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Contraception in Wildlife Management: Reality or Illusion?

David C. Guynn, Jr.

Abstract: Nuisance wildlife in areas where hunting is not an accepted practice and declining public support of lethal control measures have prompted research on contraceptives as a way to manage population levels. However, complex legal, biological, economic, and ethical issues should be addressed before such techniques are tested even on small, isolated populations. Regulatory authority by State and Federal agencies must define protocols for using contraceptive materials in wild populations. Registration of wildlife contraceptives either as pesticides or vaccines will likely be necessary. Health-related issues include harmful effects on target species, nontarget species and humans

who may consume carcasses. Models for evaluating population impacts and genetics are needed. Cost effectiveness itself and who will pay these costs must both be considered. Disruption of behavioral mechanisms and resulting population impacts raise ethical considerations. Contraception may have application with limited, isolated or confined populations, but its eventual use on free-ranging wildlife populations is questionable.

Keywords: Wildlife contraception, State and Federal regulations, impacts on animal behavior

Nuisance wildlife, particularly high densities of white-tailed deer (*Odocoileus virginianus*), have become a problem in many areas of the United States (Warren 1991). Significant economic losses can result from damage to crops and landscape plantings and from deer-vehicle collisions. Regulated hunting can be an effective means of controlling deer populations (Behrend et al. 1970). However, problems in areas where hunting is not an accepted practice (e.g., national parks and suburban areas) and declining public support of lethal control measures have prompted research on contraception as a means of managing population levels. Recent studies on immunocontraception of free-ranging feral horses (*Equus caballus*) (Goodloe 1991, Kirkpatrick and Turner 1991) and deer (Turner et al. 1992, Warren and White 1995) indicate that an effective vaccine and oral delivery system could be developed. However, complex legal, biological, economic, and ethical issues should be addressed before such techniques are applied even on small, isolated populations. This chapter will attempt to identify some of the key points of these issues with focus on management of white-tailed deer.

Legal Issues

Although wildlife contraception is a potential management tool, contraception research is being conducted outside of the State and Federal agencies having primary responsibility for management of wildlife

populations. Except for migratory species and species afforded protection under the Endangered Species Act, the State wildlife and fisheries agencies are empowered to manage wildlife populations. Each State has a unique set of statutes and regulations defining legal utilization and protection of wildlife to include status as a hunted or nonhunted species, season lengths, bag limits, baiting and feeding, sale of animal parts, appropriate nuisance control methods, and use in scientific research. In some States, other legislative agencies dealing with domestic animals and veterinary practice may regulate use of wildlife contraceptives. The situation is further complicated by land ownership patterns. A recent report by the Southeast Deer Study Group (1993) indicated that 90 percent of the white-tailed deer habitat in the 16 member States is in private ownership. Thus at the State level, there is concern whether current regulations and authorities adequately define control over determining when, where, and how contraceptives may be used with wildlife populations. Most States would probably need new legislation to clarify issues pertaining to permitting, reporting, training and qualification of personnel, and protocols for administering contraceptives to specific wildlife species.

Uncertainty also exists concerning regulation of wildlife contraceptives by Federal agencies. The Subcommittee on Wildlife Contraception of the International Association of Fish and Wildlife Agencies reviewed regulatory authority over these drugs (South-eastern Cooperative Wildlife Disease Study Group 1993). The subcommittee reported that no registration

of a wildlife contraceptive vaccine either as a pesticide (U.S. Environmental Protection Agency) or a vaccine (U.S. Department of Agriculture or U.S. Food and Drug Administration [FDA]) has been applied for or approved. Mallory (1993 unpubl.) stated that wildlife contraceptive vaccines are regulated by the Center for Veterinary Medicine at FDA. The Food, Drug and Cosmetic Act of 1938 (FDCA) requires FDA approval before marketing any drug not generally recognized as safe. A new animal drug is presumed unsafe with respect to any particular use or intended use unless an application pertaining to such use or intended use is approved by FDA. In general, approval of a new animal drug application by the FDA is a lengthy and expensive process.

