterns for the tagged species, home range estimates in other ecosystems that differ from the Ouachita Highlands (in terms of factors such as habitat productivity, species richness, and topography) are likely to vary greatly. Nevertheless, the distribution of contact points over time appear to represent a seasonal pattern where winter observations look to be restricted to areas of dense pine forest. Spring observations were noted in a valley several miles south of the wintering area, a region of mixed pine and deciduous trees, whereas the summer contacts took place in an area dominated by mature mixed deciduous forest (Figure 11).

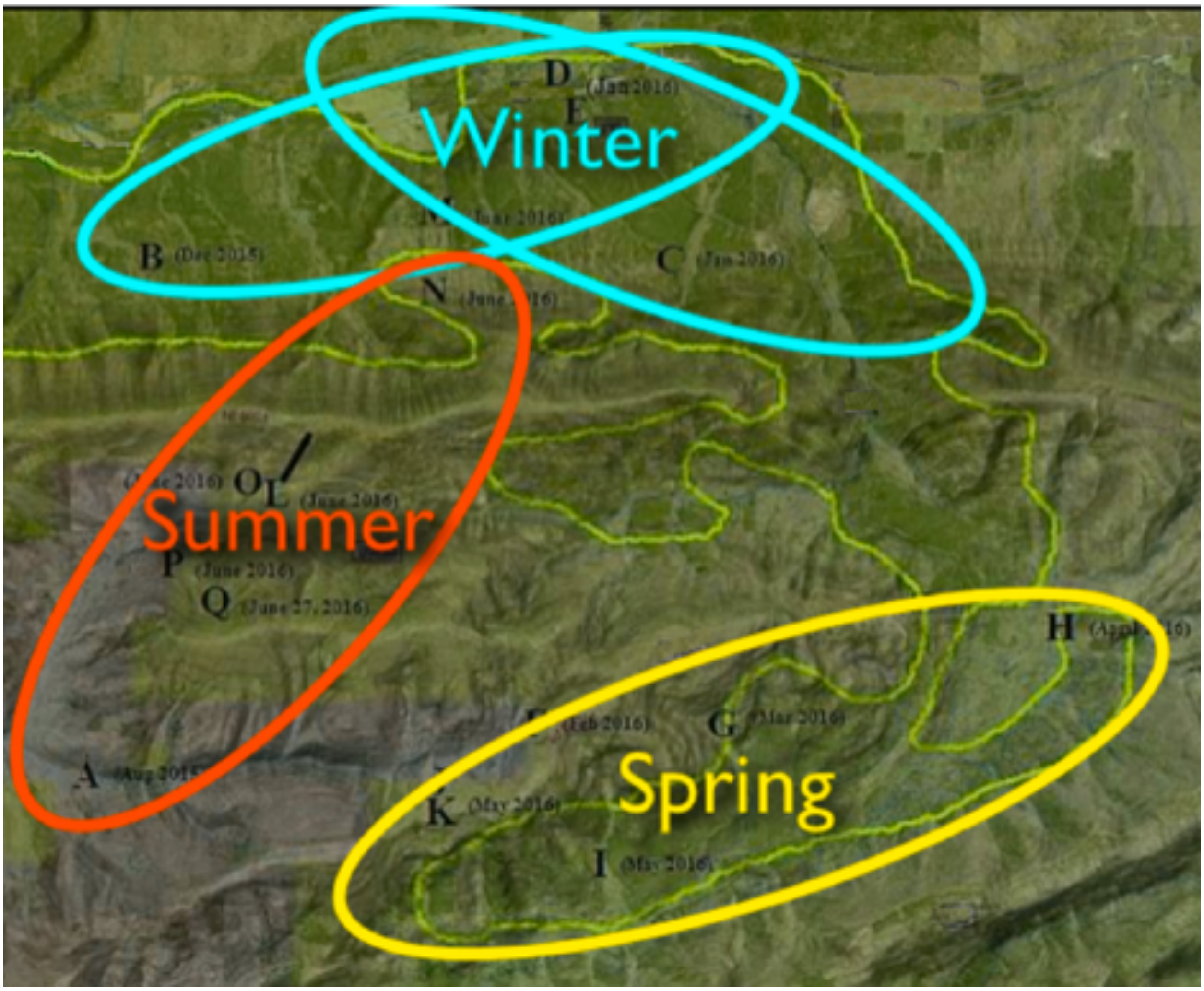

Figure 11. Seasonal distribution of contacts with the radio signal. The dark green areas outlined with lighter green represent the distribution of pine forest within the study area.

Discussion

For any research initiative involving telemetry technology, it is important to identify study objectives. Despite any misgivings that the string traps equipped with radio tags might actually accomplish their designated purpose, the NAWAC identified objectives for the exercise as follows:

1. Develop techniques for tagging animals without prior capture.
2. Tag one or more individuals of the target species.
3. Locate and observe a tagged individual to confirm identification.
4. Recover a discarded tag for a DNA sample, or secure a type specimen.

