MANAGING WHITE-TAILED DEER IN MICHIGAN: CAPTURE AND TRANSLOCATION AS A MEANS OF POPULATION CONTROL

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ISSUES

The mission of the Wildlife Division of the Michigan Department of Natural Resources (DNR) is: *To enhance, restore, and conserve the State's wildlife resources, natural communities, and ecosystems for the benefit of Michigan's citizens, visitors, and future generations.* Implicit in this mission statement is the goal of maintaining viable populations of game species that provide recreational opportunities for people. An important function of the DNR is to make recommendations to the Natural Resources Commission (NRC) concerning methods and manner of take of species. All recommendations are developed with consideration of the biological and social effects of proposed changes and are based on the best available scientific information.

The DNR was asked to examine the practice and issues surrounding capturing and translocating white-tailed deer (*Odocoileus virginianus*) as a method of non-lethal, wildlife population control in selected situations such as urban environments. The purpose of this paper is to review the biological and social considerations when using this method to control deer populations. Nielsen (1988) defined translocation as: "The transport and release of free-ranging, wild animals primarily for conservation or ecological reasons in a location different from which they come, but where the species may presently occur or historically have occurred naturally." Licensed captive deer facilities will be included as possible release sites for the purposes of this paper. These facilities have been used in other states when other release sites were not suitable (Ishmael et al. 1995*a*).

Consideration of lethal versus non-lethal population control alternatives is a significant part of a deer management program. These considerations require both social and biological input. An understanding of the biological and social effects at individual and population levels is a necessary part of evaluating alternatives. Individual health can be affected by the capture method used, stress during handling, and release site characteristics including deer density and similarity of habitat. Population level effects occur in both the population being managed (effectiveness) and the population where animals are released due to genetics, disease, and dispersal. Social concerns are expressed both for the individual animal's well being, and more generally for control methods acceptability.

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BACKGROUND AND DISCUSSION

BIOLOGICAL ISSUES

BACKGROUND

White-tailed deer are locally abundant in many parks, urban, and suburban areas creating concern over plant depredation, deer-vehicle collisions, and spread of disease (Conover 1997). Traditional methods of population control, such as hunting, are often prohibited by local ordinances. In other areas, the discharge of firearms by hunters or sharpshooters is prohibited or is not desired due to concerns for public safety. In these situations, non-lethal means of population control such as capture and translocation may be possible alternatives to traditional lethal control measures.

Biological considerations occur on two trophic levels: individual animals and populations. The sections on “Capture methods”, “Capture mortality”, “Survival and movements of translocated deer”, and “Availability of release sites” examine issues that focus primarily on individual deer. The section on “Disease risks” examines the effects of capture and translocation on populations.

CAPTURE METHODS

Methods of capturing deer can be categorized as mechanical, chemical, and a combination of mechanical and chemical (Nielsen 1988). Mechanical techniques include drop nets, standing tangle nets, Clover traps, panel traps, box traps, rocket nets, corrals, or enclosures. Chemical immobilization involves using drugs to capture and restrain animals. Sometimes a combination of these methods is used, and animals are caught mechanically and subsequently immobilized using chemicals. Each method has advantages and disadvantages. Many factors must be considered when determining which capture method to use, including reason for capture, terrain, number and type of animals to be captured, and amount of money and human resources available (Clark 1995). The reported effectiveness of various capture techniques (measured in person-hours per deer) varies markedly (Ishmael and Rongstad 1984, Hawkins et al. 1967).

CAPTURE MORTALITY

When handling wild animals, mortality from capture is always a risk that must be considered. Capture mortality can be related to capture method, number of animals caught per trapping attempt, and handling protocol (Table 1). Beringer et al. (1996) reported that capture method and the number of deer captured during each attempt were strongly related to a deer's survival. Early studies (Hawkins et al. 1967) reported that capture by remote immobilization resulted in higher mortality rates than capture with box traps or drop nets. However, more recent studies by DeNicola and Swihart (1997) and Kilpatrick et al. (1997) reported higher survival rates for remotely immobilized deer than reported in early studies. Further, DeNicola and Swihart (1997) suggested that remotely immobilized deer were subjected to less stress than deer that were manually restrained. Conner et al. (1987) reported modified handling procedures contributed to a reduction (>50 percent) in mortality between trapping periods.

