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ENRICHMENT STUDIES OF 1.1 BLACK RHINOCEROS *(Diceros bicornis michaeli)* AT ZOO ATLANTA

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INTRODUCTION

Preliminary observations during spring 1993 indicated that the 1.1 eastern black rhinos (*Diceros bicornis michaeli*) at Zoo Atlanta were often not visible to the public, but when visible, sometimes paced. Concerned with the rhinos' well-being and the public's enjoyment, we were interested in documenting how much time the rhinos spent out of sight and pacing, and relatedly, in promoting species-typical behaviors. Maladaptive behaviors could be indicators of stress, eventually leading to health and reproductive problems. After determining the extent of undesired behaviors through baseline behavioral studies, we proceeded to implement various forms of enrichment and habitat modification to encourage characteristic rhino behavior.

METHODS

Data were collected on a 7-year-old male, Bo, and a 3.5-year-old female, Rosie. The rhinos were housed at night in adjoining stalls with access to the outdoor exhibit on alternate days. Baseline data were collected during June and July, with subsequent enrichment and data collection from August through November.

Continuous focal animal sampling, instantaneous scans, all occurrences of certain events, and *ad libitum* descriptions of interesting or unusual behaviors were collected with pencil and paper. To collect habitat use information, the 1/4-acre exhibit was visually divided into three areas, and a fourth area assigned for the corral-to-exhibit pathway (Fig. 1). Data collection was balanced across all hours that the rhinos were on exhibit. Data were collected for two-hour periods, once or twice per day, at least eight times per week. Instantaneous scan samples taken every 30 minutes included behavior and exhibit location. All data were collected from public viewing areas.

The data presented are derived only from instantaneous scan sampling. The major state behaviors presented in this report are: browsing provisioned vegetation (br), foraging hay or natural vegetation (hy), lying (li), object investigation (oi), pacing (pa), standing (st), walking (wa), and not visible (nv). Wallow water levels were also noted to correlate to the rhinos' use or non-use.

After preliminary assessment of the data, several options for enrichment and habitat modification were considered, of which three were chosen and implemented in successive phases. Behavioral changes resulting from one enrichment procedure may have carried over into the next phase. For the first phase of enrichment in August, extra bamboo (*Phyllostachys* spp.) and freshly-cut willow shrub (*Salix* spp.) were provided every morning. In addition, a cut willow tree was placed in the exhibit for continual browsing during this phase. In September, various aromatic scents were sprayed in the exhibit in the morning before the rhinos entered the exhibit. Because rhinos have a keen sense of smell, used in territory and home range maintenance as well as for individual identification (Grzimek, 1984), they would perhaps be interested in novel odors in their environment. The presence of novel scents throughout the exhibit might therefore increase locomotor and investigative behaviors. The scents used were garlic, herbal tea, honey, the male's urine and the female's urine. When used, the female's urine was sprayed only when the male was on exhibit, and vice versa. From October into November, large rocks were placed along the sides of the corral-to-exhibit pathway which the rhinos frequented when pacing and resting, thus making the rhinos out of view to the public.

RESULTS AND DISCUSSION

BASELINE PHASE

The number of behavior and location scans collected for Bo and Rosie was N=100, each (Figs. 2-5). The rhinos spent approximately 30% of the day out of view from the public, primarily in the pathway to the corral. Three possible explanations for this are: 1) the exhibit rhino interacted with the rhino in the corral, 2) the pathway was shady, and 3) it was a refuge from visitors. Besides the pathway, the only other shade was from a large maple tree (*Acer rubrum*), and when resting behind the boulders around the tree, the rhino was also often not visible. Because data were taken from the public areas, they do not reflect what the rhinos were doing when not visible. The keepers informed us, however, that the rhinos primarily stood or lay, and occasionally interacted through the gate with their horns. From management and behavioral perspectives, we accepted the rhinos' needs for interaction, rest and isolation, although the rhinos may have been spending too much time in sedentary behaviors. For the visitors, however, we wanted to meet our zoo's goals for recreation and education by having the rhinos more visible.

