

Reproductive Cycle of One Southern White Rhinoceros

Robert A. Wagner, V.M.D., The Pittsburgh Zoo, P.O. Box 5250, Pittsburgh, PA 15206.

Currently in North America, there is a captive population of 150 endangered White Rhinos. Recent SSP findings show 80% of this population is not breeding. Being gregarious in nature, White Rhinos are most successfully bred in herd situations. However, twenty-six North American Zoos house only single pairs. The eventual goal of SSP is to shift these animals into a herd situation. These considerations prompted a reproductive study of a single pair of White Rhinos at the Pittsburgh Zoo in 1984.

The data was collected from an 8 year old female Southern White Rhinoceros over a period of twenty months. Attempts were made to collect samples biweekly. Behavioral observations for stage of estrus cycle were correlated with:

1. Rectal exam for uterine and cervical tone
2. Vaginal cytology
3. Urine hormones: (a.) total estrogens (estradiol-17-B, estrone and estrone sulfate)
(b.) Progesterone

Rectal exam of uterus and cervix revealed much information about the female's cycle and anatomy. Ovaries were not palpable. The reproductive tract tone was measured on a scale of 1 to 3, with 1 being soft, pliable and flaccid, and 3 being firm, well defined and turgid. There was a very strong relationship between the stage of cycle and tract tone.

The dimensions of the tract (diameter x length):

	<u>Tone 1 (diestrus)</u>	<u>Tone 3 (estrus)</u>
cervix	2½-3" x 11"	2" x 10"
uterine horn	1½" - 2"	1"

It was found, as behavioral estrus approached, the reproductive tract slowly increased in tone and often maintained a level of 2 for weeks. Then during heat the tract sharply toned to a 3 for 2 to 4 days, followed by a sudden drop to either level 1 or 2. Consistently tract tone of 3 correlated with heat and tone of 1 with diestrus.

Vaginal cytology was reported by Spellmine and Booth in A.A.Z.P.A. Regional Proceedings in 1981 for a Black Rhino. Similar findings were seen in the cytology of the White Rhino. During diestrus, round non-cornified epithelial cells with distinct nuclei were seen, along with small quantities of mucus and debris. Then for about 2 to 3 days during proestrus the epithelial cells cornified and became angular in shape with pyknotic and darker nuclei. A slight increase in mucus and debris was noted at this point. Also at this time the cells began karyolysis and lose their nuclei. A sudden change at estrus in the non-cornified to cornified cell ration (NC/C) often occurred within twelve hours. Many times greater than 70% of the cells became cornified with an excess amount of debris noted. The epithelial cells of estrus were then, irregular in shape, edges folded over and contained no nuclei. The NC/C ratio within twelve hours would revert back to 50/50 or greater with cells resembling new diestrus cells. Rapidly changing cytology seen in Pittsburgh's White Rhino closely agrees with reports from San Diego Wild Animal Park of estrus lasting 15 hours based on behavioral observations (1985 SSP Survey).

Hormone analysis of urine for total estrogens and progesterones were collected as frequently as possible but occasionally time gaps of up to twelve days would occur. Analysis was done by Radio immune assay (RIA). Hormone concentrations were corrected for dilution by standardizing against creatinine levels. Baseline estrogen levels ranged from 200 to 900 pg/ml with small mid-cycle peaks of less than 900 pg/ml occurring between November and July. Total estrogens showed the best correlation with observable heat. Estrogen peaks of greater than 1200 pg/ml occurred within 4 days of noted heat. From August to October multiple estrogenic peaks (less than 1300 pg/ml) were seen with ~~little pattern~~ ^(OUT a regular pattern) ~~or irregularity~~. During this time, poorly defined heats or no cyclic behavioral activity was seen. Progesterone peaks (.125 - .250 ng/ml) followed extremely close to declining estrogen peaks from November to July, then levels became erratic and poorly correlated. These hormone fluctuations may explain the lack of obvious estrus behavior in Pittsburgh's female Rhino from late summer to early winter. There seems to be a seasonal anestrus occurring in this female during this time.

From December to July, Pittsburgh's female has strong (easily observed) heats and regular estrus cycles. With approaching heat the uterus and cervix increase in tone, the vaginal cytology changes from non-cornified to cornified cells and urine total estrogen levels peak. Behavioral estrus lasts 3 to 5 days. Progesterones rise after estrogen peaks and tone and vaginal cytology go back to baseline levels. Cycle length varies from 38 to 58 days with most cycles 40 to 42 days. As mid-summer approaches, cyclic behavior and observable heats are much harder to determine. This agrees with the non-cyclic activity in tract tone and cytology.

Future goals are to isolate a LH-like compound in the urine, sonographic evaluation of ovaries for staging the cycle and eventually artificial insemination.

Many people contributed to this paper. Special thanks to all the keepers and technicians who collected samples and to Megan Hilf who helped write the paper. Urine hormones were run by Dr. Clinton Lothrop, Assistant Professor at the University of Tennessee, College of Veterinary Medicine.

References:

1. Lothrop, Clinton 7-1-86 - Personal Communication. Urinary Steroid Evaluations.
2. Ramsay, E.C., L. Kasman, B.L. Lasley. Urinary Steroid Evaluations for Monitoring Ovarian Function in Indian and Black Rhinoceros. A.A.Z.V. Annual Proceedings 1985, Scottsdale, Arizona, P.1.
3. Jones, D.M. The Husbandry and Veterinary Care of Captive Rhinoceroses. International Zoo Yearbook. 1979; 19:239 - 252.
4. Spellmine, T.J., Booth, B.N. Artificial Breeding Program for (Diceros Bicornis), The Black Rhinoceros. A.A.Z.P.A. Regional Conference Proceedings 1981. P. 299.
5. Species Survival Plan Program Survey on Husbandry, Reproduction and Health of White Rhinoceros. 1985, Jeff Swift, Research Coordinator.
6. Schaffer, N., Urine Collection: Value in Reproductive Research. A.A.Z.P.A. Regional Conference Proceedings, 1983. Pp. 400 - 411.
7. Nelson, L., Fowler, M., Rhinocerotidae, Zoo and Wild Animal Medicine, ed, Fowler. W.B. Saunders, 1986, p. 937.