Ungulate Research and Management

Portable drive-net for capturing urban white-tailed deer

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Abstract Increasing white-tailed deer (*Odocoileus virginianus*) numbers in urban environments is a management problem for both natural resource agencies and urban residents because of economic (e.g., deer-vehicle collisions) and ecological (e.g., ornamental and native vegetation damage) issues associated with deer "overabundance." Reducing deer numbers using nonlethal control procedures often requires the safe (i.e., low mortality) capture of urban white-tailed deer. We describe the use of a portable drive-net to capture urban white-tailed deer. We attached nylon drive-nets of various lengths, heights, and mesh sizes to an anchor (e.g., fencepost, T-post, tree) and placed them neatly on the ground. Persons on foot would drive deer toward the drive-net while one person would pull the net vertically to coincide with deer arrival. From June 1998-October 2003, we captured 76 white-tailed deer (25 M, 51 F) in Texas and Florida using the portable drive-net. No deer mortalities were recorded, and ≤10 deer suffered small cuts and scrapes. The major advantages of our drive-net (i.e., simplicity, portability, selectivity, low cost, quietness, and non-invasiveness) make the technique useful for capturing urban white-tailed deer.

Key words capture, drive-net, *Odocoileus virginianus*, urban environment, white-tailed deer

Increasing urban white-tailed deer (*Odocoileus virginianus*) numbers are a management problem for natural resource agencies and urban residents because of economic (e.g., deer–vehicle collisions) and ecological (e.g., ornamental and native vegetation damage) issues associated with an overabundance of deer (Jones and Witham 1990, Conover et al. 1995, McShea et al. 1997). Management of urban white-tailed deer populations may involve lethal or nonlethal means of population control (DeNicola et al. 1997, Hansen and Berringer 1997); however, urban residents often prefer nonlethal tactics that require the safe capture (i.e., little or no mortality) of urban deer (Jones and Witham 1990, Warren 1995, Stout et al. 1997, Peterson et al. 2003).

A variety of capture techniques has been described for capturing wild, free-ranging deer (Rongstad and McCabe 1984); however, many of these techniques are inappropriate for capturing deer in urban environments (Peterson et al. 2003). Traditional capture methods for white-tailed deer include Stephenson box traps (Hawkins et al. 1967, Palmer et al. 1980, Rongstad and McCabe 1984, Haulton et al. 2001), Clover traps (Clover 1954,

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Fuller 1990, Beringer et al. 1996, DelGiudice et al. 2001, Haulton et al. 2001), drop-nets (Ramsey 1968, Conner et al. 1987, Silvy et al. 1990, Lopez et al. 1998), traditional drive-nets (Silvy et al. 1975, Beasom et al. 1980, Sullivan et al. 1991), rocket-cannon nets (Hawkins et al. 1968, Palmer et al. 1980, DeYoung 1988, Beringer et al. 1996, Haulton et al. 2001), rocket-nets (deVos et al. 1984, DeYoung 1988), and chemical immobilization (Hawkins et al. 1967, Palmer et al. 1980, DeNicola and Swihart 1997, Kilpatrick et al. 1997, Haulton et al. 2001).

Capture methods requiring explosive charges (e.g., drop-nets, cannon nets, rocket-nets, net guns) may be inappropriate in urban areas because of the associated sound-pressure levels or human safety concerns. Capture methods that are conspicuous (e.g., drop-nets, box traps, Clover traps, traditional drive-nets) are susceptible to vandalism, which is heightened in urban environments. Other problems with some of these established capture techniques include difficulty in setting or moving traps (e.g., drop-nets, box traps, traditional drive-nets), potential for the trap to damage private property (e.g., drop-nets, net guns, cannon nets, rocket-nets), and high risk of capture mypopathy associated with the method (e.g., Clover traps, box traps) (Haulton et al. 2001, Peterson et al. 2003). Finally, some of these capture methods can be expensive (e.g., cannon nets, net guns, Clover traps) and lack the selectivity in animal capture that often is required in an urban environment. We describe the use of a portable drive-net for capturing urban white-tailed deer that overcomes many of the aforementioned problems.

