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Abstract: Genetic issues related to cat biology are separated from those related to cat conservation for cheetahs, lions and pumas. This does not diminish the importance of genetics issues for conservation of cats. It merely points to the need to distinguish when a traditional scientific discipline can, or cannot contribute to practical conservation. While no single issue will constitute the sole concern in felid conservation, conservation genetics will continue to be an important tool in the attempts to confront the complex landscape of problems in today's world. For the cheetah, if problems are only chalked up to inbreeding due to their evolutionary history, one may conclude that humans have little impact and the species is genetically doomed. However, field studies have shown that human behavior have impact on the species' success.

Cat-saving Science

BY GEORGE AMATO

It is both interesting and perplexing that two of the best-known examples of genetic issues in conservation—one dealing with cheetahs, one with lions—are not really conservation issues at all. In both instances, the scientific research added to our understanding of the biology of the study animals, but not to their conservation.

GEORGE AMATO

The case of the cheetah is one of the most widely publicized stories concerning genetics and a wild species. As a conservation geneticist, I have received a steady stream of inquiries about the cheetah "problem" from people as diverse as graduate students and aerobic instructors, investment bankers and physicians. Briefly, about ten years ago, zoo professionals became concerned that cheetahs were not reproducing well in captivity. At the same time, researchers at the Laboratory for Viral Carcinogenesis, a branch of the National Cancer Institute, began to investigate genetics of wild cats—in part, because the cat had been a model for some specific cancer research, and because the head of the lab has an inordinate fondness for cats. Their research led to an unexpected observation: Cheetahs have less genetic variation than is typical in other vertebrates—including other wild felids.

This was interesting to biologists. Unfortunately, it was overstated by researchers and in the press, resulting in such observations as "Cheetahs are as genetically depauperate as inbred strains of mice." Further research into the reproductive physiology of captive and wild cheetahs did reveal a large proportion of sperm abnormalities in male cheetahs, a characteristic loosely associated with inbreeding. News of the finding set off an avalanche of reports—and reports of reports. This was particularly true about the researchers' suggestion that the explanation for this lack of genetic variation was that the cheetah had passed through a genetic bottleneck, or a series of bottlenecks, some 10,000 years ago. (Genetic bottleneck refers to a population, or in this case a species, that declines to a very small number and thereby loses much of its genetic variation.)

To say that this hypothesis was controversial is an understatement. Few evolutionary biologists could accept the notion that a species that had been as successful and widely distributed in historic times had an evolutionary history that included being reduced to a few individuals in the recent past (evolutionarily speaking). In fact, despite implicit suggestions that cheetahs were doomed by their genetic makeup and unfortunate evolutionary history, the evidence continued to mount that cheetahs did, and do, just fine—if only humans will keep out of their way.

Clearly this is not an example of the importance of genetics for conservation. Even if cheetahs were genetically depauperate, it would be due to a natural event, not as a result of human activity. Which is what conservation is all about—our efforts to ameliorate the adverse effects of human activities on Earth's biodiversity.

The cheetah story continues. Some of the original genetic research has been criticized and a more complex picture of

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GEORGE B. SCHALLER

The author (above) scrapes a lion skull to obtain genetic material for use in mapping genetic profiles of wild animal populations, such as this East African lion pride.

Cat Book SAMPLER

Cougar: Ghost of the Rockies, *by Karen McCall and Jim Dutcher. Sierra Club Books, San Francisco, 1992. 70 color photos.*

The story follows a year in the life of Catrina, a pregnant cougar taken from the Boise Zoo and released into an enclosure in Idaho's White Cloud Mountains.

The Tiger's Destiny, *by Valmik Thapar. Kyle Cathie Ltd., London, 1992. More than 100 photos.*

Thapar has drawn on 16 years' experience working in Ranthambhore National Park in northern India to delve into the natural history of this cat and its relationship to man.

Vanishing Tracks, *by Darla Hillard, Arbor House/William Morrow, New York, 1989.*

Hillard's first-person account of a scientific expedition, led by wildlife biologist Rodney Jackson, to study the snow leopard of central Asia.

CAT SCIENCE

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the genetics of the species has developed. But the observed lack of genetic variation in cheetahs compared to other cats remains simply another attribute in a cat that has always been a biological enigma within the felid family. Of great concern to the conservationist is the spotted cat's diurnal hunting behavior, which is frequently disturbed by the ever-increasing swarms of tourists overrunning many African parks and reserves.

The case of the lion is a little less complicated. Once again, lower levels of genetic variation were observed in the resident lions of Tanzania's Ngorongoro Crater compared with the genetic variation of lions in nearby Serengeti National Park. Few people realized that, like the cheetah, the genetic make-up of the Ngorongoro lions is a natural phenomenon, reflecting an increase in inbreeding that followed a population decline caused by a parasitic disease. In addition, the Ngorongoro lions are successful in preventing unrelated outsiders from entering their territories.

Still, a discussion ensued about the importance of genetics research to the conservation of Ngorongoro's lions. If these lions did suffer from inbreeding depression, however, eventually their numbers would decrease or they would lose territorial disputes. This natural condition would correct itself and is one that may have played itself out countless times in the past.

What, then, *are* the genetics problems confronting the conservation of big cats? Primarily, they involve habitat fragmentation due to human activity, which results in small, isolated populations. Big cats typically have large home ranges, and most reserves cannot support populations large enough to avoid genetic and demographic threats associated with smaller groups. In these cases, the use of molecular genetic markers—such as DNA profiling, similar to the techniques seen in the O.J. Simpson trial—and population genetic theory can provide important information in developing management plans for certain cat populations.

In south Florida, for example, the surviving population of Florida panthers—numbering 30 to 50—suffers

from severe inbreeding and catastrophic natural and human-caused events, such as disease and car accidents. Last year, as part of a biologically sound program based on population genetic theory, eight unrelated animals from west Texas were released to infuse new genes into the Florida population. This management program helps to reconstruct the past natural situation that existed when panthers were distributed contiguously across the continent.

At the Wildlife Conservation Society's Science Resource Center, we are studying genetic markers of tigers as part of the long-term conservation project headed by WCS researcher Ullas Karanth in India. Tiger populations there have been severely fragmented by the burgeoning human population and have recently been affected by renewed poaching. Our molecular genetic studies will provide information on the likelihood of the persistence of these populations under various management strategies currently under consideration.

Perhaps I should not quibble about differentiating genetic issues related to cat biology and those related to cat conservation. If the cheetah's problems are chalked up to inbreeding due to their evolutionary history, then the conclusion may be drawn that humans have had little impact and the species is doomed genetically. Field studies have shown, however, that human behavior—tourist minibuses surrounding a hunting female—have great impact on this species' success. In this case there are more compelling conservation issues affecting the species than the relative levels of genetic variation that have been observed.

This does not diminish the importance of genetics issues for the conservation of cats. It merely points to the need to distinguish when a traditional scientific discipline can, or cannot, contribute to practical conservation. While no single issue will constitute the sole concern in felid conservation, conservation genetics will continue to be an important tool in our attempts to confront the complex landscape of problems in today's world.

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