



A synopsis on contraception in wildlife and feral animals

Contraceção em animais selvagens: uma sinopse

I. K.M. Liu

University of California-Davis, Davis, CA, USA.
Corresponding author: ikliu@ucdavis.edu

Efforts in controlling wildlife and domestic animal species have been ongoing for decades. In the earlier decades, a limited number of animals were used under experimental and field purposes and the most commonly used agents were progesterone and progesterone-like agents. Advanced technology over the years has increased significantly and the number and variety of agents that are used experimentally for contraceptive purposes in animals are many. Comments by the author that fail to be mentioned in this synopsis are not to be construed as unimportant.

The majority of agents used for contraception in animals are targeted specifically for the female. Initially, the target against the male was the focus of contraception in wildlife populations... but earlier studies in wildlife populations have shown that in order to successfully reduce populations of wildlife, all males must be contracepted or the bachelors will take over the harems. However, contraceptive targets directed toward the male may be more practical for use in zoos and situations where the numbers of males exposed to females are limited and can be more controlled.

Why contraception? Issues in contraception are more widespread than believed. The issues are large, complex and continue to expand worldwide. More so than what can be accommodated in this writing. Suffice to say that the issues involve public, governmental, state, and local agencies coordinating efforts and policies in reducing animal populations that may or may not, and are seldom agreed upon. Regardless, growing human populations have invaded territories once inhabited by animals only and human-animal conflicts have increased significantly. Deer are considered to be the largest cause for automobile accidents in the east coast of North America. The black bear, in many states in the east and west coast of North America are invading homes in search of available food and causing injury to humans and properties. Elephants in Africa have been plundering villages in search for and destroying agricultural crops and killing villagers that get in the way. Additionally, a multitude of trees in areas of South Africa have been destroyed and deforested as a result of an overpopulation of elephants. Zoos in North America are becoming overcrowded due to the expansion of animals reared in captivity and wild horses in the State of Nevada have been an issue of human-animal conflicts since the early 70s. Of most recent crisis, the overpopulation of rhesus macaques in India, and the resultant human-monkey conflict (known in India and other Asian countries, as “monkey menace”), is a complex and multi-faceted problem whose solution lies at the intersection of animal biology, animal behavior, conservation, economics, and cultural practices. Rhesus macaques are considered a “weed” species because unlike most wildlife, habitat loss and human encroachment have not brought this species to near extinction. Rather, rhesus macaques have thrived near human settlements because they are dietary generalists with robust reproductive output. Increased availability of human sources of food, from greater agricultural production and more human garbage and food waste, has artificially increased the carrying capacity for rhesus macaques, so much so that rhesus populations rival human populations in some locations. Rhesus monkeys are not simply a nuisance; they pose a serious threat to the health, well-being and safety of people. A cursory review of Indian newspapers revealed at least a dozen articles published in the past few years describing rhesus monkeys harassing hospital patients (for food), interfering with airport runway traffic, and attacking people (resulting in at least one death). Current management techniques, such as translocation of monkeys to zoos, have proven unsuccessful in decreasing urban rhesus populations, and are associated with further management difficulties in captivity. These are only few of many wildlife animal species that have become issues of human-animal conflict throughout the world, not to mention the issues of overpopulation of unwanted dogs and cats roaming the streets of many cities throughout the world.

It is generally agreed among most people that the most cost-effective means of reducing wildlife populations is to cull by hunting and killing the unwanted animals. However, from an ethical point of view, culling by killing of animals is not favored by animal advocacy groups nor is it favored by the public majority. Additionally, immediate death of an animal by shooting does not always happen and prolonged suffering of an injured animal is considered inhumane and morally unacceptable. As a result, contraceptive efforts have developed over the years and despite increased costs, have been considered as an attractive and humane alternative to culling by hunting and killing.

What are the requirements for an effective contraceptive agent? An ideal contraceptive for free-ranging wildlife populations include the following characteristics: 1) it should have a contraceptive effectiveness of at least 90%. 2) it should be safe when administered to pregnant females and should not have any adverse effect on the fetus or neonate. 3) the contraceptive effect must be reversible. 4) no short-term or long-term side-effects. 5) ability to be delivered remotely without handling of the animals. 6) no surgical invasion. 7) minimal effect on



social behavior and band integrity. 8) no passage through the food chain. 9) the effectiveness should be long-term (years) following a single injection. These requirements are fundamental to a successful free-ranging wildlife contraceptive program and regardless of how effective the agent in preventing fertility in individual animals, it must meet the majority of these requirements to be successful.