During this baseline study phase, the rhinos spent an average of 8% of their time pacing, primarily in and out of the corral pathway. This was an undesired behavior and may have reflected either the rhinos' need for alternative activity or the presence of social or environmental stressors.

The following are other behavioral results of the baseline phase of this project. About 25% of time was spent lying or standing. It is important to note that Rosie never lay while on exhibit and was usually alert when standing. Her inability or unwillingness to rest during the day could indicate stress. Each rhino spent 12-15% of exhibit time foraging. Rosie preferred foraging on natural vegetation, while Bo preferred eating hay. Walking accounted for 10% of time on exhibit. They spent less than 1% of their time investigating or manipulating objects. Additionally, mud wallowing accounted for 2.5% of time. Rosie used the wallow whether it was almost dry or full of water. Bo preferred the wallow only when the water was deep. Additionally, Bo occasionally waded into the exhibit pool, while Rosie never did.

The exhibit provided water, natural vegetation, and a diversity of structures, such as logs and artificial termite mounds, throughout. Bo used more areas of the exhibit than did Rosie; however, he did spend over 40% of his time in the corral pathway. This was his preferred resting area and sometimes while there he was partially visible to the visitors. He did walk and forage in areas further from the corral approximately 15% of the time. Rosie spent 30% of her time in the corral pathway. She paced in and out of view and stood off sight at the corral gate. She spent less than 5% of her time beyond area 1.

ENRICHMENT PHASES

Behavioral changes and habitat use throughout the three phases of enrichment are presented in Figures 6 through 9.

BROWSE. (Bo, N=60; Rosie, N=60). This phase of enrichment had a better effect on Bo than on Rosie. Between the two of them, the rhinos ate most of the tree, although initially they were afraid to approach it. The extra browse and the cut willow tree kept Bo visible more and he paced less. It had no effect on Rosie's visibility, however, and her pacing increased. Rosie increased time standing in public view, however, from 28% to 45%. Although Bo did stay in area 1 more often, neither rhino increased use of other areas in the exhibit.

SCENTING. (Bo, N=80; Rosie, N=60). This experiment had variable results. Bo seemed to react more favorably to the scents than did Rosie. Bo was visible more often, foraged more, and paced less. He seemed especially fond of the garlic scent, as he often foraged on plants that were sprayed directly with it. The effect of spraying Rosie's urine in the exhibit for Bo unfortunately appeared to have the

effect of prompting him to seek Rosie off exhibit. Rosie was extremely interested in the scents but time not visible did not change. Her walking and object investigation both increased slightly. Because object investigation was a brief duration behavior, obtaining a scan of this was rare. The increase in object investigation, therefore, might be behaviorally significant. She often stopped to investigate sprayed rocks and logs but did not follow the scents beyond her preferred area 1. Rosie may have been agitated by too much of Bo's urine present, as her pacing increased from 4% to 13%. Although Bo sprayed urine while on exhibit, Rosie may not have been accustomed to smelling his fresh urine on her exhibit days. These are just impressions as the scans are too few to be analyzed for the specific effects of the different scents. Overall, the recommendation was to continue using non-urine scents as an enrichment tool.

ROCK PLACEMENT. (Bo, N=65; Rosie, N=70). This form of enrichment did not satisfy all of our objectives but did have a positive side effect. During the first few days after placement, the rocks did keep the rhinos out of the corral pathway where they paced and rested. This was probably effective because the rhinos were often afraid of novel objects. After an acclimation period, however, the rhinos used the rocks as off-site enrichment, moving them with their horns. In the long run, the rocks did not prevent the rhinos from pacing into the pathway but did require them to find another place to lie. The latter success was especially important for the objective of increased public viewing, as Bo previously lay 30-60 minutes at a time out of view.

