Relative Efficacy of a Urine-based Lure for Attracting Wild Pigs

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Abstract: Population surveys and removal efforts for wild pigs (*Sus scrofa*) have traditionally used a food-based attractant. However, some situations or locations where these activities may take place may not be conducive to the logistical challenges associated with storing or hauling large quantities of bait. Scent-based lures are lighter and easier to store than baits, and may negate some of these logistical challenges. Our goal was to examine the efficacy of a urine-based lure for attracting wild pigs to and retaining them at camera sites. We compared the initial arrival time and length of visits among boars, sounders, and juveniles at sites with a urine lure, whole corn, and a combination of the urine lure and whole corn during June and July 2017 on Lowndes Wildlife Management Area, Alabama. Our results indicated that sounders arrived at URINE sites quicker than other treatment sites, although we did not find these same results among boars or juveniles. While feeding bout lengths tended to be shorter at URINE sites, we detected no statistically significant differences among sex/age classes or treatments. It is possible that above average precipitation during our study may have diluted urine applications and partially masked effects. These data suggest that urine-based lures may be appropriate for initial population assessments where quick attraction to a site may be desired, but a food-based attractant is more suitable for retaining wild pigs at sites long enough for removal efforts or detailed population surveys.

Key words: attractant, bait, camera surveys, *Sus scrofa*, trapping

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Wild pigs (*Sus scrofa*) are a non-native invasive species in North America whose behavioral activities associated with feeding and wallowing cause major agricultural loss, soil and vegetation disturbance, and adversely affect water quality and native wildlife (Campbell and Long 2009). Because of their adverse impacts on both the natural environment and anthropogenic resources, considerable effort has been, and will continue to be, expended towards monitoring and removal efforts (Ditchkoff and West 2007). These efforts often involve attracting wild pigs to a site baited with corn and monitored by a game camera (Williams et al. 2011a); corn is normally used as an attractant due to its relative low cost, availability, and efficiency at attracting animals. While corn is useful for monitoring and trapping wild pigs at easily accessible sites, remote sites are often not conducive to hauling large quantities of bait. Purchase and storage of large quantities of bait, such as corn, can also present challenges, whereas a scent-based lure would be more efficient in this regard. Additionally, dispersal of large quantities of corn across a study area may serve as a supplemental food source to wild pigs or other species such as raccoons (*Procyon lotor*), concentrating them in sensitive areas and potentially boosting populations via condition-dependent reproduction (Milner et al 2014). Finally, use of food-based lures for trapping wild pigs may not be legal during deer or turkey hunting seasons in some areas, as it may be considered a form of baiting. An alternative, scent-based lure that does not present the same logistical challenges could improve operating efficiency in some areas (Schlexer 2008).

Few studies have examined the feasibility of replacing a food-based attractant, or bait, with a non-food lure for monitoring or trapping wild pigs (Campbell and Long 2008). Additionally, studies using estrous sows, which may attract wild pigs to a site in the same manner as a urine-based lure, produced mixed results (Choquenot et al. 1993, McIlroy and Gifford 2005). Our goal was to examine the efficacy of a urine-based lure for attracting wild pigs to camera sites, in the belief that it could be a useful tool for managers and researchers. Because of their matriarchal social organization, we suspected that a female reproductive lure (Wild Hog Sow in Heat; Code Blue Scents, Birmingham, AL, USA) would attract sows and their respective sounders (including juveniles) to the scent of an unknown female within their home range or territory. We assumed that boars would also be readily attracted to the scent of a sow in heat due to reproductive interest. Our specific objectives were to compare the initial arrival time and length of time spent at the site among different sex/age classes of wild pigs for the urine lure, corn, and a combination of the two. We hypothesized