Trapping mortality is also influenced by whether the animal is trapped and released on site or trapped and translocated to a site unfamiliar to the animal. Cromwell et al. (1999) demonstrated that translocation increases trapping mortality. In this study, deer trapped and released at the trap site had significantly lower capture related mortality rates (25 percent) than deer that were trapped and translocated (48 percent). Translocation apparently increases stress on the animal making it more susceptible to capture myopathy. Myopathy is a condition related to stress from handling, which results in a degeneration of muscle tissue. The condition is characterized by depression, muscle stiffness, lack of coordination, paralysis, metabolic acidosis, myglobinurin, and death. There seems to be a strong relationship between use of all muscles during capture and onset of this condition. However, death from capture myopathy can occur up to 26 days after capture (Beringer et al. 1996).

SURVIVAL AND MOVEMENTS OF TRANSLOCATED DEER

Survival rates of translocated deer are frequently low (Table 2). Based on studies on nutritionally stressed black-tailed deer (*O. hemionus*) (O'Bryan and McCullough 1985), pen-raised white-tailed deer released in the wild (McCall et al. 1988), free-ranging, rural white-tailed deer (Hawkins and Montgomery 1969, Pais 1987), and white-tailed deer taken from metropolitan preserves and released in rural areas (Jones and Witham 1990). High mortality rates reported in translocated deer have been attributed to capture myopathy, unfamiliarity with the release area, wide dispersal from the release site, and encounters with new mortality agents such as predators, hunters, and automobiles. Jones et al. (1997) also suggested that translocated deer did not locate traditional deeryards, and Jones and Witham (1990) suggested that urban deer may be more susceptible to mortality because of habituation to people.

In a review of deer management options, Ellingwood and Caturano (1988) wrote: "The poor physical condition of deer from an overpopulated range, and the behavior of some deer from overpopulated urban settings, predispose them to starvation, accidents and dog predation following relocation into new surroundings."

Annual mortality rates of translocated deer are higher than those of deer captured and released on the trap site (Cromwell et al. 1999) (Table 2) and resident deer native to the release area (Jones and Witham 1990, Jones et al. 1997). Cromwell et al. (1999) reported lower survival rates for translocated deer compared to deer that were captured and released on site. The authors concluded that physical translocation caused an initial increase in deer mortality through stress-induced capture myopathy, despite identical capture and handling techniques and precautions to minimize stress. Bryant (1992, as cited in Ishmael et al. 1995*b*) reported 96 percent mortality in radio-tagged, translocated deer compared to 45 percent mortality in ear-tagged translocated deer during a similar period. However, determining survival using band (or tag) recovery is difficult during nonhunting periods (Samuel and Fuller 1994).

Several studies have reported high rates of post-release dispersal (Jones et al. 1997, Cromwell et al. 1999). Jones et al. (1997) reported that translocated deer, even those that were related did not remain together after release and had average dispersal distances of 23.5 km after release. Jones et al. (1997) reported that upon release, most translocated deer wandered initially, resulting in larger home ranges than resident deer. The authors reported that movements of resident deer did not seem to be affected by the release of translocated deer, although the reason that resident deer did not change their home

ranges in response to the new deer may have been because many of the new deer dispersed after release. Jones et al. (1997) noted that does remained closer to the release site. Bryant (1992, as cited in Ishmael et al. 1995*b*) reported deer moving an average 5.1 km from the release site, maintained their tameness, established themselves near subdivisions, and caused nuisances on their new range.

AVAILABILITY OF RELEASE SITES

It is often difficult to locate suitable release sites for translocated deer. Ideal sites are where deer numbers are lower than carrying capacity, public demand for more deer is high, and potential problems are remote.

Deer populations at release sites in Wisconsin had reached or exceeded population goals. Many other eastern states face the same problem of far too many deer for suitable available habitat. Additionally, there have been problems with deer damage and complaints from landowners at release sites. Eventually, the State of Wisconsin began relocating deer to licensed deer farms with proceeds being returned to the state (Ishmael et al. 1995*b*). However, the authors in that study cautioned that there may not be enough demand from deer farmers to accept large numbers of deer, and deer farmers in Wisconsin did not seem interested in this method of population control.

In Texas, translocated deer must be released in natural habitat where their release will not be a nuisance and hunting is permitted. Deer may not be sold or transferred to commercial breeding facilities (Messmer et al. 1997). The transfer of wild deer to licensed captive facilities is presently restricted in Michigan due to bovine tuberculosis (TB) testing requirements. Transfer of wild deer to licensed facilities in Michigan will not be a "management alternative" after June 1, 2001, because of the potential spread of bovine TB (Public Act 190 and 191, 2000).

Additionally, some researchers are concerned with the possible negative effects of moving deer into new areas and introducing different genetic traits into the breeding population (William Moritz, personal communication).