In wildlife populations, the emphasis on contraception is directed toward the females. Although there are many agents that have been studied in a variety of both domestic and wildlife species, this presentation will focus primarily on two prominent and most used contraceptives in free-roaming wildlife studies. Gonadotropin Releasing Hormone (GnRH), and its synthetic analogs and porcine zona pellucida (pZP) are two of the most commonly used agents in wildlife studies today, with pZP being the primary agent that is being used on a large-scale basis in free-ranging wildlife populations, while GnRH, progestins and pZP are all being used as contraceptive agents in zoos. Medroxyprogesterone acetate (Depo-Provera) and the Melengestrol (MGA) implant are commonly used progestins for contraception in animals with MGA being the most widely used in a variety of species in the zoo environment. However, despite its effectiveness, adverse effects have been reported in canids and felids and its use in free-ranging wildlife or for feral animals is not practical or recommended. The GnRH analog, Deslorelin, in the form of an implant, has shown the most promise as a contraceptive agent for use in the zoo environment. Numerous studies are currently being undertaken to adopt the use of GnRH and its analogs in field studies as this agent has proven to be an effective agent for contraception in a variety of animals, including canids and felids. However, because of the downregulation of reproductive function and effect on behavioral characteristics and thus disruption of social patterns during the mating season, hormonal implants, despite its effectiveness, may not be feasible as a contraceptive in free-ranging wildlife programs. Furthermore, passage of the hormonal agent through the food chain while the implant is active may occur and delivery of the implant requires capture and restraint of individual animals. Porcine zona pellucida (pZP) has been used as a contraceptive agent for a number of years and was originally developed for use in horses. PZP continues to be used in horses and is the only contraceptive agent that is currently being used on a large-scale basis in free-ranging wildlife management for population control. Zona pellucida is an acellular membrane which surrounds the oocyte and contains three primary epitopes, ZP1, 2 and 3. The mechanism of action of pZP is immunological and its effectiveness rests upon the presence of anti-pZP antibody in an inoculated animal. When inoculated, antibodies generated surround the oocyte of the injected animal and through steric hinderance, prevents attachment and fertilization of the oocyte by the sperm. An initial formulation required two injections to achieve an effect and it is at least 90% effective in preventing pregnancy in a variety of ungulates. Over the past 20 years modifications to the pZP formulations including method of delivery (remote), incorporation of controlled release polymers which mimics booster inoculations at predetermined periods and the incorporation of an adjuvant which does not crossreact with the diagnosis of *M. tuberculosis*. These modifications enable a single injection of the vaccine which has a contraceptive effect in horses lasting for at least three years. Further improvements of the pZP vaccine are being tested for a contraceptive effect lasting for up to four years following a single injection.

For feral dogs and cats, the contraceptive strategy is similar for free-ranging wildlife populations with one single exception. The exception is that the agent used must have a permanent effect (sterilization), whereas, in wildlife populations the contraceptive effect must be reversible. The primary focus for feral dogs and cats relies on a nonsurgical approach and an agent that can be used as a single injection protocol. Every two years, the Alliance for the Contraception of Cats and Dogs hold a conference throughout the U.S. The Alliance comprise a large group of international scientists, humane groups, private organizations, research companies and governmental agencies to discuss and share information related to contraception/sterilization of cats and dogs. The most recent conference was held recently (2010). Information from this conference report that there are approximately 500,000,000 + stray dogs worldwide. Estimated numbers for a few example countries are:

China: 65,000,000
India: 60,000,000
Brazil: 30,000,000
Mexico: 16,000,000
Russia: 9,600,000
Columbia: 6,400,000
Argentina: 5,400,000

The above numbers are stray dogs only and many other countries are not included including United States, Europe, other South American countries, Australasia, Africa, etc. In the U.S. alone, there are approximately 5-10 million dogs and cats that are euthanized yearly.

Feral cats

In the U.S., there are approximately 50 million feral cats. The number of feral cats in other countries has not been publicly reported, but no doubt, it has to be a staggering amount.

Since GnRH is responsible for controlling the reproductive function of most mammalian species, it



would seem plausible that if a successful GnRH sterilant was developed, whether it is a native protein, an agonist or antagonist, it would be as effective for many other targeted species of unwanted or overpopulated animal species such as deer, elk, wolves, bears and other wildlife species where the reversibility of a contraceptive agent may not be an issue. The number of overpopulated animals other than dogs and cats are far less (thousands rather than millions) but there still is a demand for reducing populations by governmental agencies and private organizations.

There are several products available on the market for contraception/sterilization of dogs. These available products (both chemical and hormonal) are less than optimal because they are either limited to males only, require booster injections and/or are effective for only a limited period of time. Neutersol and Esterilsol are both zinc gluconate compounds that are available commercially and are currently the most widely used chemical sterilants for male dogs, the majority of which are used in South America. Additionally, the deslorelin implant, Supralorelin has gained wide acceptance as a temporary and effective contraceptive agent for male and female dogs. Despite the limitations of the available products, these efforts are to be applauded for their insight and missionary accomplishments. While these available products are useful under some circumstances and effective, clearly, there is a demand for an optimal agent for nonsurgical sterilization in both, male and female dogs and cats. To my knowledge, while there are numerous ongoing studies throughout the world, there is currently no known agent that will fulfill the requirements of a nonsurgical sterilant for both male and female dogs and cats.

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Selected references

Asa S, Portion IJ. (Ed.). *Wildlife contraception: issues, methods and applications*. Baltimore, MD: The John Hopkins University Press, 2005.

International Symposium on Non-surgical Contraceptive Methods of Pet Population Control, 4th, 2010, Dallas, TX. Proceedings... Dallas, TX: Alliance for Contraception in Cats and Dogs, 2010.

Proceedings of the 6th International Conference on Fertility Control for Wildlife. *Wildlife Res Suppl*, v.35, n.6, 2008.