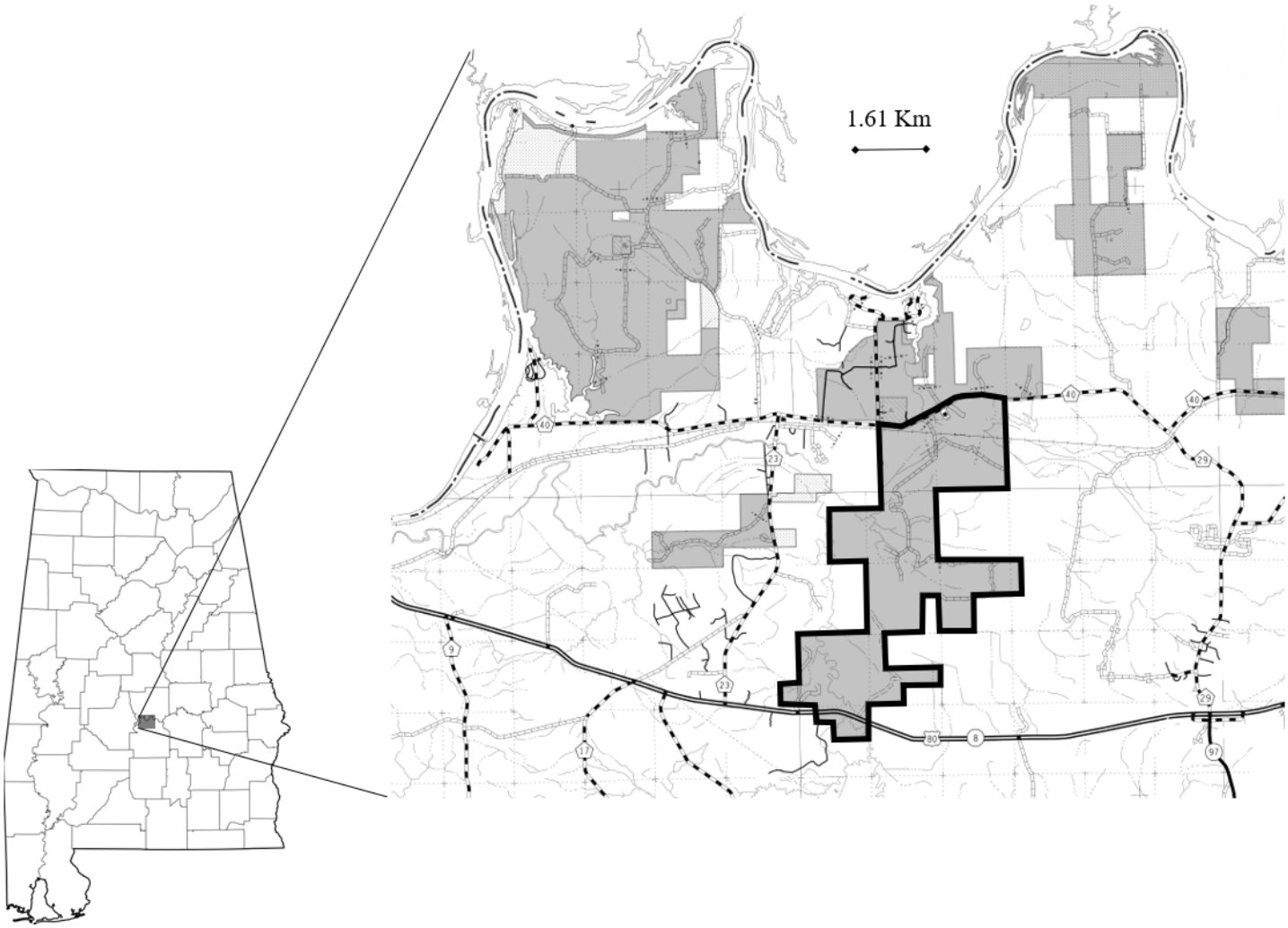

Figure 1. The study was conducted on a portion of Lowndes Wildlife Management Area, located in Lowndes County in central Alabama. The shaded areas represent Lowndes WMA properties, and the area bounded by the bold black line is the section of Lowndes WMA where the research took place.

that wild pigs would have shorter initial arrival times at sites utilizing a urine lure due to its stronger odor, but remain at sites baited with corn longer due to its attractiveness as a food source.