Study areas

We trapped urban white-tailed deer using a portable drive-net on 2 independent study sites. We trapped Florida Key deer (*O. v. clavium*) on Big Pine Key, Monroe County, Florida. Big Pine Key was approximately 3,457 ha in area and located 161 km southwest of Miami. Drive-net captures occurred in subdivisions or urban areas with single residential homes, fences, canals, and interspersed woodlots. Approximately 24% of the native areas on Big Pine Key have been developed and are no longer available for deer (Lopez et al. 2004). Key deer were approachable, and hand-capture was possible in some instances. We also trapped white-tailed deer at the National Aeronautics and Space Administration's Johnson Space Center (JSC), approximately 40 km south of downtown Houston in southeast Harris County, Texas. Johnson Space Center, approximately 656 ha in extent, was characterized by numerous buildings, pastures, and scattered woodlots (Whisenant 2003). Its exterior perimeter was surrounded by a 1.8-m-tall chain-link fence adorned with 3 strands of barbed-wire angled out at 45º from the top; the fence effectively prevented immigration or emigration of deer. Approximately 140 deer were enclosed in JSC; they were moderately habituated to humans and human activity but were not approachable within 30 meters. The area surrounding the JSC has become increasingly urbanized over the last decade (Whisenant 2003).

Methods

Net construction

We captured urban white-tailed deer using portable, nylon drive-nets that varied in length (12–50 m), height (2–6 m), and mesh size (20–40-cm stretch) (Memphis Net and Twine, Memphis, Tenn.). Net cost varied by dimensions and twine size, but our nets cost approximately $100–$500 (US). In all cases a 0.6–1.2-cm-diameter nylon rope was threaded through the top of the net with a loop tied on each end (loops prevented rope from sliding out), which the net handler used to pull the entire length of the net when a target deer was approaching. Drive-nets were lightweight (<5–20 kg) and could easily be pulled by one person.

Net use

We attempted to use urban structures (fence lines, buildings, houses) and physiographic terrain (waterways, canals) to confine and funnel deer into capture areas (Figure 1). Some capture areas were regularly baited with corn to attract deer and facilitate capture. Many of these capture areas were used multiple times. In other cases subdivisions were driven to locate potential target deer and assess potential for drive-net capture (e.g., a target animal in an enclosed fenced area). In either case, once we located a capture site or target animal, drive-net setup time was approximately 5–10 minutes. We used plastic containers (Rubbermaid 38 L) for net storage and to facilitate quick net setup.

In setting up a drive-net, we secured one end of the net to a stationary object (fencepost, T-post, tree). We secured the net edge to the anchor in 3 areas (top, middle, and bottom) using short nylon

Figure 1. A typical drive-net scenario at Johnson Space Center, Texas, and Big Pine Key, Florida (June 1998-October 2003), in which deer (star) were attracted to an area confined by fences (3 black lines) and buildings. A drive-net (black dots) was set up perpendicular to a fence line while the net handler (A) used available structure for concealment. Persons on foot entered (arrows) and pushed deer in the direction of the drive-net.

ropes or bungee cords (approximately 0.5 cm thick, 0.5 m long) (Figures 2*a* and *b*). We extended the drive-net perpendicular to the fence line or anticipated direction of deer and laid it neatly on the ground with the nylon pull rope visible and the loop accessible. We tucked in the net at the anchor point for further concealment (Figures 2*b* and *c*). A net handler remained at the free end of the drive-net, using available vegetation or building structure for concealment (Figures 1 and 2*d*).

To capture a deer, 2–5 people on foot (hereafter "drivers") would slowly push deer in the direction of the drive-net (Figure 1). Prior to deer arrival at the net site, one or more drivers would attempt to increase the deer's speed toward the net by frightening the animal (yelling, clapping hands, waving arms). Increasing their speed prevented the deer from stopping or changing directions and also increased their entanglement in the net. The net handler manually pulled the loop upward and away from the anchor point, creating a net "wall" to coincide with the deer arrival (Figure 2*d*). Drive-nets were pulled 1–1.5 m in front of the deer. Once the deer hit the net, the handler pulled the net down behind the deer, effectively enveloping it. Bungee cords with quick-release clips often were used to safely decrease momentum when the deer hit the net and to quickly release the drive-net end to remove captured deer. In some instances, net handlers manned both ends of the drive-net and simultaneously pulled the net upon deer arrival.

We physically restrained each captured deer and placed a hood placed over the head to reduce stress, after which we untangled the animal from the drive-net. Once the deer was extracted, we hobbled its legs with a 0.25-cm-diameter nylon rope and commenced handling procedures and data collection (e.g., sex and age class, weight, radiocollar). We either reset the drive-net for another attempt or collected it and moved to another capture area. We placed mortality-sensitive radiocollars on captured deer and monitored them regularly (2–3 times/week).

