CONTRACEPTION
A New Way of Looking at Wildlife Management

THE MARE CALLED “M2E” WATCHED ME carefully, staying on the edge of the tree line and measuring the distance between us with uncanny accuracy. Using a dart gun, I could easily hit large animals at distances greater than thirty meters, but the winds on Assateague, a coastal barrier island, could make long-range inoculation tricky. The mare made sure we stayed at least forty meters apart. After all, she had been inoculated three years in a row, so she knew what I planned to do. I crept closer. When I peeked around a tree, she was barely twenty-five yards away, busy munching marsh grass, and presented me with a wonderful view of her backside. I slipped the safety off, aimed, and squeezed the trigger. There was a hiss as the dart sped through the air and landed in M2E’s rump with a satisfying thump. The dart fell out a few minutes after the injection. Unharmed, but unhappy, M2E wanted nothing more to do with me that day—or year.

M2E is one of approximately 150 feral horses living on Assateague Island National Seashore. She is one of the mares in my study. Each year she is darted with a contraceptive vaccine that prevents pregnancy by blocking the fertilization of her eggs.

The National Park Service (NPS) manages the herd that lives within the park while the Chincoteague Volunteer Fire Company grazes its herd at the southern end of the island off the Virginia coastline. A barrier fence separates the two herds. (For more information on the Chincoteague ponies, see the Fall 1989 HSUS News.)

The horses are descendants of the horses left there in 1630 by Virginia colonists. Today the Assateague herds have been designated a cultural resource. As such, their presence is protected by the National Park Service despite the herds’ impact on the fragile island ecosystem and despite the claim that they are an exotic species not native to the island.

In an earlier study, Dr. Ron Keiper, a Pennsylvania State University biologist, determined the carrying capacity of the NPS-managed land. The NPS wanted to maintain that 150-horse herd size without resorting to a program to capture and remove animals. For this reason, in 1985 NPS officials at Assateague Island National Seashore invited me to begin research on contraception as a way to control the feral-horse population on the island.

Controlling feral-horse populations by means of contraception is not a new concept. The idea was first discussed with federal officials in 1972, shortly after the passage of the Wild, Free-roaming Horse and Burro Act. At that time, an estimated 17,000 feral horses inhabited public lands in ten western states. Officials postulated

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that complete protection afforded to the wild horses would lead to an uncontrolled population increase.

Since the social structure of feral horses is highly developed, a single sexually mature stallion impregnates anywhere from one to ten mares each year. From 1972 to 1980, my colleague, Dr. John Turner, of the Medical College of Ohio, Anne Perkins, a Montana State University graduate student, and I carried out a series of experiments designed to promote contraception in stallions.

We administered a microencapsulated form of the male sex steroid hormone testosterone to stallions in the wild-horse herds near Challis, Idaho. Given in large doses, the steroid lowered the stallions' sperm counts and decreased sperm motility. In our field study, stallions were first immobilized by darts shot from a helicopter. Then the contraceptives were administered by hand. The mares bred by those stallions had an 83 percent reduction in foal production. Although the contraceptive treatment was pharmacologically successful, we were disturbed by the need to capture the wild stallions, a procedure that was hard on the animals, and by the prospect of steroidal hormones passing through the food chain. Eventually when those horses die, scavengers such as the golden eagle will consume their carcasses. The effects of steroidal hormones on such animals are not known.

With the appointment of James Watt as Secretary of Interior, feral-horse contraception research came to a halt. The feral-horse dilemma became worse in the next five years, as costs for the Adopt-A-Horse program increased. More than 20,000 horses were captured and confined in government corrals as the rate of reproduction increased among the horse herds on public lands.

When Dr. Turner and I went to Assateague Island, we tried two different approaches. First, we repeated our experiment with microencapsulated testosterone, using remote delivery this time. We administered the testosterone to several stallions, using darts. A year later there was a moderate reduction in the number of foals born on the island. However, in order to deliver a sufficient volume of the drug, each stallion had to be darted four times. The cumbersome logistics of this approach made it clear that it had little utility as a management tool.

We also used darts to prevent pregnancy in the mares by delivering a slow-release microencapsulated form of a contraceptive called progestin. (It's an ingredient in several human contraceptives.) The steroid prevents ovulation in most mammalian species.

The results were scientifically significant but not exactly what we had in mind. One hundred percent of the treated mares produced foals. It turned out that we had discovered a wonderful fertility enhancer!

Despite this setback, we learned valuable lessons from our studies. They pointed the way to a new approach. In 1987 Dr. Turner and I joined forces with an expert in equine immunology, Dr. Irwin K.M. Liu, of the University of California at Davis. We literally threw out fifteen years of work with
steroidal hormones and turned to the cutting edge of medical technology—immunocontraception. Basically, it is an approach that relies upon an animal's own immune system to interfere with some important component of the reproductive process.

Dr. Liu had previously tested an experimental vaccine on captive feral horses in California with almost 100 percent success in inhibiting their fertility. The vaccine, known as porcine zona pellucida, or PZP, is made from the protein in pig ova. When PZP was injected into the mares, their blood developed antibodies against that protein. The antibodies became attached to sperm receptor sites on the mares' eggs. The antibodies occupied the sites on the males' eggs that the males' sperm cells have to recognize and occupy at fertilization. Our task was to discover if the PZP vaccine could be administered to feral mares remotely, without capturing them. We also wanted to determine if the vaccine was safe to give to pregnant animals. We needed to test whether its effects were reversible and whether we would alter the normal social behavior of the horses in any significant way.

The vaccination program began in March 1988. We identified 26 mares known to be fertile. Each one was given two or three inoculations of PZP.