Methods

Study Area

Research was conducted between June and July 2017 on Lowndes Wildlife Management Area (WMA) located in Lowndesboro, Alabama, USA (Figure 1). The specific section of Lowndes WMA that we used for the study was the southeast 18-km^2 section of the WMA located between County Hwy 40 to the north, Highway 80 to the south, Brown Road to the west, and the WMA boundary to the east. The area was composed of planted pines (*Pinus* spp.), planted hardwoods (*Quercus* spp.), bottomland hardwood forests with palmetto (*Sabal minor*) understories, bald cypress (*Taxodium distichum*) swamps, and food-plot openings in a generally flat landscape surrounded by agricultural land (Gaston et al. 2008). This area had a humid, subtropical climate with average summer temperatures (June–July) of 26.25 °C and an average yearly rainfall of 137 cm, with 11.4 cm occurring in June–July. The official hunting season for wild pigs on the area was 15 August–30 April, thus no hunting occurred during the study.

Experimental Design

We tested the attractiveness of two lures/baits (urine and whole corn) in three treatments (URINE, CORN, and URINE + CORN) during four, 4-day sampling periods from 9–12 June, 14–17 June, 20–23 June, and 30 June–4 July (the last sampling period was deployed over two days due to weather). Using ArcMap, we generated a grid with cells of 1 km^2 over our study area, resulting in 19 indi-

vidual cells with ≥40% area within the WMA. During each period, we randomly selected 7 grid cells for use, and then generated 3 random points within each cell to serve as locations for cameras sites, for a total of 21 camera sites during each sampling period. At no time during the study was a camera location used more than once. All camera sites were within the WMA boundary, accessible, and were at least 200 m from the next closest camera site. We randomly assigned one of our 3 treatments to each of the 3 camera sites within each cell. We selected the specific location for camera placement by finding an area close to the generated point (within 100 m) where we were likely to detect pigs based on proximity to a water source, cover, and food availability (Kay et al. 2017). We only used some cells for one sampling period due to the amount of water present.

On Day 1 of each sampling period, we spread 11.3 kg of corn over an area approximately 2.5 m by 2.5 m at each camera site that required use of corn. A labeled (date/location/treatment) plastic capsule containing cotton soaked in 5 ml of urine was attached with a rubber band to a tree/branch approximately 1.2 m off the ground on sites where the lure was required. On Day 3, camera sites were refreshed with 5.7 kg of corn as needed, while urine capsules were refreshed with 10 sprays of urine. Since this area was heavily baited with corn outside of this particular study due to other trapping efforts, no pre-baiting was conducted. To collect data on initial arrival time and length of visits, a game camera (RECONYX HC500 HyperFire Semi-Covert IR; Reconyx LLP, Holmen, WI, USA) was set at each site and was programmed to collect 1 image every 3 minutes using a time-lapse setting, and 5 images on a motion trigger setting with a 3-minute delay. We retrieved cameras on day 5 of each sampling period.

Based on time/date of initial camera deployment, we noted the initial arrival time of a group of wild pigs to each of the three treatments by sex/age class (boar, sounder, and juvenile). We classified all pigs based upon photographic characteristics, and considered any pigs <22.7 kg to be juveniles (Williams et al. 2011b). If a group contained adult females, we classified it as a sounder: we defined other groups as boar or juvenile when those groups were only comprised of those animals. We defined length of visits as the amount of time, in minutes, each sex/age class spent at a site, and considered site visits distinct if >30 minutes elapsed between visits (Williams et al. 2011a). Lengths of site visits were only accurate to approximately 3-minute intervals since the cameras were on a 3-minute time lapse. We used linear mixed models in program R (R core development team, version 3.3.1 accessed 1 May 2018) to compare initial arrival times and lengths of visits to bait sites among sex/age classes of wild pigs and among treatments. We included random effects terms for sampling period and camera site in models examining length of visitation, and a random effect term for sampling period was included in models examining initial arrival time to account for variation associated with these effects. We considered all effects statistically significant at the 0.05 significance level. Research methods were approved by the Auburn University Institutional Animal Care and Use Committee (PRN 2014-2555; PRN 2017-3164).