5. Document movements of the tagged animal.
6. Derive home range estimates using accepted methodology.

The authors acknowledge that for those who dismiss the possible existence of a undocumented anthropoid species residing in remote pockets of North America, there is little, if anything, that would alter their opinion. Based on such a perspective, the data derived from the animal tagged and tracked by members of the North American Wood Ape Conservancy over a ten-month period can be dismissed as nothing more than, at best, the product of the activities of a known species. However, we submit that it would be difficult to find a likely candidate among known fauna based on: 1) height of encounter with the tag, 2) year-round seasonal activity, 3) extent of home-range, and 4) likelihood of the tag staying with the individual. Understandably, for those with such a mindset, nothing short of an independently confirmed type specimen will suffice as proof of existence, and the consideration of the evidence derived from this study will prove to be a fruitless exercise. However, those who are at least open to the possibility of such a species, no matter how improbable, may find the information presented here to be intriguing and supportive of the proposition that an animal for which there presently is no taxonomic classification was successfully tagged and tracked by means of radio telemetry.

From August 2015 through June 2016, the NAWAC collected 25 locational data points from contacts with radio tag 7; battery life dictated the maximum possible duration of the study period. The distance of the study area from the homes of most of the NAWAC volunteers, and attendant logistical difficulties, served to limit the number and duration of search opportunities, resulting in the limited data set of radio tag signal detections. The initial deployment of the tag and the next time it was detected, during an aerial reconnaissance several months later, meant that no movement data exist for the September 2015 to November 2015 fall period.

NAWAC investigators noted trends within the data and the data collection process that are indicative of a highly active animal interacting within its environment in real time and space, adeptly negotiating some of the most challenging terrain that the south-central part of the North American continent has to offer. Indeed, on June 7, 2016, one team tracked the radio tag as its carrier quickly negotiated a mountain's extremely steep, rocky, and heavily forested south-face. The team then lost contact with the tag as its carrier apparently continued to the north, over the top of the mountain, and down onto the rocky and heavily forested *north*-face.

The radio tag 7 string-trap was deployed at a location where NAWAC members had repeatedly observed large, upright, hair-covered, ape-like creatures unrecognized by science (Colyer et al., 2015). The radio tag was activated by an individual animal that managed to breach the string-trap to which the tag was attached, causing the sticky device to attach to, and presumably, become entangled in, the creature's hair. As stated earlier, the string-traps were typically placed at heights of seven feet or more to preclude accidentally tagging an unintended species. It is the position of the NAWAC that an individual of an undescribed species—the same cryptic species observed repeatedly by field teams at the site of tag 7 over the course of several years—encountered the string trap. The animal carried the tag for the next ten months as the NAWAC tracked the pulsing radio signals across the study area. As of the release of this paper, the authors were not aware of any examples of any wildlife species self-tagging with a radio transmitter. This feat alone appears to be the first of its kind. The accomplishment is made even more unique if indeed a previously undescribed or relict species was tagged.

Still, several issues of a potentially problematic nature can be raised regarding the value and limitations of the data. In the case of the NAWAC field study, presuming the identity of the species is correct in the first place, direct knowledge is lacking concerning the tagged animal's gender, age, size, health, social status, etc.; therefore, any range assessments or behavioral insights must be evaluated with the limits of the data in mind. However, due to the height (7 feet) and manner (in the open air between trees) in which the tag was deployed, we can infer that it was most likely a tall organism, beyond the immature age class. Although it is normally desirable to ensure tagged animals in a radio tag tracking study are representative of the social group being studied—animals varying in gender and age often have different movements and patterns throughout their ranges—this was simply not possible in the NAWAC field study for reasons that are obvious. Even in tracking studies of formally described wildlife species, in cases involving extremely elusive, rare, or shy animals, statistically acceptable examples of gender and age can be difficult to obtain for ideal research purposes. As in those situations, the data collected by the NAWAC are not necessarily representative of this or any population (Harris et al., 1990).

It should also be noted that the 25 location data points for the active radio tag 7 do not represent precise locations; that is, each contact location illustrated in Figure 8 constitutes a reasonably accurate estimation of the tag's location at a given moment in time, based on the strength of the signal, the terrain, the direction of the tag as indicated by receiver readings, elevation differences, etc. Testing was carried out by the NAWAC to allow for such educated estimations regarding signals using an active tag in a variety of terrain settings. Based on discussions with experienced professional practitioners and field observations, an estimate of 100 meters or less was determined to be reasonable for most observations.

Finally, the potential for human error must also be acknowledged. It is possible that positive hits on the receiver could have been misread or ignored, resulting in a loss to the data set. It is also possible that other readings could have been misinterpreted. There were no occasions when a single person searched for and recorded observations. NAWAC teams consistently made efforts to rule out the possibility of false hits by identifying, or attempting to identify and eliminate, extraneous radio signal sources capable of producing what appeared to be radio tag hits on the receiver. Identified extraneous sources included overhead power lines and running motor vehicle engines; however, having acknowledged the possibility of human error, the authors feel confident that multiple teams consisting of two or more collaborators noting strong pulsing hits on the receiver provided results that are indicative of the presence and movements of the tagged animal.