CONCLUSIONS

Having documented undesired behaviors in our black rhinos, we designed three short behavior modification experiments to promote species-specific behaviors while reducing time pacing and being off-site. The overall effects of enrichment and habitat modification on behavior and enclosure use are summarized in Table 1. Enrichment had positive effects on Bo. For Rosie, however, results indicated either neutral effects or a combination of positive and negative effects. The results reflected the individual variations in these rhinos that should be considered in all management procedures.

FINAL RECOMMENDATIONS

The following recommendations were made for continuing enrichment, with consideration for issues of individual health and well-being:

1. Providing supplemental browse, especially for the male.
2. Spraying the exhibit periodically with natural, food-related scents.
3. Keeping boulders too large for the rhinos to move in areas where they were frequently out of public view.

REFERENCE

Grzimek, H.C.B. 1984. Chapter 2: Rhinoceros, pp. 34-70. In, Grzimek's Animal Life Encyclopedia, Vol 13, Mammals IV.

ACKNOWLEDGMENTS

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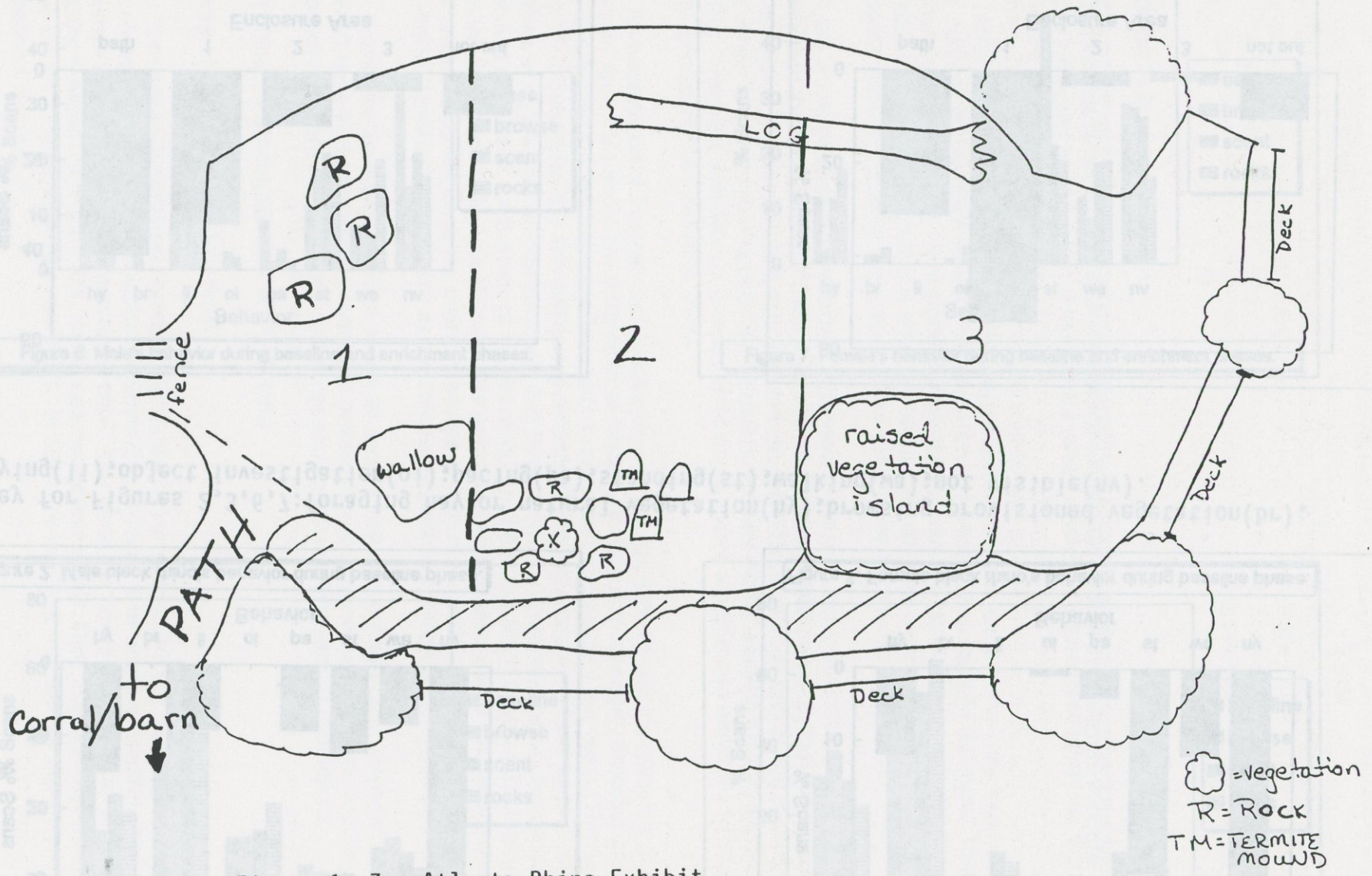