Biological Issues

Health-related issues concerning use of wildlife contraceptives include effects on target and nontarget species and effects on humans who consume carcasses or have other contact with contraceptive materials. Nettles (1993 unpubl.) identified the following concerns about use of contraceptives in white-tailed deer; however, many of these concerns would apply to other species as well:

1. Will contraceptives cause females to experience an abnormal number of estrous cycles, expending stored energy and increasing predation on deer?
2. Will males expend themselves by repeatedly breeding sterile females that are constantly recycling?
3. What effects will contraceptives have on pregnant animals concerning abortion, fetal resorption, uterine infection, birthing difficulties, and lactation failure?
4. What effects will contraceptives have on prepubertal animals concerning permanent sterility and growth defects?
5. What effects will contraceptives have on sex characteristics such as antler cycles?
6. An antisperm membrane vaccine for deer is under study (White et al. 1993). Will vaccinated does exposed to deer sperm experience anaphylactic shock? Will orchitis, epididymitis, or anaphylaxis occur in males inadvertently injected with antisperm vaccine?
7. Will remote injection or implantation of contraceptives cause traumatic injury problems or infection?

McShea et al. (1994) report that immunocontraception of does has dramatic effects on mating season and activity budgets of white-tailed deer. In that study, 30 does were captured from a wild population and porcine zona pellucida was remotely administered by darts to 20 does during October 1992. The 30 does were exposed to 5 bucks from November 1992 through March 1993. Although control does mated in December, contracepted does exhibited estrus behavior through February. Whereas locomotion constituted 18 percent of the activity budget of control does, it constituted 32 percent of the activity budget of contracepted does and 39 percent of the activity budget of males.

Nettles (1993 unpubl.) reports that although wildlife contraceptives currently being evaluated for deer are delivered by injection or implant, the final goal is to have an oral vaccine. Such an oral vaccine would probably be genetically engineered and would use a live virus or bacteria as a carrier. But there are several potential hazards associated with this approach:

1. The carrier virus or bacteria could be pathogenic to the target or nontarget animals. This concern would include safety of vaccinated animals for human consumption.
2. The carrier organism could be highly transmissible from the initial vaccinate to secondary nonspecific animals. This situation could result in a reproductive disease that—once introduced—might be impossible to remove from a wild population.
3. In the carrier organism, a genetic reassortment or mutational change might occur that would increase virulence and/or transmissibility.

Other concerns have been expressed concerning impacts of contraceptives at the population level (Nettles 1993 unpubl.). The efficiency of immunocontraceptives is dependent upon an effective immune response in the target animal. When contraceptive vaccines are administered, the animals with the best immune systems will be the most susceptible to

Table 1. Reported harvest of white-tailed deer in Jasper County, SC (1974–94)

Year	Club areas reporting	Antlerless tags issued	Bucks harvested	Does harvested	Total harvested	Harvest rate (deer/mi ²)
1974	39	—	2,120	687	2,807	5.8
1980	67	—	1,669	915	2,584	5.3
1985	62	1,706	1,853	1,016	2,869	5.9
1988	82	2,468	2,228	1,800	4,028	8.3
1990	19	3,824	2,381	2,536	4,917	10.2
1993	79	4,029	2,239	2,837	5,096	10.5

sterilization while those with the poorest immune systems will be the most refractory. Thus, the deployment of contraceptive vaccines could shift the gene pool in favor of immunodeficient animals with resultant increased susceptibility to pathogenic organisms. Another concern is the capability of a contraceptive-treated population to respond to a natural disaster that would not be selective in regard to sterile *v.* fertile animals. Thus, a contraceptive-controlled population could theoretically be pushed to the brink of extinction directly or through creation of a genetic bottleneck.

Potential impacts are not limited to the target species. The reproduction of nontarget species that consume oral contraceptives placed for target species or that consume carcasses of target species through predation or scavenging could be affected. Populations of predators or scavengers that use the target species as a food source could be reduced. There is also concern over the safety for humans who use contraceptive-treated animals for food, particularly with implanted materials, or for people who have particular sensitivity to drugs, such as pregnant women with potential impacts on a developing human fetus.

Economic Issues

Although the effectiveness of experimental treatments with contraceptives of wild populations of feral horses looks promising (Kirkpatrick 1993, Kirkpatrick et al. 1990), two important questions must be examined before application to wild populations of ungulates is

considered: (1) What proportion of the populations must be treated, and (2) How much will it cost? The management of white-tailed deer populations in Jasper County, SC, will be used to illustrate the relevance of these questions.

Jasper County is located within the Coastal Plain of South Carolina. Land use is predominantly agriculture and forestry. Deer densities are estimated to be as high as 1 deer/5 acres in some areas (Lewis Rogers, pers comm.), and deer-caused damage in this area has reportedly caused repeated crop failures.