Consideration was given to adding at least one additional data point in the valley where radio tag 7 was initially deployed for purposes of assessing home range, since NAWAC members have documented visual contacts of the target species, as well as other forms of evidence pertaining to the target species, as far as two kilometers west of the original string trap site. Based on those observations, it is reasonable to surmise that the tagged individual included the area to the west as part of its home range; however, in the final analysis, this western area was not included in home range assessments, and only radio tag data points were used.

Naturally, considering the hypothesis forming the basis of this project, the possibility that a mundane species engaged the radio tag has been carefully, and hopefully thoroughly, evaluated. In the case of every reasonable option considered, the derived determination was that the animal tracked by the NAWAC was not a documented indigenous species. The home range estimates presented above, in and of themselves, would appear to eliminate indigenous species for the tagged animal. Thoughts pertaining to some of the candidate species are presented in the following section.

Black Bear (*Ursus americanus*)

Upon cursory consideration, of all the known wildlife species found within the region, the black bear would seem to be the likeliest candidate as the carrier of radio tag 7. To be sure, black bear sightings are now common in Latimer, LeFlore, Pushmataha and McCurtain counties in southeastern Oklahoma, with a population of at least 500 in LeFlore County alone ("Black bear sightings on the rise in parts of state," 2015; Godfrey, 2009). Moreover, although improbable, it is not outside the realm of possibility that an extremely large black bear could have reached the string trap while standing on its hind legs ("How high can a black bear reach?" n.d.). Testing for adhesiveness to hair/fur like that of a black bear did indicate that the radio tag/cocklebur/rat-trap-glue combination readily stuck and became entangled upon contact (see Appendix 1 for a detailed accounting of the NAWAC's testing process). However, in the unlikely event that a very large bear reached up to the adhesive tag suspended at a height of roughly seven feet, and the tag stuck around the bear's paw, the authors consider it to be extremely implausible that a tag would have remained stuck on or near the paw, or forearm of the bear, for any significant length of time.

Home ranges for black bears can vary depending on habitat diversity, richness, and species population within a given ecosystem. Two previous black bear studies exist for the region and are used here for range comparison purposes for black bears and the carrier of radio tag 7. In 2007, Lyda, Hellgren, and Leslie produced a paper that presented the results of a 2001-2002 home range study that focused specifically on female black bears in the Ouachita Mountains of southeastern Oklahoma. Using the MCP method the home range was estimated at 5.6 mi^2 or 14.5 km^2; using the Adaptive Kernel Method, the range was estimated to be 8.1 mi^2 or 21 km^2.

Another relevant study was conducted along the east side of the White River of Arkansas. The home range, calculated using the MCP method, for 4 adult males in the study was 58 km^2 or 22 mi^2. The mean annual range for 2 adult females in the study was 8 km^2 or 3 mi^2 (Smith & Pelton, 1990). Also in the White River study, in the summer, the black bears were found to utilize 66 to 89 percent of their annual home ranges. Using these relevant black bear studies, the radio tag 7 animal's home range would appear to be much larger than what would be expected for a black bear, particularly as it pertains to the Ouachita Mountain black bear study of southeastern Oklahoma.

The seasonality of the radio tag 7 location data is also problematic for a bear explanation. Black bears in the Ouachita Mountains invariably go through an annual denning period during which they enter dormancy (also known as carnivorean lethargy or torpor). Black bear denning season in Oklahoma can begin as early as November for females and can last all the way through May, with an average denning season of around 142 days. For males, denning season typically begins in December or January and ends in March (Barker et al. 2005; anonymous Oklahoma State University bear biologist, personal communication with A. Higgins, May 16, 2016; Comer & Siegmund, 2010; White, McPeake, & Eastridge, 2008; Hubbard, 2015). Moreover, during a five-year camera-trap project, Operation Forest Vigil, conducted in the center of the present study area, the NAWAC collected hundreds of photos of black bears from 2006-2011, but the cameras did not collect a single photo of a black bear from December through March for the entire five-year period. The earliest black bear photos for the NAWAC were in April, with the latest in October and only a few in November (Figure 12). For radio tag 7, ten of the first eleven data points were collected from December through March (Figure 8), during the heart of black bear denning season. The tagged animal in this study was extremely active during these months and covered many kilometers. Every time the NAWAC obtained a new location data point for the tag, it had moved, in some cases a number of kilometers, from the previous known position. It is our opinion that the black bear hypothesis is nullified by the ten data points collected from December to March and the well-documented denning season for black bears in the region.

Finally, the timing of the deployment is problematic for a bear explanation. To begin with, bears were very rarely observed near the string trap and base camp area over the course of more than a decade of research and many thousands of man hours on site. No bears were observed anywhere near the site during the preceding months. The camp area was only briefly vacated on the day the string trap was compromised, an hour or so during the afternoon, during which time it appears the animal approached the camp and walked through the string, tagging itself in the process. Upon observing that the string had been broken and radio tag 7 was missing, the team assured Higgins, who had recently arrived for the start of his week-long assignment, that the setup had been regularly checked that day and was undisturbed. Upon activating the ATS receiver, the signal from radio tag 7 was extremely strong, maxing out with all bars, indicating the creature was nearby. While it cannot be asserted with certainty what constitutes normal wood ape behavior, presuming the species exists, this does not seem to constitute typical black bear behavior.