Figure 1. Zoo Atlanta Rhino Exhibit

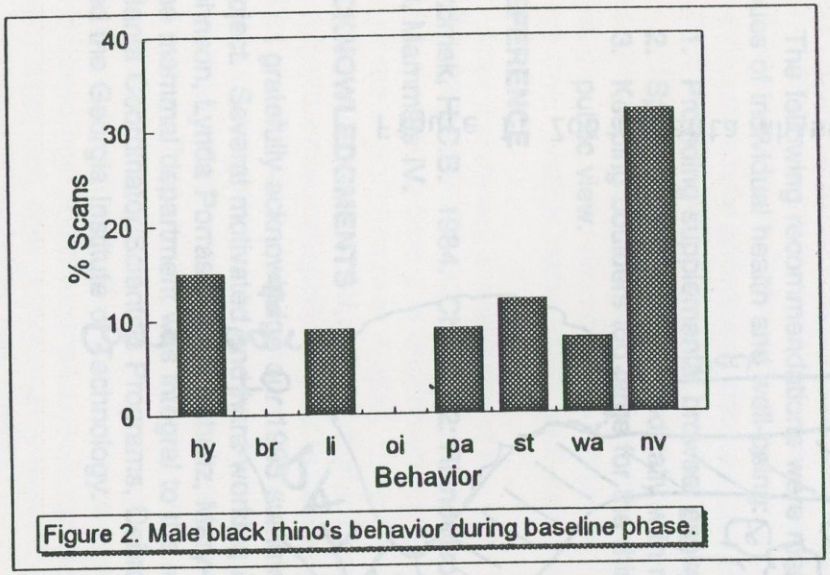

Figure 2. Male black rhino's behavior during baseline phase.

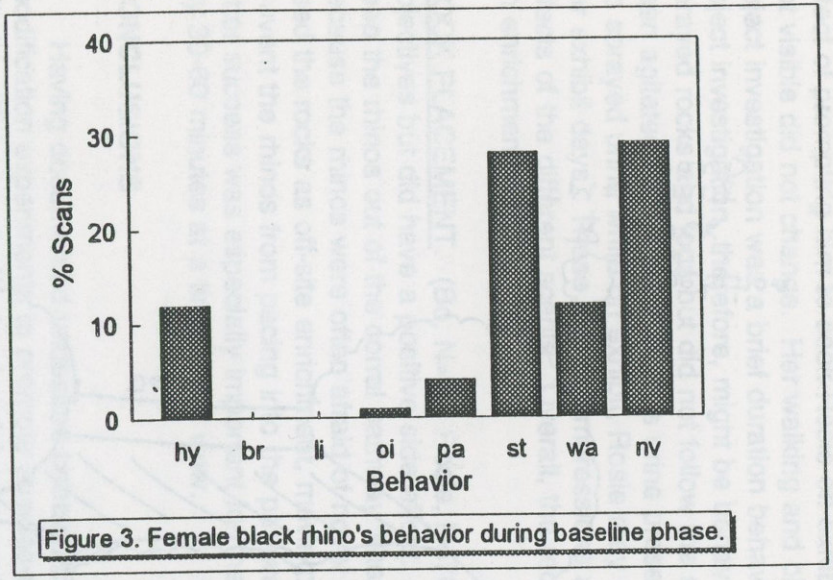

Figure 3. Female black rhino's behavior during baseline phase.