DISEASE RISKS

There are inherent risks involved with moving deer from one area to another when the disease status is unknown. Although it is difficult to attribute the spread of disease to deer density alone, it is true that some diseases arise more commonly in high-density areas and are less frequent in low-density areas (Eve 1981). This can be attributed to several factors including poor nutrition, stress, and increased number of animal-to-animal contacts (Davidson 1981). Because deer at high density may be more susceptible to diseases, moving those deer to other areas may spread disease to new areas. Additionally, parasites that have deer as hosts may spread to new areas by the translocation of deer.

To determine if deer are disease free they must be tested for disease at a holding and testing facility, and a protocol accepted for testing live animals. However, quarantine provisions for tests are lengthy, and disease testing would add cost and possibly mortality to captured animals. The recent discovery of bovine TB in wild deer has resulted in both the DNR and Michigan Legislature implementing

restrictions on the sale of live deer to captive facilities and increased restrictions on translocation of wild deer.

EFFECTIVENESS

In "An Evaluation of Deer Management Options," Ellingwood and Caturano (1988) concluded "…trap-and-transfer options are generally impractical and prohibitively expensive. As a consequence, they have limited value in the management of free-ranging herds. They may have more value in the control of small, insular herds where deer are tame and/or hunting is not applicable." Similarly, McNulty et al. (1997) reported that management of deer populations may be effective in localized areas, especially in small areas (1 km^2) such as parks and preserves. Localized management would be most effective in areas in which deer do not leave summer range. This may occur more frequently in northern forested landscapes (McNulty et al. 1997) and less frequently in highly fragmented agricultural landscapes (Nixon et al. 1991). Costs may be reduced if animals were captured and euthanized, rather than relocated. Palmer et al. (1980), and Ishmael and Rongstad (1984) demonstrated that lethal deer population techniques such as public hunting and sharpshooting over bait were more cost effective than non-lethal capture techniques.

Nielsen (1988) cautions that wildlife managers must consider the biological and ecological viability of translocating wildlife before committing personnel, funds, and technology to such a project. Although, he noted that there may be times when translocation may provide an answer to a wildlife management problem and should not be dismissed without consideration.

SOCIAL ISSUES

STAKEHOLDER'S PERCEPTION

Many residents of urban areas and animal welfare groups are opposed to lethal control measures for deer because they often hold humanistic and/or moralistic attitudes toward animals (Kellert 1978). These groups often suggest capturing deer alive and relocating them to other areas as a means of population control. Messmer et al. (1997) surveyed various stakeholder groups including state and federal wildlife agencies, agricultural departments, animal activists, environmental groups, and the public for acceptability ratings for various techniques used to manage overabundant deer. That study found that fish and wildlife agencies prefer hunting-based programs to live-capture and translocation of deer in urban areas.

However, some agencies continue the practice of capture and translocating deer in response to public concerns providing that local jurisdictions were willing to accept program responsibility and cost (Messmer et al. 1997). Stout et al. (1997) conducted a survey of suburban residents and reported that the majority of suburban landowners preferred non-lethal deer management techniques in New York. Respondents favored trapping and transporting deer as a short-term solution to the problem of deer overabundance. In contrast, those techniques involving firearms were the least preferred of all options. The most popular solution was trapping and transporting deer, which was perceived to be a non-lethal solution for deer population management. Similarly, Green et al. (1997) surveyed residents in Chincoteague, Virginia, and found that 77 percent of those surveyed favored trapping and relocating

deer as a wildlife management technique. Additionally, many studies cited intensive media coverage surrounding proposals to use lethal methods to control deer populations. This media coverage often results in agencies trying non-lethal means of control to avoid controversy and pacify residents. In Wisconsin, documentation of high mortality rates and nuisance problems caused by translocated deer did not change public attitudes about translocation (Ishmael et al. 1995*b*).

In contrast to most studies, a recent survey of Michigan residents found that the public is very supportive of the use of lethal control of wildlife with only one percent of those surveyed indicating that it would "never be acceptable to kill individual wild animals." Mertig and Koval (1999) reported that respondents found it is acceptable to kill individual animals in order to…control wildlife disease (92 percent), preserve the ecological health of an area (80 percent), control wildlife damage (67 percent), ensure public safety (81 percent), and manage population levels of wild animals (76 percent).

When asked about attitudes toward specific deer management strategies, the survey revealed that while 73 percent supported allowing hunters to kill more deer, 48 percent still found it acceptable to capture and translocate deer from an overpopulated area (Mertig and Koval 1999). The survey characterized people supportive of deer capture and translocation as reporting no problems with deer, supportive of winter feeding, and in agreement that the DNR is responsible for individual wild animal health. These people were less supportive of consumptive recreation and lethal control of wildlife, who perceived fewer deer and fewer deer-car accidents, residents of the Upper Peninsula, non-agricultural landowners, less frequent hunters, urban residents, and older people.

