TRANQUILIZER DARTS AS A CAPTURE METHOD FOR FREE-RANGING BLACK-TAILED DEER

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Abstract: Clover traps and tranquilizer darts were used to capture black-tailed deer in Hollister Hills State Vehicular Recreation Area in central California. This area has mild temperatures, open terrain free of cliffs and deep water, and deer that are tolerant of vehicles. Darting with non-barbiturate, immobilizing drugs proved to be a safer, more selective, less expensive, and more efficient method than Clover traps.

Baited Clover traps (Clover 1956) have often been used to capture small numbers ($n \leq 30$) of black-tailed deer (*Odocoileus hemionus columbianus*), but the method has limitations. Clover traps are relatively expensive and require many hours to construct, maintain, transport, set up, and monitor. Clover traps are not selective as to sex, age, or in some instances, species. Traps located in urban areas or natural areas frequented by humans are exposed to tampering and vandalism (Ferris 1989). Furthermore, physical restraint of the animal is required, exposing the researcher and the deer to possible injury (Jessup et al. 1986).

Tranquilizer darting has been used widely and successfully as a method of capture for many large ungulates (Day et al. 1980). Black-tailed deer are an exception because they may hide in dense cover after being darted and before immobilization occurs (Jessup et al. 1986). Many researchers that have chemically immobilized black-tailed deer or mule deer have used trapped or penned animals (Jacobsen 1983, Jessup et al. 1983, Eberhardt et al. 1984). Other researchers using free-ranging deer have reported low success rates or high capture-related mortality (deVos et al. 1984, Krausmann et al. 1984). Few small-scale deer captures have been attempted using tranquilizer darts. The use of tranquilizer darts on deer in California has generally been limited to the relocation of tame or problem deer from park lands (Jessup et al. 1986). Some have argued that it is expensive, increases capture mortality, and exposes researchers to dangerous, potentially lethal chemicals (deVos et al. 1984 and Koch et al. 1987).

I used Clover traps and tranquilizer darts to capture black-tailed deer as part of an investigation of their movement and home range characteristics in San Benito County, California. This paper compares the efficiency of these two methods within the context of this study.

STUDY AREA

The study was conducted in the 1,000 ha Lower Ranch of the Hollister Hills State Vehicular Recreation Area, San Benito County, California. The terrain consisted of rolling hills with open areas of coast live oak (*Quercus agrifolia*), valley oak (*Q. lobata*), and blue oak (*Q. douglasii*). Oak woodlands were interspersed with 2-10 ha patches of chamise (*Adenostoma fasciculatum*) and sagebrush (*Salvia mellifera*). The study area contains approximately 126 km of motorcycle trails and fire roads.

METHODS

Clover Traps

Ten Clover traps, placed in riparian oak woodland habitats preferred by black-tailed deer (Ferris 1989), were used for capture purposes by project personnel from 1 June to 1 September 1988. The traps were baited with mistletoe (*Phoradendron flavescens*) and small salt licks and equipped with radio transmitters that signaled when the gates were tripped. Traps were set with their doors tied open and pre-baited for two weeks prior to trapping.

Tranquilizer Darts

Darting was used on four occasions from 1 September to 30 November 1988. Drugs were delivered using Pneu-dart (Pneu-dart, Inc., Williamsport, PA) or Palmer (Palmer Chemical Equipment Co., Douglasville, GA) darts. The darts contained a 2 cc mixture of ketamine hydrochloride and xylazine (200 mg/ml : 40 mg/ml, respectively), propelled by either CAP-Chur CO_2 rifle (Palmer Chemical Co., Douglasville, GA) or Paxarms black powder dart rifle (Paxarms Ltd., Timaru, New Zealand). All deer were darted during early morning or early evening hours at ambient temperatures of 16-24 C. Capture efforts were halted at dark.

Deer within the study area were tolerant of people and motor vehicles, consequently, darting

efforts were conducted from four-wheel drive vehicles. In most cases we approached within 25 m of targeted animals.

Pursuit methods and capture crew size changed throughout the study. During the first seven capture attempts, four workers pursued the animal immediately after darting. Later capture attempts used two-three people who delayed pursuit for 3-7 minutes and followed animals from distances over 70 m.

RESULTS

Clover Traps

In the summer of 1988, six adult female deer were captured using Clover traps at a cost of 25.8 field hrs/successful capture. No animals were injured during capture and there were no capture-related or unexplained mortalities in the two weeks following capture.

Tranquilizer Darts

In the late summer and fall of 1988, 17 deer were darted (12 adult does, two yearling does, one yearling buck, and two fawns). Of these, four adult females, two yearling females, one yearling male, and one female fawn were immobilized at a cost of 4.4 field hrs/successful capture.