Expenditures for recreational hunting contribute significantly to the local economy. The annual economic impact of hunting on private land in Jasper County during 1990–91 was estimated at \$9 million (Richardson et al. 1992). The deer-hunting season in this area extends from August 15 to January 1 with no limit on antlered bucks. Antlerless deer may be taken by permit from October 1 to January 1. Harvest trends from 1974 through 1993 reflect efforts by the South Carolina Department of Natural Resources to curb increases in deer density (table 1). During this period, total reported harvest nearly doubled while doe harvest increased fourfold.

Several studies suggest that 35–40 percent of adult does must be removed annually to stabilize a deer population at levels substantially below (60–70 percent of) carrying capacity (McCullough 1979, Downing and Guynn 1983, Guynn 1985). Thus, it can be assumed that 35–40 percent of the adult does would have to be treated annually with contraceptives to achieve this same level of population regulation.

About 25 percent of the total doe harvest in Jasper County is fawns; thus, of the 2,837 does reported harvested in 1993 (table 1), about 2,128 were adults. The current level of harvest does not appear to be constraining populations within acceptable levels; obviously, treating less than 2,100 adult does with contraceptives every year would not alleviate crop depredation problems. Administering contraceptives with darts to this number of animals would be impractical. An oral delivery system would be needed.

The costs of administering a contraception program plus the forgone economic losses from reducing or eliminating a major recreational hunting opportunity would be substantial. Who would pay the costs—Federal agencies, the South Carolina Department of Natural Resources, the county, landowners, or the members of the local community? It is doubtful that any or all of these groups collectively would be able to pay for such a program. The overall impact of attempting wildlife contraception as an alternative to sport hunting for managing deer populations in Jasper County could easily exceed \$10 million annually.

Ethical Issues

Species such as the white-tailed deer have evolved with complex behavioral mechanisms that keep populations and their individual members fit and competitive. The disruption of these mechanisms and the resulting population impacts imposed by sport hunting, contraception, or any other management practice should concern everyone. Preservation of the natural processes that define free-ranging populations of wildlife should concern everyone as well as the welfare and death of individuals. A large part of this dilemma can be attributed to the way in which people view the natural world.

In a video for the American Forest Council (1991), Gustare Repie discussed the forest archetype of American culture. An archetype is simply the way people think about any one certain idea or object in a given culture. As an illustration, he described the failure of marketing French cheese products in the United States. In France, cheese is displayed in the

open without refrigeration. Customers can smell, feel, and taste the cheese, buying whatever amount they desire. Cheese is a living thing to the French. In contrast, Americans are accustomed to seeing cheese highly processed, wrapped in cellophane, and refrigerated. Cheese is dead. Marketing cheese in American stores in the typical French manner was offensive to Americans and sales of the product were a dismal failure.

Repie's forest archetype assumes three perceptions: the natural forest, the managed forest, and the jungle. The natural forest perception resembles the fantasy of Disneyland—there is no death, predation is bad, there are no humans, and the hand or influence of humans is unseen. Humans constitute a visible part of the managed forest with destruction, cutting of trees, and exploitation being the norm. Connotations include killing of the bison and removal of the Native Americans from their homelands, for example. In the jungle is the true natural forest—every living thing is subject to death, competition for basic resources is universal, and humanity is at best an abstract concept. Few Americans appreciate this perception, especially if humans are viewed as part of the jungle rather than separate from the jungle.

If they deliberately tamper with natural interactions, scientist-managers must be careful to consider all the impacts that any management approach may have on individual species of wildlife and the ecosystems in which they live. Consideration must be given to species populations and their function as well as the humane treatment of individuals. Those who utilize contraception methods must convey the limitations of contraception as well the positive attributes so that society does not view this tool as a cure-all for wildlife management problems.

Conclusion

Is wildlife contraception a reality or an illusion? I conclude that it's both. The technology exists to make wildlife contraception a reality for controlling populations of large ungulates on small confined areas such as zoological settings and islands. The potential in

these situations to prevent environmental damage and provide esthetic benefits is great. As a generalized tool for managing species with high reproductive rates, such as the white-tailed deer, in unconfined free-ranging populations, contraception is currently an illusion. Even if the technology were currently in place, the legal, biological, economic, and ethical issues that must be considered will likely require decades for resolution.

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