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Confirmation of Coyote Predation on Adult Female White-tailed Deer in the Southeastern United States

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Abstract - The recent expansion of *Canis latrans* (Coyote) into the eastern United States has generated interest among wildlife managers because of the potential impacts on *Odocoileus virginianus* (White-tailed Deer) populations. Coyotes have been reported as predators of adult and neonate White-tailed Deer in some parts of their range, but recent studies in the Southeast have documented only Coyote predation on neonates. We report 4 confirmed Coyote predation events on adult female White-tailed Deer that were radiocollared, implanted with vaginal implant transmitters, monitored every 4–8 hours, and apparently healthy. Field necropsies confirmed killing-bite wounds to the upper throat and base of the mandible, and feeding behavior on the carcasses was consistent with what has been observed for Coyotes. Further, we used swabs from bite wounds to confirm the presence of predator DNA, and the 3 carcasses that were swabbed tested positive for the presence of Coyote DNA. To our knowledge, our results represent the first scientifically documented Coyote predations on adult female White-tailed Deer in the Southeast.

Canis latrans Say (Coyote) is relatively new to the fauna of the southeastern United States (Gompper 2002, Hill et al. 1987); thus, its role as a predator in the region is largely unknown. Because *Odocoileus virginianus* Zimmermann (White-tailed Deer; hereafter, Deer) populations are important economically, interest in Coyote impacts on Deer in the southeastern US is high (e.g., Kilgo et al. 2010). With burgeoning Deer populations in many areas, Coyote predation might be welcomed by wildlife managers, and recent evidence has suggested that localized declines in Deer density could be attributed to high neonate mortality due to Coyote predation (Kilgo et al. 2012, Saalfeld and Ditchkoff 2007). Though Coyote predation on adult Deer is significant in other regions (see Ballard 2011 for review), data quantifying Coyote predation on adult Deer are scant for the Southeast. Though collar-based Deer research in the Southeast is common, we failed to find a documented case of Coyote depredation of adult Deer. Because many studies rely on 4- or 8–hour motion-sensitive mortality switches, and collars are not monitored intensely, it is possible that many depredations have been missed. Thus, the capability of Coyotes to depredate healthy adult Deer has been questioned, particularly in the absence of environmental factors like snow and ice, which have previously been reported as important factors in making adult Deer vulnerable to predation (Mech 1984). Moreover, in the Southeast, because Coyote predation on healthy adult Deer is undocumented, our knowledge about the potential impacts of Coyotes on Deer population dynamics is limited to Coyotes' effects on neonate survival (e.g., Kilgo et al. 2012). However, Coyote food-habit studies suggest year-round Deer predation (e.g., Schrecengost et al. 2008, McVey et al. 2013).

We conducted a neonate-survival study at Fort Bragg Military Installation in central North Carolina. From January through May 2011, we darted 28 adult (i.e., >1-year-old) females from vehicles or over bait and fitted them with GPS collars (Wildcell, Lotek Wireless Inc., Newmarket, ON, Canada) and vaginal implant transmitters (VITs; Model M3930,

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Advanced Telemetry Systems, Isanti, MN). We monitored females periodically after capture to make sure they were alive and VITs were functional. In mid-April, we began monitoring VITs daily in preparation for fawning season. On May 1, we started checking VITs in the morning and evening, and after we detected the first birth on 12 May, we monitored all VITs every 8 h or less. We assumed that birth had occurred and a neonate would be present when a temperature-sensitive switch caused the VHF pulse-rate to indicate that a VIT had been expelled. We then used the precise-event transmitter (PET) in the VIT to estimate parturition time (to within 30 min). We waited ~3 hours before approaching a potential birth site. However, on 4 occasions, we discovered the radiocollared adult Deer had been killed.