Figure 12. The earliest seasonal photo-capture by the NAWAC of any black bear during the Operation Forest Vigil camera-trap project, 2006-2011, was during April, with the latest in October and only a few in November. From December to March, 2006-2011, black bear photo-captures were non-existent. Independent sources confirm this period as black bear denning season in the Ouachita Mountains of Oklahoma and Arkansas.

Mountain Lion (*Puma concolor*)

The home range for the carrier of radio tag 7 falls within the home range profile for the mountain lion; however, there are other factors that serve to disqualify the mountain lion as a realistic candidate. The species is extremely rare and elusive—described as "uncommon" in greater Oklahoma by state officials, with no acknowledgement of residence at all in southeastern Oklahoma (Godfrey, 2014)—and is mostly crepuscular. Oklahoma Department of Wildlife Conservation biologists have not even attempted population surveys, due to the rarity and furtiveness of the species ("Mountain Lion," 2011). The hair on mountain lions is typically smooth and short, factors that would likely preclude lasting tag adhesion. The NAWAC testing of deer hair indicated only "momentary adhesion" (see Appendix 1 for testing details); it seems reasonable to assume that mountain lion hair would produce similar results. If the species does indeed reside in the NAWAC study area, the likelihood of a mountain lion, at approximately 16:00 hours on August 28, 2015, coming to within 40-50 meters of the human encampment and jumping up seven feet into the air at the precise location of the deployed tag, and having the tag stick to its short hair, and then remaining attached for the next ten months, is so low that such a scenario does not warrant further consideration. The same rationale for dismissing the mountain lion as a candidate also applies to smaller cats in the region, such as the bobcat (*Lynx rufus*), and stray domestic or feral cats (*Felis catus*).

White-tailed Deer (*Odocoileus virginianus*)

The home range for white-tailed deer is typically quite small, and in southeastern Oklahoma, white-tailed deer home ranges are on average normally less than .49 mi^2 or 1.26 km^2 (Masters, Bidwell, & Elmore, n.d.). Testing for sustained tag adhesion to white-tailed deer hair failed. The maximum height of deer browse, 2.1 m/6.889 feet (Beals et al., 1960), while within the range of the tag's height, is unlikely as the small tag is suspended within midair and is an unlikely target for a deer.

Elk (*Cervus elaphus*)

In neighboring Pushmataha County there is a managed, small, surviving elk population on the Pushmataha Wildlife Management Area (Walter & Leslie, 2002); however, there are no elk in the study area. Moreover, elk hair is like white-tailed deer hair and would likely result in no sustained tag adhesion.

Avian Species

Birds that could conceivably fly through the trap, and of sufficient size to have the tag stick, include owls, diurnal raptors, pileated woodpeckers, and wild turkeys. During the testing phase, feathers failed to successfully adhere to the sticky tag (see Appendix 1 for details of testing). Based on radio tag 7's tracking data, seasonal migration and small home ranges also eliminate avian species as possible candidates.

Southern Flying Squirrel (*Glaucomys volans*)

It is remotely conceivable that a flying squirrel could have flown through the trap, but the fur on a flying squirrel is smooth and short, resulting in adhesion failure. Moreover, flying squirrels are nocturnal, and the home range for the Southern flying squirrel is quite small (Taulman & Smith, 2004), further disqualifying this species from serious consideration.

Bats

Southeastern Oklahoma is home to quite a few bats; however, all of them migrate out of Oklahoma or go into hibernation during the winter ("Bats of Oklahoma Field Guide," 2013). The tagged animal tracked by the NAWAC was active throughout the winter.

Cow or Horse

It is not theoretically inconceivable that a stray cow or horse could have somehow found its way to the human encampment and jumped through the string trap; however, even in the highly unlikely event this happened, neither have the hair necessary for effective adhesion, except for the mane or tail of a horse. Moreover, cows and horses leave very distinctive sign and scat in abundance, none of which have ever been observed by the NAWAC since 2000 within five kilometers of where the radio tag string-traps were deployed.

Feral Hog (*Sus scrofa*)

NAWAC observers have only observed possible feral hog sign on rare occasions in the area, and there have been no visual observations of feral hogs. During Operation Forest Vigil, the NAWAC only obtained one photo of a feral hog. They appear to be extremely rare in the study area. Furthermore, even the largest feral hogs are too small and fall well below the seven-foot-high threshold of the string trap.

Canids and Raccoons

Several canid species, including coyote (*Canis latrans*), were considered. Coyotes have never been observed entering the base camp area, but foxes (*Urocyon cinereoargenteus*) were commonly seen. Raccoons (*Procyon lotor*) occasionally entered the camp area, but always at night. The fact is that all these species are simply not large enough to engage string-traps. The size of the estimated home range predicted for the animal carrying the NAWAC's radio tag was much larger than what would be expected for any of these species.

