



Division of Science, Research & Technology

Research Project Summary

An Analysis of the Feasibility of Using Fertility Control to Manage New Jersey Black Bear Populations



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Project Managers

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The Division of Fish and Wildlife (DFW) is responsible for managing black bears and developing comprehensive management strategies for the control of the state's growing black bear population. DFW requested an assessment of the current status of, and feasibility of using fertility control agents as a method of population control. The Division of Science, Research and Technology (DSRT) provided technical support to DFW and funded this project to conduct this independent literature review.

Objectives

The contractor was directed to use all literature services available to document and evaluate all relevant research pertaining to the topic, and to provide an assessment of the:

- Biological feasibility (e.g., efficacy, health & safety);
- Effectiveness for population control (probability of success in controlling free-ranging bear populations) ;
- Economic practicality of using fertility control agents to control NJ's black bear population; and
- To provide conclusions on viable and non-viable techniques to control NJ's black bear population.

Peer Review

Nine professionals with extensive experience with large mammals and/or bears were identified and contacted to peer review the final report. Comments were received from five reviewers. Four of the five peer reviewers agreed with the report conclusions. One peer reviewer thought

additional numerical analysis should be performed once management objectives were clearly defined.

Results

Reproductive Biology and Social Structure –

Bears are long-day breeders, with most mating taking place in late-June and early July. Most cubs in a population¹ are sired by just a few dominant males, which tend to be large-bodied and aggressive. Females often mate with more than one male, and litters may be comprised of cubs sired by more than one male. Females often come into estrus and mate more than once in a season.

After fertilization, the zygote develops to a blastocyst (~300 cells), which floats in the uterine lumen until late November or early

¹ A **biological population** is a group of individuals that interbreed among themselves and that are generally isolated from individuals of other populations. Some barrier or impediment to movement must separate populations from one another. Several biological populations of bears live in New Jersey.

December, when it implants in the uterine wall. Late in the fall, there appears to be an endogenous physiological cascade in female bears, which prepares the uterus to implant one or more embryos, regardless of whether an embryo is actually present. This results in pseudopregnancy in sows that have not been impregnated. After a gestation period of ~55 days, pregnant sows give birth in the den to tiny, hairless, helpless cubs. The cubs nurse and grow in the den until they emerge in the spring. They remain with their mother for about 16 months, after which they are weaned. Soon after separating from her cubs, the female comes into estrus and mates again. Thus, a two-year reproductive cycle is normal.

Males compete aggressively with other males for the opportunity to mate with females. Dominant bears are large and often show physical evidence of fighting, such as scars and broken canine teeth, as a result of competition for females. The resident dominant males may impose limits on the immigration of other bears, particularly young males, into an area. Removing dominant males may alter the social dynamics of the bear population.

Bear Residency and Movements – Female black bears occupy relatively small home ranges during the breeding season in late spring and early summer. In some circumstances, these home ranges are defended and thus may be considered territories. When female yearlings become independent, at about 16 months, they usually settle in areas adjacent to or near the ranges of their mothers. In contrast, males often disperse long distances. The home ranges of breeding males encompass the ranges of several females. Outside of the breeding season, black bears of both sexes may move relatively long distances (i.e., tens of kilometers) to exploit seasonally abundant food resources.

Approaches to Fertility Control – A number of contraceptive methods have been developed for use in various mammals. These include hormone implants, surgical procedures, chemical sterilants, and vaccines. Of these, two are under active consideration for fertility control in bears: 1) Neutersol®, approved for use on male dogs, uses an injection of high concentration of the

heavy metal, zinc. The testes of treated dogs undergo severe atrophy, spermatogenesis ceases, and serum testosterone levels fall. Neutersol® is expected to have similar effects on male bears, which will likely result in lowered social status of treated males. The treatment is permanent. (Sterilization of males by vasectomy is unlikely to affect male social status and libido, because testosterone levels would not be altered, although the procedure carries a greater risk of infection.) 2) pZP (porcine *zona pellucida*) vaccines have proven effective in several mammal species, including black bears. Females treated with pZP vaccines respond by producing antibodies that attach to the surface of their eggs, blocking sperm binding. Treated females may undergo repeated estrous cycles, but are otherwise unaffected. The pZP vaccines that have been shown effective in bears require boosting.

Limiting population growth by using fertility control is more likely to succeed if females, rather than males, are contracepted. This owes to three factors: 1) one male can inseminate many females, 2) each female often mates with several males during a breeding season, and 3) males disperse over large distances, while females tend to be more sedentary. Contracepting males is not an effective population control strategy.

Black Bear Capture Techniques – Capturing an adequate proportion of the population for treatment is the main technical challenge and expense in applying fertility control agents to any population. Various sorts of traps have been used successfully for many years. The main difficulty is capturing a large proportion of the bear population in a specific area necessary to achieve population control. Treating a large proportion of the bear population would be extremely difficult and very expensive.

Regulatory Framework² – There are no approved fertility-control agents that are specifically approved for bears or any other mammalian wildlife species. However,

² NOTE ADDED IN PROOF: In 2006, regulatory authority for contraception of wildlife and feral animals was transferred from the FDA to the EPA (Environmental Protection Agency). The implications of this change are not known at present.

AMDUCA (Animal Medicinal Drug Use Clarification Act) provides that most drugs approved for use in one species can be used in another, under the supervision of a veterinarian. For example, Neutersol®, which is approved for use in dogs and is being tested as an agent for sterilizing male bears in captive animals, could be applied to wild bears under the supervision of a veterinarian. Vasectomies could also be performed under existing regulations. pZP vaccines do not have regulatory approval. Whether the FDA (US Food and Drug Administration) would issue an INAD (Investigational New Animal Drug) exemption for a pZP vaccine specifically intended for bears is unknown. New Jersey state wildlife authorities would also have to approve the use of any fertility control agents or procedures.

Discussion & Conclusions

- 1) Immunocontraception, using a pZP (porcine zona pellucida) vaccine administered to females, has the best potential to control reproduction in individual female bears, while minimally affecting normal social dynamics. Neutersol® is very likely to be effective in sterilizing male bears, although treated males will be relegated to subordinate social status because of the effects of the treatment on hormone levels. (Males could, however, be vasectomized without affecting social structure and dynamics.)
- 2) Because one male can inseminate many females and because males tend to disperse more widely than do females, fertility control applied to females, is the most effective strategy for managing population size of wildlife species, including black bears.
- 3) Of the options presently being considered for bear fertility control, only Neutersol® and vasectomy have regulatory approval. Although pZP vaccines, which contracept females with minimal effects on treated animals, are best suited for wildlife population control, none has regulatory approval. Whether the FDA would permit field

trials of pZP vaccines on black bears is unknown.

- 4) If all or most dominant male bears in a population are effectively removed from their social positions by sterilization with Neutersol®, it is likely that the consequential social disruption would allow an influx of young males, which would do much of the breeding.
- 5) Managing black bear populations using fertility control will be much more technically difficult and costly than in other wildlife species, such as deer and wild horses, where this approach has been successfully applied. This is a consequence of the difficulty of capture, lower density, and the variable and wide-ranging nature of bear movements.
- 6) Fertility control is very unlikely to be a feasible means of managing black bear populations in New Jersey.

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