Cromwell et al. (1999) wrote, "Wildlife managers must emphasize that live-capture of deer carries inherent risks and that if deer also are relocated, excessively great mortality rates probably will result. If the urban public's opposition to lethal methods of herd reduction is indeed based on concerns of humaneness, then that public should be made aware that live-capture and relocation methods may in fact be less humane."

COST

Costs of capturing deer vary with technique. A review of literature revealed eight projects where white-tailed deer were captured and translocated. These projects used a variety of capture and transport techniques. The eight projects involved the movement of 1,224 deer at an average cost of about $352 per animal. However, it is difficult to compare the costs of capture between studies done at different times because published costs are not adjusted for inflation. Frequently additional costs were incurred, such as state employees' time, vehicle mileage costs, costs of liability insurance coverage, costs of disease testing, and costs of independent contractors that were not factored into the cost of moving deer. Operational costs in capture and translocation projects are difficult to estimate and may include maintenance of traps, purchase of bait, pre-baiting traps, and relocating traps. In addition, to capture equipment, additional facilities may be necessary to temporarily hold deer for disease testing and quarantines. The State of Virginia estimated the cost of building a temporary holding facility to house 20 deer at about $6,600 and the cost of bedding and food at $5 per deer per day, excluding labor (Virginia Dept. of Game and Inland Fisheries 1998).

PUBLIC SAFETY

Techniques used to capture deer can be dangerous to people or pets who inadvertently contact a trap, dart, or net. The door or gate on a box trap is heavy and could cause injury to a child or adult who tampers with it (Virginia Dept. of Game and Inland Fisheries 1998) although the heavy wooden doors of Stephenson Box Traps in Wisconsin were counter-weighted to reduce risk of injury (Ishmael et al. 1995*b*). The propellants used to fire capture nets are explosive, therefore adequate precautions need to be made to use and store them properly. To ensure public safety, any area in which this technique is used must have controlled access so people will not contact supplies and equipment.

Chemicals used to immobilize deer require the handling and use of drugs that are dangerous to both deer and humans. Drugs that are used are often controlled substances or are federally restricted. These drugs must be kept locked and may be only accessed by authorized personnel. Darts used to carry immobilization drugs are easy to lose either by missing a target or by being deflected by a deer that was shot. Lost darts containing hazardous substances limit the use of drugs to remote sites where it is unlikely human contact will result. However, transmitters can be used to reduce the number of lost darts. Kilpatrick et al. (1997) reported recovering 97 percent of fired darts and 86 percent of darted deer using transmitter darts. Recent advances in chemical immobilants and remote delivery methods are improving the safety and effectiveness of this technique (Kilpatrick et al. 1997). Humans should not eat meat from a treated deer, and the Food and Drug Administration prohibits the release of treated deer into areas that are hunted until 45 days following treatment (Virginia Dept. of Game and Inland Fisheries 1998). This prohibition of releasing animals into hunted areas would also serve to restrict either the areas treated deer could be released into or the timing of trapping and translocating deer.

SUMMARY

Translocation as a means of deer population control may be appropriate for some very limited and unique situations but a review of the literature suggests the method will not be generally applicable. The decision will require that objectives be established for the population control and that translocation be evaluated regarding its potential for achieving those goals. For example, it is likely that expectations would be for a population control method to:

- Be capable of achieving the population management goal;
- Achieve the goal cost-effectively;
- Present no unacceptable public safety risks;
- Pose no unacceptable risks to areas where animals would be located to;
- Meet the objectives regarding deer mortality expected in that situation; and,
- Be acceptable to stakeholders involved.

Following is a brief summary evaluation of translocation for each of those objectives based on the science reviewed here.

A. Achieve population management goals:

Experiences with translocation suggest that several means of capture could be used to lower deer numbers and, depending on the time available and ultimate goal level expected, could be effective when properly implemented.

B. Cost-effectiveness:

All methods of capture and translocation are quite expensive compared to lethal techniques. When implemented to achieve other objectives such as minimal mortality of deer, maximum public safety, etc, the costs increase. Whether they are cost-effective depends on the value of removing the deer and the option to use alternative methods such as lethal control. In most cases, cost is a significant concern.

C. Pose no unacceptable risks to public safety:

Both trapping and use of remotely administered chemicals pose some public safety risks for the area under management. These risks can be minimized and made acceptable, however, if funding and manpower are available to do so.