Results

From June 1998–December 2003, we captured 76 white-tailed deer (5 adult M, 7 yearling M, 13 fawns M, 38 adult F, 4 yearling F, and 9 fawns F) using our portable drive-nets. Capture and handling time varied but was <20 minutes. No capture mortalities were reported, and ≤10 captured deer suffered only minor injuries (e.g., small cuts, scrapes). We recorded no mortalities of radiomarked deer ≤ 30 days after capture. Due to differing study objectives, we captured deer selectively by sex and age classes. For instance, the objective at the JSC study site was to capture female deer to administer an immunocontraceptive. Therefore, total number of captures potentially could have been higher if we had not been selective. We recorded no captures of nontarget animals. Furthermore, because of the small number of people we typically used in a trapping session, we were not capturing a large number of deer (≤2 per net) at 1 time. We focused on capturing 1–2 target animals at a time rather than numerous animals.

Our drive-net technique failed when deer hit at or near anchor points (fence post, T-post, or tree) at a high velocity. Three deer at JSC broke through the net and escaped. We ameliorated the problem by attaching a bungee cord with a quick-release and

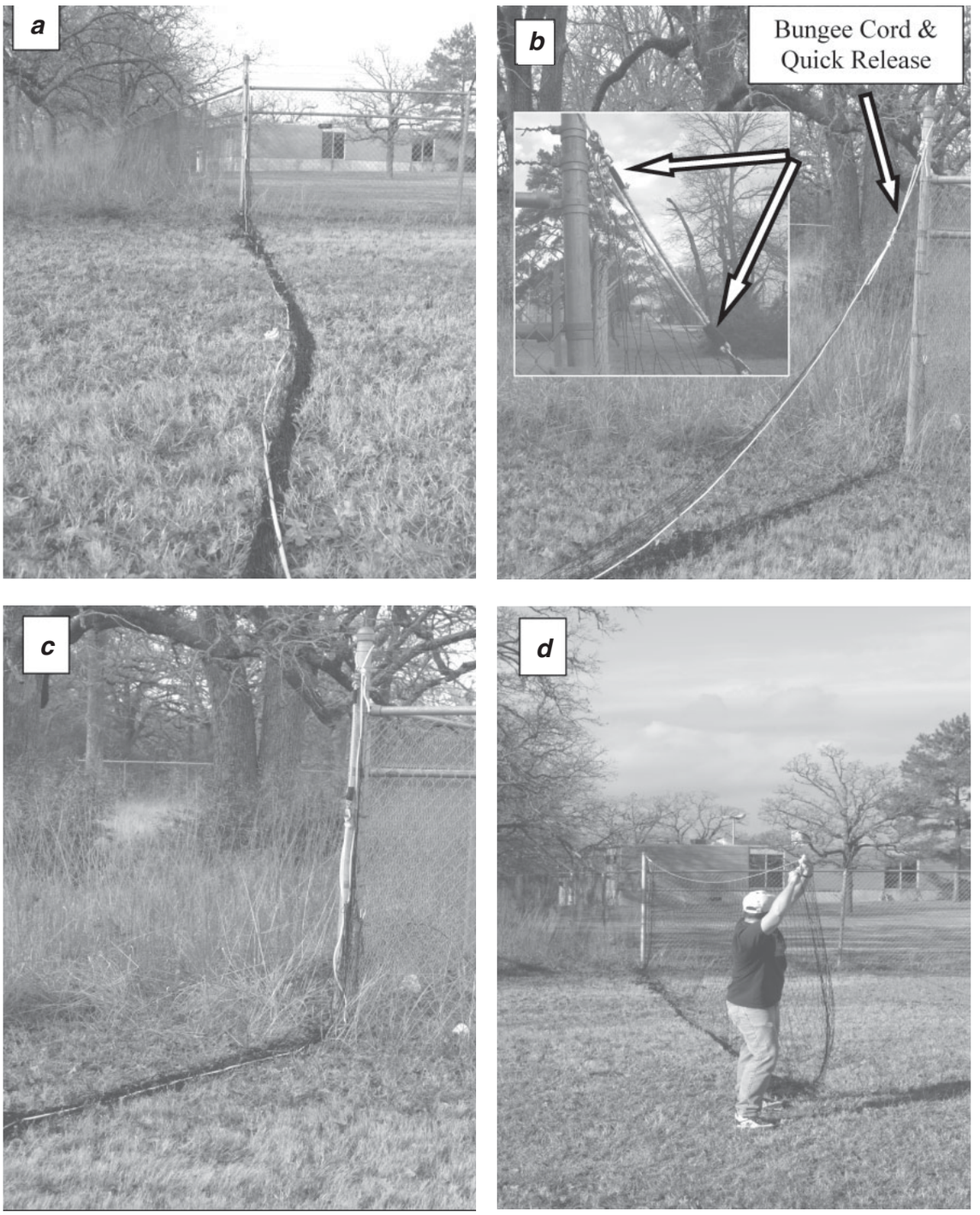

Figure 2. At Johnson Space Center, Texas, and Big Pine Key, Florida (June 1998-October 2003), we attached the drive-net to an anchor (fence post), then extended and neatly laid it on the ground with the nylon rope visible and accessible (a). A bungee cord with a quick-release (inset) was attached to the anchor and approximately 0.5-1.0 m of the "untucked" drive-net (b). The drive-net was "tucked" in to visually conceal the net (c). The net handler manually raised the drive-net to coincide with the arrival of deer (d).

incorporating 0.5–1 m of slack in the drive-net (Figure 2*b*). This provided some elasticity when the deer hit the net and facilitated entanglement. A quick-release snap also allowed the bungee cord to be removed quickly after capture to relieve net tension. We also left the drive-net "untucked" (Figure 2*c*) or placed barricades (e.g., a wood pallet on its side) at the anchor point to force deer toward the center of the drive-net. Another solution to this problem was using one person on each end of the net rather than tying the net to a stationary object. Drive-net setup using 2 persons was quicker and useful in situations where an anchor point was not available. However, we often used a 2-person set only when there was nothing available to anchor the drive-net.