Results

We collected data from 80 camera sites during four sampling periods (21 sites in each sampling period; 3 sites were inaccessible due to high water and 1 site had a camera error). Over the course of the study, 35 sites were visited by wild pigs, and of the initial visits at these sites, boars accounted for 18, sounders accounted for 7, and juveniles 10. These 35 sites accounted for a total of 62 initial visits (Table 1) by boars (n = 25), sounders (n = 19), and juveniles (n = 18), and were visited a total of 245 times: 95 by boars, 77 by sounders, and 73 by juveniles (Table 2). Wild pigs visited CORN sites more frequently (n = 121), than either URINE (n = 39) or URINE + CORN (n = 85) sites.

We observed that sounders had quicker initial arrival times to

Table 1. Initial wild pig (all sex/age classes) arrival times to, and length of visits at URINE, CORN, or URINE + CORN sites at Lowndes WMA, Alabama, 9 June–4 July 2017.

	Initial arrival time (hr)					Length of visit (min)				
				95% CI[a]					95% CI[b]	
Parameter	n[c]	x̄	SE	Lower	Upper	n[d]	x̄	SE	Lower	Upper
URINE	8	37.9	9.5	19.3	56.5	39	22.5	6.7	9.3	35.7
CORN	30	41.4	5.0	31.7	51.1	121	37.2	3.9	29.5	44.9
URINE + CORN	24	42.4	4.4	33.7	51.0	85	33.4	3.8	25.9	40.8

a. Calculated for URINE, CORN, and URINE + CORN as: $\bar{x} \pm 1.960 \times$ SE.
b. Calculated for URINE, CORN, and URINE + CORN as: $\bar{x} \pm 1.960 \times$ SE.
c. Number of sites visited.
d. Number of individual visits.

Table 2. Mean initial arrival times and length of visits of wild pigs by sex/age class to URINE, CORN, or URINE + CORN sites at Lowndes WMA, Alabama, 9 June–4 July 2017.

	Boar			Sounder			Juvenile		
Parameter	n	x̄	SE	n	x̄	SE	n	x̄	SE
Initial arrival time[a]									
URINE	4	44.6	16.47	2	14.2	1.51	2	48.1	11.90
CORN	13	40.6	9.36	9	40.4	5.69	8	43.8	9.81
URINE + CORN	8	48.5	6.49	8	42.7	8.33	8	35.9	8.36
Length of visit[b]									
URINE	17	28.3	14.01	13	25.8	8.02	9	6.8	3.36
CORN	60	36.7	5.18	31	52.9	9.64	30	22.0	5.65
URINE + CORN	18	28.9	5.84	33	38.4	6.07	34	30.8	6.87

a. Initial arrival times are measured in hours.
b. Length of site visits are measured in minutes.

URINE sites than URINE + CORN sites (β = –33.48; 95% CL = –59.49 to –7.47; P = 0.025) and CORN sites (β = –31.0; 95% CL = –56.91 to –5.08; P = 0.035). We did not observe differences in sounder initial arrival times between CORN and URINE + CORN sites (β = –2.49; 95% CL = –18.37 to 13.39; P = 0.763; Table 2). Neither boars [URINE vs. CORN (β = 4.00; 95% CL = –29.17 to 37.17; P = 0.816), URINE vs. URINE + CORN (β = –3.84; 95% CL = –39.37 to 31.68; P = 0.834), CORN vs. URINE + CORN (β = –7.84; 95% CL = –33.91 to 18.232; P = 0.561)] nor juveniles [URINE vs. CORN (β = 4.27; 95% CL = –34.89 to 43.43; P = 0.833), URINE vs. URINE + CORN (β = 12.159; 95% CL = –27.00 to 51.32; P = 0.552), CORN vs. URINE + CORN (β = 7.891; 95% CL = –16.87 to 32.66; P = 0.542)] demonstrated differences in initial arrival times among treatments. We did not observe differences in lengths of visitation among treatments for boars [URINE vs. CORN (β = –12.59; 95% CL = –39.18 to 14.33; P = 0.371), URINE vs. URINE + CORN (β = –2.30; 95% CL = –19.90 to 15.30; P = 0.885), CORN vs. URINE + CORN (β = 10.29; 95% CL = –13.13 to 33.71; P = 0.396)], sounders [URINE vs. CORN (β = –31.14; 95% CL = –69.76 to 7.48; P = 0.167), URINE vs. URINE + CORN (β = –20.72; 95% CL = –59.99 to 18.55; P = 0.340), CORN vs. URINE + CORN (β = 10.425; 95% CL = –15.20 to 36.04; P = 0.441)], or juveniles [URINE vs. CORN (β = –15.22; 95% CL = –40.65 to 10.20; P = 0.245), URINE vs. URINE + CORN (β = –24.05; 95% CL = –49.126 to 1.034; P = 0.064), CORN vs. URINE + CORN (β = –8.82; 95% CL = –25.58 to 7.93; P = 0.306)].