D. Pose no unacceptable risks to the release sites:

The release of captured deer poses the greatest barrier to the method. The literature reviewed provides evidence that movement of deer poses considerable risks of disease transmission, potential ecological impacts and social impacts in the release site or adjacent areas in which deer might move. Means for mitigating these effects were not identified in the literature review.

If captive cervid facilities were available to take the animals, this objective would be met. In Michigan, such opportunities are restricted and will be even more severely restricted under legislation that relates to movement of deer and the risk of disease transmission. It is not likely that captive cervid facilities will provide acceptable release opportunities in the future, certainly not for large numbers of displaced animals.

E. Deer mortality objectives:

If a primary reason for selecting translocation is to avoid deer mortality, it is likely to be a failure. The literature suggests means for reducing – but not eliminating – deer mortality during capture and translocation. However, methods for successfully avoiding additional mortality among deer released outside their home range are not available. This objective also poses a major barrier to selection of translocation as a means of deer population control due to these high mortality rates during capture, translocation and following release.

F. Acceptable to stakeholders:

Research shows a considerable preference among stakeholders for translocation over direct lethal removal of deer. There is some mixed results because a Michigan study suggests there is also a margin of support for lethal control of wildlife populations. In spite of this strong expression of attitude on the statewide survey, it is likely that local stakeholders will still prefer translocation for deer in their specific neighborhoods and that issues over the choices will exist. Translocation seems to meet the objective of acceptability to stakeholders even though it fails to meet many other objectives.

In Michigan, the Wildlife Division of the DNR does not recommend trapping, moving, and releasing deer into the wild (Langenau et al. 1993). Factors cited in Michigan were the expense, labor-intensive nature of these capture and translocation efforts, the lack of suitable locations to release deer, trauma and mortality to deer during capture and translocation, and potential for disease transmission (Langenau et al. 1993). Langenau et al. (1993) suggested that live trapping and selling deer to licensed captive cervid facilities was an option in urban and suburban areas where there was no hunting, sharpshooting was not an option, the deer herd was isolated with no immigration, and the area had a goal of no deer. This recommendation is still supported by this review of literature although releasing deer in captive cervid facilities in Michigan will not be an option after June 1, 2001.

Table 1. Published mortality rates for some common deer capture techniques (Table adapted from Virginia Dept. of Game and Inland Fisheries 1998).

Method	Number Captured	Mortality (%)	Reference
Corral Trap	260	16.2	Hawkins et al. 1967
Box Trap	47	0.0	Hawkins et al. 1967
Box Trap	2,035	2.1	Palmer et al. 1980
Box Trap	85	7.6	Peery 1969
Drop Net	175	7.4	Conner et al. 1987
Dart Gun	44	13.6	Palmer et al. 1980
Dart Gun	60	25.0	Hawkins et al. 1967
Dart Gun	6	25.0	Ishmael and Rongstad 1984
Rocket Net	17	23.5	Palmer et al. 1980
Rocket Net	9 (control)	25.0	Cromwell et al. 1999
Rocket Net	10 (relocated)	48.0	Cromwell et al. 1999
Clover Trap	2	0.0	Ishmael and Rongstad 1984
Drive Net	5	0.0	Ishmael and Rongstad 1984
Combination of Several Methods	215	5.6	Mayer et al. 1995
Combination of Several Methods	29	6.9	Mayer et al. 1995
Rocket Net and Clover Trap	902	7.2	Beringer et al. 1999

Table 2. Published mortality rates for relocated deer (Table adapted from Virginia Dept. of Game and Inland Fisheries 1998).

Number Translocated	Time Frame	Mortality (%)	Reference
27	Within 3 months	85.2	McCullough et al. 1997
203	Within 1 year	85.0	O'Bryan and McCullough 1985
310	Within 1 year	43.0	Ishmael et al. 1995*b*
10	Within 1 year	49.0	Cromwell et al. 1999
19	Within 4 months	67.0	Florida Game and Freshwater Fish Comm. 1983
17	Within 1 year	47.0	Jones et al. 1997
28	≤ 502 days	68.0	Hawkins and Montgomery 1969
13	Within 1 year	62.0	McCall et al. 1988
11	Within 1 year	45.0	Diehl 1988
35	248 days	25.0	Pais 1987
12 (adults)	Within 1 year	66.0	Jones and Witham 1990
10 (fawns)	Within 1 year	56.0	Jones and Witham 1990

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For information or assistance on this publication, contact the MICHIGAN DEPARTMENT OF NATURAL RESOURCES, WILDLIFE, PO BOX 30444, LANSING, MI 48909-7944 (www.dnr.state.mi.us).

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