Conclusion

To summarize, over the period of several years and thousands of hours in the field for months on end, animals meeting the description of a large anthropoid species were visually observed by NAWAC members. Some of the observations took place in specific locations where seven "string-traps" bearing small radio tag transmitters, modified to adhere to hair and fur, were subsequently placed in the summer of 2015. One radio tag was activated in late August. The signal was initially very strong, but after the first day it could not be reacquired for several months. From December through the following June 2016, ending when the transmitter battery died, teams tracked the signal, documenting 25 locations.

Signals detected over the mountainous region suggested a home range estimated at upwards of 115 km^2 extending over extremely steep, rocky, heavily forested terrain. The fact that the radio tag remained on the animal for ten months suggests the presence of long hair to become entangled with the modified transmitter, and the broken string supports the hypothesis that the tagged creature was very large, tall enough to breach the string, initially hung at more than seven feet above ground. Teams reported that the movements of the signal source indicated that the bearer of the tag was capable of negotiating the challenging terrain with ease and rapidity, far beyond, in their opinions and experience, what humans were capable of achieving, and that its apparently furtive movements suggested avoidance of encroaching teams.

After due consideration, no candidate of indigenous wildlife, feral species, or domestic livestock appears likely to have been responsible for the observations summarized in this report.

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Appendix 1

Mark McClurkan's development and testing of the radio tag/cocklebur fruit device.

Alpha Testing**:**

1.) "Dummy tags" were created with a matching weight (4g) to the actual radio tags (Figures 13, 14).

Figure 13. ATS radio tag.

Figure 14. Dummy Tag

2.) The cocklebur fruits were attached to the dummy tags with jeweler's epoxy (Figures 14, 15).

Figure 14. Cocklebur fruits and epoxy.

Figure 15. Dummy tag with cocklebur fruits attached

3.) The cocklebur fruit-covered test tags were attached to a string trap with wire loops.

4.) Medium length fake fur (1.5 inches) was attached to a test subject and the test subject walked through the string trap, contacting the dummy tag.

Results: Fail
The dummy tag adhered to the fake fur, but was easily dislodged with a few ounces of pressure, because it did not have enough time for the cocklebur fruits to bury themselves in the hair.

Modifications:
Because the tags needed to stick to the hair long enough for the cocklebur fruits to entangle deeply, it was determined that a primary adhesive was required to hold them in place temporarily. Several substances were tested: toilet seal wax, marine grease, pine pitch, rat trap glue.

Beta Testing:
The primary adhesives were tested for adherence to the fake fur and other substances.

1.) Toilet seal wax - moderate adherence prevented cocklebur fruits from tangling, non-hardening, water resistant.
2.) Marine grease - moderate adherence prevented cocklebur fruits from tangling, non-hardening, water resistant.
3.) Pine pitch - good adherence, moderate tangling, but tended to harden with time.

4.) Rat trap glue - excellent adherence, severe tangling, non-toxic, non-hardening, water resistant (Figure 16).

The primary adhesive selected was rat trap glue. This substance was far superior to any other test adhesive for the required purpose.

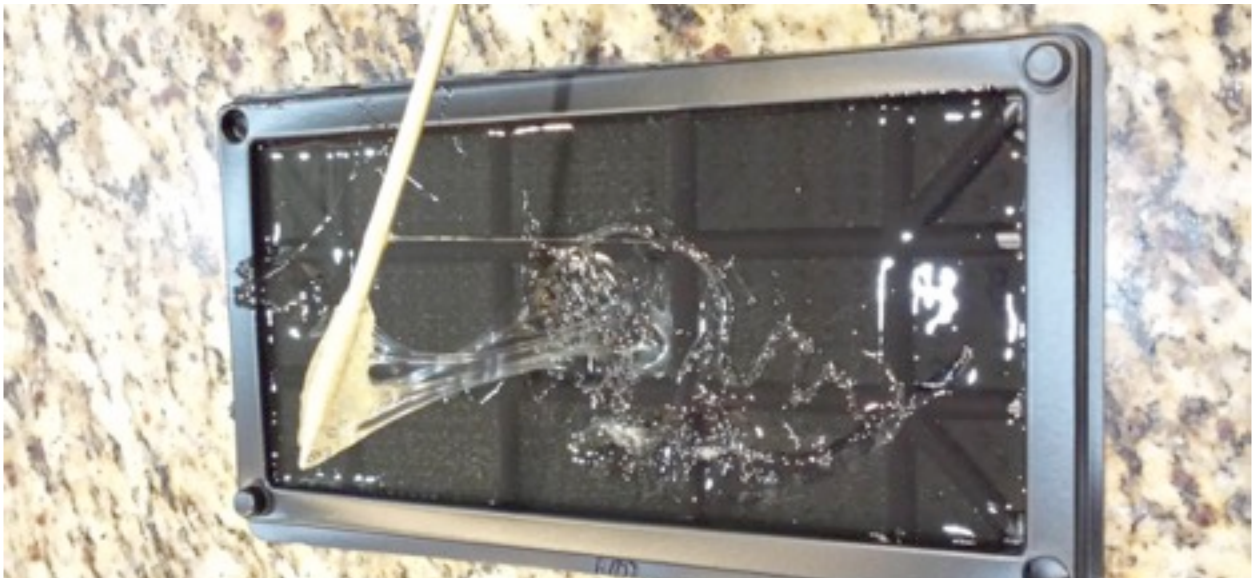

Figure 16. Rat trap glue

The selected primary adhesive was then applied to the cocklebur fruit-covered dummy tag (Figure 17). This was deployed on a string trap with a wire loop, as with alpha testing. However, a magnet attached to a wire loop was added, to simulate the magnet used to activate the radio tags. As before, a test subject walked through the string trap with fur attached to his torso.