Discussion

While we found no difference in initial arrival times within or among sex/age classes among any treatment types, wild pigs visited CORN sites 3 times as often as URINE sites, and approximately 50% more often than URINE + CORN sites. CORN sites also tended to produce longer site visits than URINE sites, however low sample sizes may have precluded significant results. The urine-based lure initially attracted wild pigs to a site, but they tended not to revisit these same sites without an added food resource (Lavelle et al. 2017). For similar reasons, McIlroy and Gifford (2005) suggested that estrous sows be used to trap residual pigs. However, Choquenot et al. (1993) did not report success when using traps with estrous sows for capture of residual animals. Our results suggest that reproductive/urine attractants may be beneficial for luring pigs to a site, but may not be effective for activities (e.g., trapping) that require retaining pigs at a site, such as whole sounder removal. While we had pig activity at URINE sites, we found that without a reason for continued visitation (i.e., food), these sites were not effective at retaining pig activity. Although the appeal of using an olfactory lure alone remains obvious, these studies (McIlroy and Gifford 2005, Choquenot et al. 1993), along with our results, suggest that bait is still the optimal attractant for trapping wild pigs.

Although URINE sites did attract all sex/age classes, sounders and juveniles tended not to remain at these sites as long as at those offering a food bait. Assuming some degree of territoriality among sounders, as suggested by Sparklin et al. (2009), the dominant adult females in a sounder may be quick to assess the potential threat associated with another sow in heat, which may explain the presence and, upon failing to find a real intruder, the rapid departure of, these sows and their associated sounders. Similarly, the advertised presence of a sow in heat may explain the appearance and, compared to juveniles, lingering of boars. Duration of visits at food-baited sites were comparable to those observed by Williams et al. (2011a), but the shorter lengths of visitation associated with lure-only sites may not provide the site retention required for trapping or detailed population surveys. However, the mean feeding bout lengths found with boars and sounders would be adequate for management activities such as shooting, darting, or behavioral observations.

Precipitation may have confounded some of the results of this study. Our study area received approximately 25 cm of rain during the course of the study, more than twice the average amount normally expected during this time of the year. Most of this rain fell during the last two sampling periods, which led to zero pig visitations to camera sites where urine was the sole attractant. Pigs still visited the camera sites baited with URINE + CORN, likely due to the presence of corn at those sites. We hypothesize that precipitation diluted the urine and diminished the amount of odor that was produced, making the sites more difficult to detect by olfactory clues alone. These findings suggest that the use of urine-based attractants for wild pigs may be less effective during periods, or in climates, with considerable precipitation unless waterproof odor dispensers are utilized.

Because of the size of our study area, it was impossible to establish a sampling scheme under which we were not potentially sampling the same animals or groups of animals multiple times. We are confident that multiple camera sites may have fallen within a single sounder home range: Sparklin et al. (2009) indicated that sounder territories may exceed 3.5 km^2 in this region, and the home ranges of boars (2.18–4.1 km^2) exceed those of sounders (Kurz and Marchington 1972, Wood and Brenneman 1980, Singer et al. 1981, Friebel and Jodice 2009). This situation obviously violates assumptions of independence of sampling, and thus it is possible that our results are not representative of the responses that could be expected of other wild pigs. This situation may have also impacted the sample sizes of some of our treatments: if the same individual(s) had previously visited a urine-based site, they may have been less interested in visiting that same site again or another

site of the same treatment. These observations, as well as other data produced in this study, generate some confusion as to the value of urine-based lures for attracting wild pigs to camera sites. As a result, we suggest that further work be conducted to examine their effectiveness.

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