CONSERVATION OF BLACK RHINO IN NAMIBIA AND ZIMBABWE: VETERINARY CONTRIBUTIONS

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The capture of black rhinoceros (*Diceros bicornis*) for relocation within Zimbabwe and for export, and to a lesser extent capture of black rhino in Namibia for relocation and dehorning, presented opportunities to improve capture methods and reduce morbidity and mortality. Adjustments in the dosage levels of etorphine, fentanyl and xylazine and the addition of hyaluronidase appear to have a significant influence on the induction time for free-ranging black rhino (Kock, et al., 1990a). More rapid induction appears to result in lower body temperature, better vital signs and fewer physical problems recovering the immobilized animal. Kock and his co-workers recently documented many of the normal metabolic and physiologic parameters of free-ranging black rhino in Zimbabwe (Kock, et al., 1990b,c). Although some of these values are influenced by the physiologic stresses of capture, they should be of comparative value to zoo veterinarians. Relatively simple changes in boma design and management schemes and use of long-acting tranquilizers, Acuphase and Trilifon, appear to reduce self-inflicted injuries, stress of initial confinement, and speed of adaptation.

The 1986 African Rhinoceros Workshop in Cincinnati identified a number of promising areas for biomedical research that could enhance the health and long-term survival of captive black rhinoceros (*Diceros bicornis*). These included research into diseases in general, hemolytic anemia and hepatic disease, optimal vitamin and mineral levels and genetics. Large scale capture and relocation efforts aimed at reducing poaching losses in the Zambezi Valley of Zimbabwe and smaller efforts in Namibia presented the opportunity to take biological samples from free-ranging black rhino for comparison with captive animals. A total of 65 sets of sera were brought back to the United States in 1989, with 16 additional sets coming in 1991. Individuals and organizations that expressed an interest in obtaining samples from captive black rhino at the Cincinnati workshop were contacted and offered access to samples from free-ranging rhino. Both leptospirosis and vitamin E deficiency have been implicated in the "hemolytic anemia syndrome" deaths of a number of captive black rhino. Red blood cell fragility, red cell parasites, leptospirosis and vitamin E deficiency had been blamed.

Analysis of plasma by high performance liquid chromatography has proven an accurate method to determine circulating levels of vitamin E in black rhinoceros (Dierenfeld, et al., 1988). In previous studies these authors showed that vitamin E levels in free-ranging black rhino from Zimbabwe (0.77 ug/ml) were considerably higher than those seen in captive rhino (0.18 ug/ml). Using the same techniques, Dierenfeld and co-workers

analyzed an additional 34 plasma samples from rhino captured for relocation from the Zambezi Valley in 1988. The mean vitamin E level was 0.54 ug/ml. In 1989 they analyzed an additional 21 plasma samples of Zimbabwe origin, mostly from the Zambezi Valley. The mean vitamin E level was 0.46 ug/ml. Although these means are somewhat lower than their previously published results, they are significantly higher than captive black rhino. The respective mean serum vitamin A levels of the 1988 and 1989 samples were 0.04 and 0.05 ug/ml (Dierenfeld, 1989). Three Namibian desert rhino, living on very xeric plant species, had mean plasma vitamin E levels of .80 ug/ml and vitamin A levels of .04 ug/ml. As Dierenfeld has suggested, supplementation of captive rhino diets with vitamin E may be in order. The relationship between hemolytic anemia and vitamin E levels is still speculative.

Leptospirosis is known to cause intravascular hemolysis and hepatitis. Lepto has been implicated in hemolytic anemia problems of nine captive black rhino (Jessup, et al., 1991). Microscopic agglutination titers for serovars of *L. interrogans* were determined at the National Animal Disease Center (NADC) on sera from 60 wild-caught black rhinoceroses from five locations in Zimbabwe and three samples from Namibia. This study will be more fully reported elsewhere (Jessup, et al., 1991). Briefly, free-ranging black rhino from the Zambezi Valley frequently had relatively high titers to a variety of leptospirosis serovars. Thirty eight of 60 rhino (63%) samples in Zimbabwe had titers to one or several serovars of leptospirosis of at least 1:100. Titers as high as 1:400 were seen in nine of 37 (25%) in one group of animals tested. Location and altitude appeared to determine which serovars the free-ranging Zimbabwe rhino were exposed to. Namibian animals from a desert environment did not have significant titers. Microenvironmental differences at water sources in the various locations may explain this observation.