Figure 17. Deployed tag with trap.

Results: Successful delivery of the tag

The primary adhesive not only stuck to the fur, but allowed for the release of the magnet from the dummy tag (Figure 18). The initial strength of the bond between the fur, primary adhesive, and cocklebur fruit was tested by attempting to remove the tag immediately after delivery without further movement from the subject. The bond required 7-8 lbs. of pressure to remove the dummy tag.

Figure 18. Initial bond.

After testing the initial bond, the fur was jostled, moved, and bumped together to simulate animal movement and impacts from branches, vines, and other forest elements. This further buried the tags into the fur, creating secondary bonds (Figure 19). The strength of these bonds was tested and resulted in at least 20 pounds of pull to dislodge the tag.

Figure 19. Secondary bond.

Additional test notes: After the beta test confirmed the tags with rat trap glue would adhere, McClurkan executed further testing using several lengths of artificial hair, raccoon (*P. lotor*) hide, natural white-tailed deer (*O. virginianus*) hair, and Rio Grande wild turkey (*Meleagris gallopavo intermedia)* feathers. The radio tag/cocklebur device adhered tightly to both the raccoon hide and the artificial hairs. The white-tailed deer hair allowed momentary adhesion, but did not allow the radio tag/cocklebur device to become entangled, except for the tail hair. The Rio Grande wild turkey feathers showed a similar result as the white-tailed deer hair.

This concluded the testing and development process.

Appendix 2

Summary Narratives Regarding Searches for the Tag 7 Signal.

January 1, 2016: Beginning near the December 10 contact point determined by the airborne team, an NAWAC ground team ("Zeus Team") attempted to relocate radio tag 7, scanning from ridges, highways, forest service roads, along rivers, etc. They reported no signals detected.

January 2, 2016: The ground team resumed its efforts to re-establish contact with radio tag 7 at 10:00 hours. The team was unable to locate the radio tag.

At approximately 11:25, an airborne team entered study-area air space to assist the ground team. The air crew began receiving pulsing contact signals from radio tag 7 around 13:00 in an area over six kilometers east of the December 10 contact point. The ground team scrambled to the location. At approximately 13:45, proceeding via ATV to coordinates obtained from the airborne team, some members of the ground team acquired contact signals from radio tag 7. Eventually the team dismounted from the ATV and began a pursuit on foot, during which time they heard sounds they described as "wood knocking" emanating from the surrounding forest. Due to the inhibitive topography and impending sunset, the team was unable to continue pursuit of the creature carrying the radio tag, which by all indications was moving away from them to the southwest over extremely difficult terrain (Figure 20).

Figure 20. Due to terrain and sunset, Zeus Team was unable to continue pursuit of radio tag 7. January 2, 2016.

January 23, 2016: After two days of searching for signals from radio tag 7, at approximately 19:45 hours, a three-man ground team took "extremely strong contact" signals to the north while parked near a river. The radio tag was now over three kilometers northwest of the January 2 position.

The team became mobile again by vehicle and moved west as a control to test the equipment. The team maintained contact back behind them and to the north as they moved west until eventually they lost contact.. They then attempted to take a road farther to the north that led back to the east to see if that could get them closer to and north of the contact, but they were unsuccessful in reacquiring the signal despite many stops to scan.

At approximately 21:30 hours the team turned around and headed back to the original position where they had taken the strong signals at 19:45. At roughly 22:00, over two hours after the first contact, in the same general location as before, they again took contact, except now the radio tag signal was coming from a different direction (Figure 21). During the period of time the team had driven some kilometers away to the west and north, the tagged individual had apparently crossed the road and was now moving in a southerly direction.

Figure 21. The three-man team of January 23, 2016 received strong contact signals from the north and later from the south after the tagged individual crossed the highway and moved into the forest on the south side of the highway.

January 24, 2016: At approximately 08:00 hours, the ground team succeeded in reacquiring the tracking signal from radio tag 7. In the same general area as the previous night, the radio tag was located somewhere within a dense pine forest south of the road. In an attempt to get a better fix on the tag's position, the team drove a short distance south down a narrow dirt trail that bordered a field with cattle and received strong pulsing signals from due east. Based on a weakening signal, the team believed the tagged animal was initially "fairly close" to where they were parked and that it was quickly moving away from them to the east as they scanned.