Immediately after being darted, all animals ran for 25-80 m ($\bar{x}$ = 47.35, SD = 15.92). There was no significance difference in the length of the initial run between animals that failed to become immobilized and those that were successfully captured (t = 0.473, df= 7, P = 0.651).

After the initial run, the behavior of deer which were darted varied. Upon reaching cover nine deer stood within the edge of the chaparral and one deer took refuge in the shade of an oak tree. The remaining seven ran at a slow trot or continued to walk away from where they were darted. Animals entering dense brush were easily tracked because the dissociative effect of the ketamine caused them to stumble and make noise (Jessup et al. 1983). None of the deer fled at high speed after their initial run.

The escape behavior of the deer changed as pursuit method and crew size were modified. Secondary trots shortened and then disappeared when tracking was done from increased distances. Crew size was positively correlated with the length of the initial run (r = 0.607, df = 16, P = 0.05) and escape distances diminished with decreased crew size.

In seven instances where adjacent deer were present, the animals continued to travel as a group until the darted deer could no longer continue. In two instances does waited for or stayed close to their darted fawns. In all cases, fawns (n = 12) waited in heavy cover near their tranquilized mothers. Both behaviors allowed for additional animals to be darted. In all instances (n = 8) deer directed their escape movements to areas that were subsequently shown to be small, exclusive use areas within their home ranges (Ferris 1989).

Induction times (n = 8) ranged from 7-18 min ($\bar{x}$ = 10.3, SD = 2.83 min). There was no significant correlation between the weight of deer darted and induction time (r = .236, df = 7, P = 0.10). Darted animals that failed to become immobilized, were followed for periods of up to 20 min or until it became obvious that darting had been ineffective (i.e., a return to normal undisturbed activities such as browsing).

Dart injection performance varied during the project. Palmer darts were reliable two out of two times but expensive (approx. $15.00/unit) and too heavy for long distance shots (>40 m). Pneu-darts were inexpensive (approx. $2.60/unit) and more accurate at long distances but less reliable with only six successful injections out of fifteen. The Pneu-darts with double crimped tail pieces (approx. $2.60/unit) appeared to perform better with two out of two darts operating successfully.

The animals did not appear to suffer ill effects as a direct result of darting. Increased darting activity and repeated darting of the same subjects (n = 4) did not noticeably affect the wariness of the population or the individuals involved. Excess dosages did not seem to create problems for darted animals. All females had estimated weights between 22.67-40.82 kg (50-90 lbs) and were given the standard dose for animals up to 55 kg (120 lbs). One fawn (approx. 15.88 kg) was given an adult dose and one adult (approx. 40 kg) was darted twice within an hour. No ill effects were observed in either animal.

DISCUSSION

Successful darting is dependent on several factors including animal condition, weather, topography, approach method, equipment reliability and drug choice (Lange 1982). Studies that have reported problems with darting deer were

conducted under sub-optimal conditions.

The condition of animals influences both their susceptibility to the drug and their chances of survival (Harthoorn 1982). The deer in my study were captured during the fall to avoid immobilizing pregnant does and does with young fawns.

Weather conditions are important because immobilizing drugs reduce the respiratory rate of deer and the ability to regulate internal body temperatures (Lange 1982). Evaluations of tranquilizer darting by deVos et al. (1984) and Krausman et al. (1984) were conducted in the hot, arid Southwest desert where temperatures regularly exceed 38 C. The animals in my study were all captured at dawn or dusk and did not appear to suffer from heat stress. The topography of the my study area was free of steep cliffs or deep water, so animals did not fall or drown.

The approach method contributes to the animals stress level. Active animals tend to have higher body temperatures than inactive animals (Golightly and Hofstra 1989). Frightened animals have increased heart rates and higher levels of cortisol and other compounds indicative of stress and capture myopathy (Koch et al. 1987). The deer in my study were acclimated to motor vehicles and did not appear to be stressed by their presence (Ferris 1989). They were in a relaxed state when darted, unlike animals in other studies that were pursued by helicopters prior to darting (deVos et al. 1984, Koch et al. 1987, Krausman et al. 1984).

The drug chosen for this study was a ketamine-xylazine mixture. This is a relatively safe, non-barbiturate drug with a high margin for error in dosage (Golightly and Hofstra 1989).

There were a number of darting failures in my study and my success rate of 47% differed from the 83% previously reported by Jessup et al. (1986). This difference was the result of a manufacturing defect in the Pneu-darts with single-crimped tail pieces. Although sample size was small ($n = 2$), the double-crimped Pneu-darts were trouble free.

Tranquilizer darting may be a safer, more selective, and less expensive method for capturing black-tailed deer than Clover trapping in some instances. Mild temperatures, open terrain free of cliffs and deep water, vehicle-tolerant deer, and the use of non-barbiturate immobilizing drugs were factors which contributed to the successful darting of free-ranging deer during this study.

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