Leptospiras are usually passed between animals via urine contaminated water sources, and they survive best in warm alkaline mud and water. It would seem logical that leptospiras are more common in some moist riparian forests, where the rodent fauna and other potential carriers may account for the differences in prevalence between locations. Leptospirosis may be a naturally occurring disease of black rhino in the Zambezi Valley, but clinical cases have not yet been reported. The effects of leptospiras on free-ranging rhino and those destined for relocation need further investigation.

Relocation of wildlife carries the risk that diseases which threaten livestock and/or man may accidentally also be relocated. Sera from 26 Zimbabwean black rhino and three animals from Namibia were tested for antibodies to African Horse Sickness (AHS), Foot and Mouth Disease (FMD), Rinderpest (RP) by enzyme linked immunosorbent assay, virus infection associated antigen and fluorescent antibody neutralization, respectively, at the USDA Foreign Animal disease Diagnostic Laboratory in Plum Island, New York. No evidence of previous exposure to any of these viruses was found (Yedloutschnig, 1990). These samples included the 10 rhino shipped to the United States and the two shipped to Germany in 1989. As several outbreaks of Foot and Mouth Disease occurred in Zimbabwe during 1989 around the time the rhino were shipped, this is rather reassuring information.

When wild populations decline sharply and particularly when captive breeding strategies may become part of species survival, genetic questions come to the forefront. The basic questions usually are: How much

heterozygosity is present in natural populations, is there evidence of distinct races or subspecies exist, and how can existing heterozygosity (genetic diversity) best be preserved. Although pedigrees may be used to answer these questions for captive animals, they can seldom be applied to truly free-ranging animals. When seven blood proteins (PEP-GL, LDH-1, LDH-2, MDH, PGD, PGI, EST-F-A (2), General Protein loci (4), coding for 12 genetic loci from 16 Zimbabwe and three Namibian black rhino (*Diceros bicornis minor* and *Diceros bicornis* respectively) were separated by electrophoretic means, no differences in patterns between populations and, in fact, no heterozygosity was found (May, et al., 1990). These findings agree with those of Melnick. This preliminary data should not be over-interpreted and should be supplemented by additional samples, by checking additional loci, and by utilizing more advanced methods such as analysis of mitochondrial and nuclear DNA sequences.

Two of the 10 black rhinoceroses that were relocated to the United States (Agrippa and Marongora) in 1989 died on ranches in Texas. In neither case has a firm cause of death been established. Hepatocellular degeneration and cholestasis was present in the former animal and an acute mild hepatopathy along with enteritis, pneumonia, nephritis and stomatitis in the latter. Samples taken from Agrippa at capture, after signs of disease were evident (August 27) and three weeks later, did not reveal rising titers to leptospirosis. Although the availability of blood chemistry and hematology data and extra sera or plasma taken at capture did not help establish a diagnosis or successful treatment program in either of these two cases, the value of this kind of reference data should be apparent. Samples taken at capture should serve as the beginning of each animal's health record and health data base whenever black rhino are shipped internationally. The veterinarian accompanying international shipments of wild-caught black rhino should be responsible to see that health records are complete, starting from the day of capture, and that those records are delivered to the recipient institution's veterinarian.

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LITERATURE CITED

1.Dierenfeld, E.S. 1989. Unpublished laboratory data, New York Zoological Society.
2.Dierenfeld, E.S., R. du Toit, and R.E. Miller. 1988. Vitamin E levels in captive and wild black rhinoceros (*Diceros bicornis*). J. of Wildl. Dis. 24(3):547-550.
3.Jessup, D.A, R.E. Miller, C.A Bolin, M.D. Kock, P. Morkel. 1991. Microscopic agglutination testing for leptospirosis in wild caught and captive black rhinoceros. In Press.
4.Kock, M.D., M. La Grange, and R. du Toit. 1990a. Chemical immobilization of free-ranging black rhinoceros (*Diceros bicornis*) in Zimbabwe. J. of Zoo and Wildl. Med. 21(3):283-291.
5.Kock, M.D., R. du Toit, N. Kock, *et al.* 1990c. Effects of capture and translocation on biological parameters in free-ranging black rhinoceros (*Diceros bicornis*) in Zimbabwe. J. of Zoo and Wildl. Med. 21(4):414-424.
6.May, B., R. Ramey, D.A. Jessup. 1990. Unpublished data from Cornell University for Ecological and Evolutionary Genetics.
7.Yedloutschnig, R.J. 1990. Final laboratory report, accession 90043, USDA APHIS FADDL.