We responded to all 4 mortalities within 3.5 h of birth, as indicated by the activation of the temperature switch in the VITs, according to the PET. Thus, our recoveries were rapid and not associated with mortality signals in the adult collars (set to 8 hours). All 4 mortalities had field evidence of predation, including penetrating bite wounds to the upper throat and back of the mandible that were consistent with Coyote predation (O'Gara 1978). Subcutaneous hemorrhaging associated with the bite wounds provided evidence of perimortem blunt trauma (i.e., bite pressure), indicating the Deer were alive when bitten. Feeding was concentrated on the hindquarters and viscera, which are typical feeding locations selected by Coyotes (O'Gara 1978). One female still had 1 fetus in her body cavity, but we do not know if any of the females were in the process of giving birth when they were killed. Two of the 4 still had the VIT in the vaginal canal, indicating they probably were not killed while giving birth. However, 2 of the Deer were killed (17 May and 22 May) during the 2011 documented fawning season; based on VIT-related births fawning occurred 12 May–23 June. The other two adult Deer were killed on 1 May and 14 August. Thus, all 4 Deer lived well into the late-gestation (April–early-May) or fawning (mid-May–mid-June) seasons, though 1 individual never expelled her VIT and survived into August. Two females left noticeable blood trails and trampled vegetation, which indicated a prolonged struggle.

Because we anticipated a parturition event rather than an adult mortality, we were not equipped to take DNA swabs when we discovered the first dead adult Deer on 1 May. However, we swabbed the other 3 to confirm the predator species. We wiped a cotton swab around killing-bite wounds, on body parts where feeding had occurred, and on the GPS collars. We sent samples to Wildlife Genetics International (WGI; Nelson, BC, Canada) for genetic analyses, the results of which included identification of the predator species and individual identity (i.e., genotype) of the predator(s) when sufficient quality DNA was obtained (see Kilgo et al. 2012 for detailed description of molecular methods used by WGI).

Coyote DNA was present on all 3 mortalities that we swabbed, and 2 genotypes (1 each from 2 Deer) were identified. Though multiple individuals were not detected at any single kill site, it is possible that other individuals were present. The quality of the DNA on the swab or the location we swabbed on the carcass could have precluded recovery of additional genotypes.

Our results indicate that current molecular methods are useful for confirming field determinations of predator assignment (as in Kilgo et al. 2012). We believe the detection of Coyote DNA and presence of killing bite wounds on 3 fresh adult female Deer carcasses confirms them as depredation events. Because the mortality for which we did not obtain predator DNA was consistent in all respects with the evidence we observed on the other kills, we confidently identified all 4 mortalities as Coyote depredations. Assuming our GPS-collared sample of adult females is representative of the female Deer population in 2011, Coyotes could be a significant source of mortality for adult female Deer at Fort Bragg. Our results indicate that the percentage of adult females killed by Coyotes was greater than either hunter-harvest or vehicle collisions (M.C. Chitwood, unpubl. data).

Coyote density at Fort Bragg appears to be high (B. Will, North Carolina Statue University, Raleigh, NC, unpubl. data). Deer density is low (~2–4 Deer/km^2) and body-condition metrics (e.g., body weight, kidney-fat index) suggest that Deer are healthy and within carrying capacity (Fort Bragg Wildlife Branch, Fort Bragg, NC, unpubl. data). We speculate that females killed in our study might have been vulnerable due to gestation (or perhaps even parturition itself). We know from our monitoring schedule and GPS data that none of the depredated females was hit by a vehicle, and it is unlikely they were wounded by poachers. Thus, we assumed they were healthy as fawning season began. Further, all of the Coyote depredations occurred in or along the edge of dense vegetation associated with drainages at Fort Bragg. Our data indicate these areas commonly serve as bedding, escape, or parturition cover (Chitwood 2014, Lashley 2014). Regardless, vulnerability is a key component for understanding the emerging predator–prey dynamic in the Southeast. In more northerly latitudes, deep snow can make adult Deer more vulnerable to predation by Coyotes (Ballard 2011). Though snow is less likely to create that situation in the Southeast, Coyotes may be able to exploit late-gestation females simply because they represent vulnerable targets. Additional research on Coyote impacts on adult female Deer is needed to determine if similar mortality events occur across the Southeast. When coupled with high rates of Coyote predation on neonates, potential adult mortality due to Coyotes should be considered when establishing Deer-management goals.

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