February 2-3, 2016: Another ground team attempted to acquire the signal from radio tag 7. After two days of searching, the team was unable to receive any signal. The team searched in the immediate area of the previous contacts and along many miles of primary roads and Forest Service roads.

February 6, 2016: After searching unsuccessfully throughout the entire day, a two-man team acquired a "very substantial" pulsing contact signal from radio tag 7 at approximately 18:00 hours while driving on a Forest Service road some eight kilometers south of the last contact site of January 24, 2016.

February 7, 2016: The team renewed efforts to acquire the contact, as on the previous day. They could not relocate the radio tag signal.

March 28, 2016: At approximately 21:00 hours, after hiking and searching all day, a two-man team reacquired the signal from radio tag 7. The team recorded the following in their journal: “We had a strong hit as we were approaching our camp after spending a great deal of time and effort searching elsewhere. We were a [few hundred meters] away, and it appeared that the signal was coming from the direction of camp. We slowly approached by vehicle and stopped to scan a couple of times, still picking up the signal. Then after another short approach, the signal was gone. We got out and walked back uphill a ways to see if a change of angle could help. We got a weak signal, but then nothing from that point all the way to camp. We thought the critter had simply dropped off the edge in one of several directions it could have gone.”

March 29, 2016: At approximately 09:00: “We returned to the same spot as the previous night. We picked up the signal again, but this time it was coming from the valley below us. We decided to go look for it. The descent was steep and extremely densely covered with green briar and such, as well as lots of deadfall. It was super slow going, and the dense vegetation tore us up. We needed machetes! Worse than this, however, was the fact that the signal weakened as we dropped into the abyss and it soon disappeared. We made our way back to the road and hiked back to the truck where we checked for the signal again.”

At 10:57, the team recorded: “We picked up a solid signal again from Tag 7, but it was weaker than before, leading us to think the subject had moved away from us.”

Still later, at approximately 13:00, the team wrote the following in their field journal: “We returned to camp and decided to hike [the camp road]. In the course of doing that we picked up the signal again, coming from the east/southeast.” This contact was roughly one and one-half kilometers from the contact of February 6, 2016, and was back in the direction of the signals detected earlier in the day (Figure 22).

Figure 22. The March 29 team received strong contact signals from the valley below.

April 15-16, 2016: A two-man team searched unsuccessfully for a signal from radio tag 7.

May 2, 2016: After two days of searching for the radio tag signal, a three-man ground team recorded the following: "Got into hot pursuit of a pulsing consistent contact signal that fluctuated between four and five bars, approximately [one kilometer] south of campsite. We pursued the contact on foot, actually at a run at one time. After 30-40 minutes of chasing the contact, we lost it. We further advanced on foot to reacquire, combed the entire area in a zig-zag fashion and could never reacquire signal."

May 3, 2016: The team camped approximately one kilometer north of the previous day's contact. During the night, team members heard one clear wood-knocking sound from the south and received a weak pulse hit using the omni-directional antenna. The team returned to the contact site from the previous day. Very near where they had documented a signal on the previous day, they received more pulsing contact signals from radio tag 7. Again the team attempted to close distance with the tag on foot and methodically attempted to land navigate to the contact, using azimuths, walking 30-40 meters and then scanning again. The carrier of the radio tag led the team in a circle, before moving around and eventually flanking them, so that after 20-25 minutes the team ended up back at their starting point where they had parked the ATV. Shortly afterward, the team lost the signal for the duration of their stay (Figure 23).

Figure 23. The signals received by the ground team of May 2 and 3 were approximately three kilometers east of the contacts made on March 29, 2016.

May 15-18, 2016: After three days of seeking out contact from radio tag 7, at 16:20, May 18, a four-man team acquired one- to three-bar pulsing hits while scanning from a mountaintop. The signal was coming from the south, much like the March 29 signal acquisition.

May 19, 2016: At 07:00 the team registered another contact with radio tag 7 from their mountaintop position. This time the three- to four-bar pulsing hits came from the north. The tag carrier had moved from the valley to the south, where it had been detected the previous day, over the rough and rocky mountain, and down into the valley to the north at some point during the previous 14 hours. At 12:38 the team briefly acquired a weak signal originating from the north, but that was the last time the signal was detected by this team.

May 20 - June 5, 2016: Several teams scanned daily at a variety of locations throughout the entire study area, but they were not able to reacquire any signals from radio tag 7.

June 6, 2016: A two-man team searched five hours for signals from radio tag 7 along a three-kilometer stretch of Forest Service roads and ATV trails near where the last signals had been detected, but to no avail.

June 7, 2016: At 10:45, the same two-man team resumed their search for the wayward radio tag 7. The team scanned again along much of the same terrain as the previous day, then continued another six kilometers or so to an area of a few remote summer cabins. They estimated that they had covered some one-hundred-twenty kilometers over the two-day search, much of it on ATV.

At 14:20, as the team scanned down into a valley, they heard a "commotion of vocalizations" from tracking hounds moving up the slope out of the valley to the west, perhaps 4-500 meters distant. The team relocated closer to the sound of the dogs and then heard the dogs begin to "bay," indicating they may have locked onto the scent of something. The men listened as the handlers/owners of the dogs angrily yelled and attempted to get control of the dogs; the dog handlers were on horseback.