Our results were excellent. Contraception was 100 percent effective. No foals were produced by the treated mares in 1989. In February 1989 we split the test group by administering single-dose booster inoculations to 14 of the 26 mares. Only one such mare produced a foal in 1990. The 12 mares that did not get booster shots produced foals at their normal, pretreatment rates. This confirmed the reversibility of the contraceptive effects of the vaccine. Over a four-year period, the 14 mares would have birthed approximately 30 foals; instead only a single foal has been born.

We found the vaccine safe to give to pregnant mares. The social behavior of the animals was not affected; females mated but did not get pregnant. The effect of the vaccine was not permanent. Withdrawal of the vaccine was followed by normal pregnancies in the mares that did not receive booster shots.

We have now found a way to institute measures to control excessive wild-horse population growth by vaccinating mares against pregnancy. The National Park Service is working on a carefully designed management plan for Assateague Island National Seashore that is aimed at maintaining a population of about 150 horses with this immunoncontraception technique.

In a similar study supported by PNC Corporation and The HSUS, our research team tested PZP vaccine on white-tailed deer. In certain areas, the swelling deer population may represent a threat to itself, from overpopulation, and to humans, in ever-increasing deer-and-car collisions. The vaccine proved as effective in preventing pregnancy in captive deer as it was in feral horses; but in order to reach the point where PZP vaccine will control free-roaming deer populations, we must first "engineer it" into one inoculation per animal per year. Developing such a vaccine has become the focus of our research and has been made possible by The HSUS.

Zoos Begin PZP Vaccinations

The PZP vaccine has proved useful in preventing pregnancies in captive exotic species in zoos. In 1996, in collaboration with Drs. Waltraut Zimmermann and Lydia Koller of the Cologne Zoo and with the support of the European Endangered Species Program, we used PZP vaccines on several of the rare Przewalski's horses and bantengs. This might at first seem a paradox. We usually think the purpose of captive-breeding programs is to produce animals, not prevent their births, but too much of a good thing can be a problem. Zoos refer to their dilemma as the surplus-animal problem. Recognizing the seriousness of the problem, more progressive zoos are beginning to use carefully-controlled contraception programs. A variety of types of hormonal contraceptives have been given to captive exotic animals by zoos, but preventing pregnancies in ungulates and primates has proved technically troublesome. Dr. Tony Sacco, of the Wayne State School of Medicine, has been researching forms of PZP vaccine for many years with an eye to putting it ultimately to work in human contraception. He recently inoculated a group of patas monkeys at the Calgary Zoo and a hybrid orangutan (a cross between a Sumatran and a Bornean orangutan) at the Toledo Zoo. The orangutan should not be bred because it may cause the extinction of a subspecies. In collaboration with the Bronx Zoo, my colleagues and I initiated tests of the PZP vaccine on a variety of hoofed animals including sika, muntjac, sambar, and axis deer. Research projects are being planned with a number of other zoos. At the University of California at Davis, Dr. Cherric Mahi-Brown is directing tests using PZP vaccine on bison for the San Francisco Zoo.

Dr. Bonnie Dunbar, a Baylor University School of Medicine researcher, has been instrumental in the development of the PZP vaccine. Her efforts led to the formation of a privately funded research effort by Zonagen Corporation to develop a PZP contraceptive vaccine for cats and dogs. The work of Dr. Jurriaan Dean, of the National Institutes of Health, has focused on the development of a human-contraceptive PZP vaccine.

Other Approaches to Fertility Control

Several small mammals, such as skunks, raccoons, and foxes, have adapted to urban environments with so much success that they are viewed by some as "nuisance animals." The phenomenon of growing populations of city-bound wild animals has caused some concern, aside from that generated by upended garbage cans, about the spread of fox- or skunk-borne rabies and raccoon-borne Lyme disease. Immunocontraception can reduce the reproduction potential of the mammal populations in a safe, humane way.

In a somewhat different approach to wild-
Assateague horses live a normal life after being vaccinated against conception. Only one foal in four years has been born to inoculated mares.

Virginia have identified anti-sperm antigens that, when injected in male animals, cause antibodies against sperm. Such vaccines would be particularly useful in species like horses, where a single stallion breeds many mares.

With each advance in wildlife contraception, however, comes greater threats of abuse of this technology. Should contraception ever be used in an endangered species? If so, under what conditions? Who should make the decisions about the use of contraceptive technology on wildlife, using what criteria? What are the allowable limits of stress to which animals should be subjected in order to apply wildlife contraception? Such questions must be answered before fertility control becomes a common wildlife-management tool. There is a multitude of ethical and moral questions to consider if we are to solve wildlife problems rather than make them worse. We have already begun to ask such questions and to develop responsible and ethical guidelines for wildlife contraception.

Last March, while giving the fourth annual booster shot to the Assateague mares, I came upon the carcass of an old friend. This mare, M4, was twenty when she died of natural causes in December 1990 at almost the northernmost terminus of the island. Her remains were still pretty much intact and I could still see her white socks and the star on her forehead. There were two small depressions in the sand where she had pawed vainly after going down, but the depressions were shallow and I don’t think she suffered long. She had been among the mares originally inoculated in 1988 and she was special to us. I briefly laid my hands on her neck, something no human had done during her twenty years. She died less than a mile from where she had been born, and she had never been roped, captured, rounded-up, immobilized, or otherwise harassed, my contraceptive darts notwithstanding. M4 was born wild and lived free. She was permitted the dignity to die where she lived. I am a scientist, but my emotional self mourned her loss. For a few moments, in my grief, I lost sight of the fact that I should have been celebrating her life and not mourning her death. I almost lost sight of the tribute her life—and death—represented to the bold Park Service officials on Assateague who elected to find a humane solution to managing this herd of wonderful animals. I almost missed the whole picture.

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