Discussion

Traditional drive-nets (Beasom et al. 1980, DeYoung 1988, Sullivan et al. 1991) have been used with success in the capture of free-ranging white-tailed deer. The use of traditional drive-nets in urban areas, however, is prohibited because of the difficulty in setup (heavier nets used), potential damage to ground (requires upright poles), and potential for vandalism. Silvy et al. (1975) described use of portable nets in the capture of free-ranging Key deer. Our method involved a similar approach, differing in how nets were anchored (our nets were attached to a stationary object or a 2-person set versus attached to a vehicle), their application (we used our drive-net in the exclusive capture of urban deer), and time of capture (Silvy et al. [1975] worked at night). Use of spotlights and vehicle headlights described by Silvy et al. (1975) was prohibited in our study areas for safety and privacy concerns; most of our captures occurred during the day. Daytime captures also increased the safety of deer and trapping crews, allowed for selective captures by identification of age and sex classes, and minimized captures of nontarget individuals. Most importantly, we incorporated use of urban structures to improve net efficiency in capture of urban deer. Urban structures such as fences or buildings in essence increase the "length" of the drive-net by funneling target animals to a focal trapping site. Net modifications also allowed for capture of average-sized white-tailed deer (~70 kg) with the use of bungee cords or 2-person sets.

Silvy et al. (1975) reported only 3 mortalities out of 144 deer captures. Our method resulted in similarly low (0%) capture mortality rates, and we observed no post-capture myopathy. Peterson et al. (2003) found low (near 0) mortality rates with use of drive-nets, drop-nets, hand capture, net guns, and dart guns, but suggested that the first 3 are more suitable in urban areas. We found the portable drive-nets to be an inexpensive and safe alternative for capturing free-ranging white-tailed deer in urban environments.

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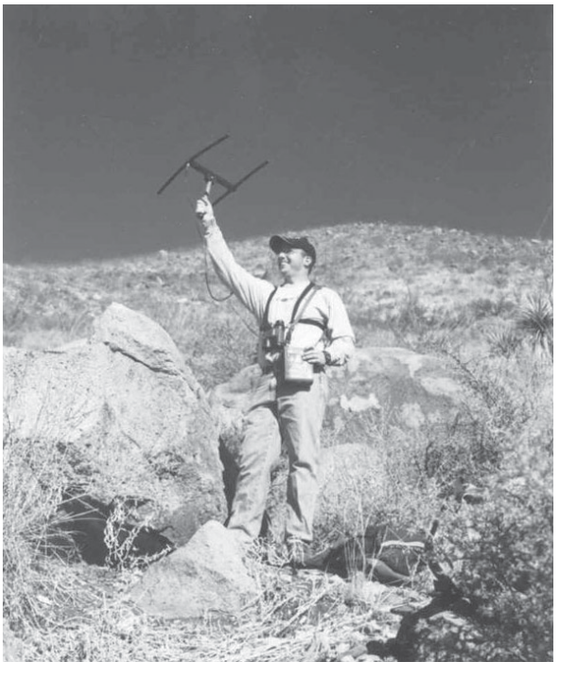

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