At 14:50 the team picked up an intensely strong pulsing signal and chirps on the ATS receiver from radio tag 7 "due south." The tag's carrier appeared to be moving quickly to the east, apparently away from the howling, baying dogs (to the west). The radio tag signal was directly downslope from the NAWAC team, whose position was on a rocky outcrop overlook where the two men could look down into the valley over dense vegetation. They continued to track the radio tag as it moved to the northeast, left of their position. The tagged animal crossed the ridge, and descended the north-facing slope, away from the NAWAC team, away from the loud dogs, and out of contact range of the ATS receiver in the space of a few minutes.

June 8, 2016: 12:13: After studying a topographic map, the team settled on a plan to scan for the radio tag from a position north of the mountain where the signal was detected the previous day. The team had lost contact the previous day when the radio tag carrier had moved up and over the mountain and disappeared down the north-facing slope. The team had hopes that the signal could be reacquired with the team facing south, north of where contact had last been acquired.

14:00: The team, now a three-man team, began scanning for radio tag 7. They had projected the course of the tag carrier based on its movements the previous day. The team immediately took contact to the southwest with pulsing, chirping hits of three to five bars. The team drove west, stopping and scanning at intervals of roughly one kilometer.

15:15: The team recorded the following in their journal: "At the third stop, standing on the lid of a utility vault and looking over open ranch land to the south, we reacquired solid hits up to eight bars up slope to the southwest. We reconned a Forest Service road [that bordered a big ranch.] After moving rocks and hand-sawing a large downed black walnut tree, we traveled south for [three kilometers] to the foothills of [the mountain]. There we found donut-shaped clearings in the forest. These appeared to be Forest Service wildlife food plot areas. At the first such clearing, we acquired strong signals (up to eight bars) back to the northwest, back between the team and the highway, along the back of the ranch property. We had passed the radio tag. At this point we had to return closer to the [road] as a heavy thunderstorm moved into the area. After waiting out the storm we resumed the quest, only to find the signal had weakened and was now to the south. After again moving toward the signal direction, the trail ended at another food plot. We attempted to follow on foot but soon realized that the terrain was too difficult. We remained in place, listening to the chirping of the receiver as the signal finally faded out. The tag was going right back up [the mountain] to the exact area as the previous evening's events."

June 9, 2016: The team again acquired signals from radio tag 7. At approximately 12:50 they acquired a weak pulsing signal from radio tag 7 from the direction of the last detection. The hits were two to three bars in strength, meaning the tag may have been distant from the team's position.

The team continued north in the hope that they could repeat the actions of the day before and reacquire the radio tag on the north-facing slope, but they were unsuccessful. When they drove to the area where they had last received a signal from the tag on the previous day, there was no signal. They believed it was reasonable to assume that the carrier of the tag had crossed over the mountain and had moved back into the valley to the south. They would later find their assumption to be correct.

At 18:30, after driving to a shop to have a flat tire repaired and taking chow at a restaurant, the team resumed the search. After several stops the team started receiving soft hits from the tag about one and one-half kilometers west of the group of remote cabins on the forest service road. As the team progressed eastward the signal became stronger.

At 19:45, after continuing to get soft hits from radio tag 7, at about one kilometer to the east of the spot where the team had taken contact on June 7, the team reacquired strong signals from directly south in the valley below their position. The team continued to receive signals until they were forced to turn back to camp due to nightfall. This was the last signal from radio tag 7 this team would document.

June 12, 2016: After several days of searching and no new signals from radio tag 7, another two-man team acquired the signal from near where the previous team had last taken contact. The contact started out very strong in the eight- to ten-bar range. This time the tag carrier appeared to be ascending the north-facing slope of the mountain. The team continued to hold contact looking south, with strong pulsing hits, and then the contact faded down to three- to four-bar hits, before fading down to one to two and then to nothing. The signal disappeared as the carrier of the tag either reached the top of the mountain and crossed over to the south face, or it moved farther down the drainage until blocked by terrain features. The team believed the tag was now near the location where it had originally picked up the tag in August 2015.

From June 13 to June 26, 2016, several teams failed to re-establish contact with radio tag 7.

June 27, 2016: At approximately 15:00 hours, a two-man team received signals from radio tag 7, again from the same location as the last few hits as the team scanned to the south.

June 28, 2016: The two-man team hiked down into the valley in the direction of the signal received the previous day. After a difficult hike, they established a campsite at the north base of the mountain. Overnight, they documented wood-knocking and several large rocks thrown into camp.

June 29, 2016: At 08:00, from their campsite at the north base of the mountain, the team received strong contact from the south, high up near the top of the mountain. The signal weakened and eventually disappeared. This was the last time that the NAWAC was able to detect the whereabouts of radio tag 7.

Shortly after this point in time, when the last signal was monitored, all the radio tags remaining in hand ran out of battery life, as did, presumably, radio tag 7. The distribution for 25 points where radio tag signals were detected is illustrated in Figure 8.