**Key for Figures 2,3,6,7:foraging hay or natural vegetation(hy);browsing provisioned vegetation(br); lying(li);object investigation(oi);pacing(pa);standing(st);walking(wa);not visible(nv).

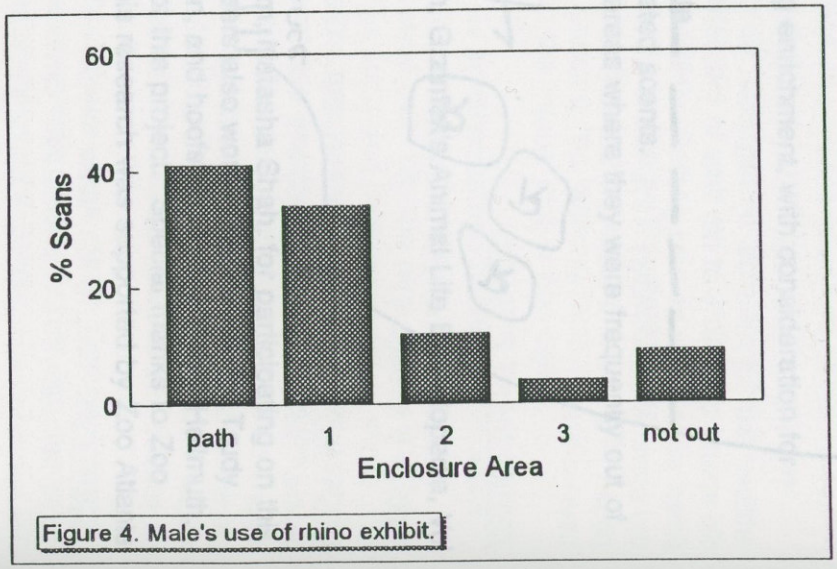

Figure 4. Male's use of rhino exhibit.

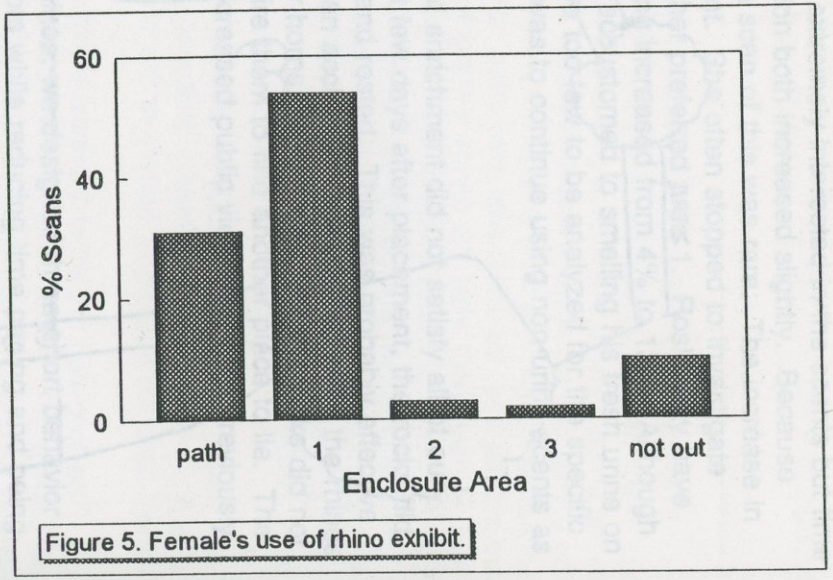

Figure 5. Female's use of rhino exhibit.

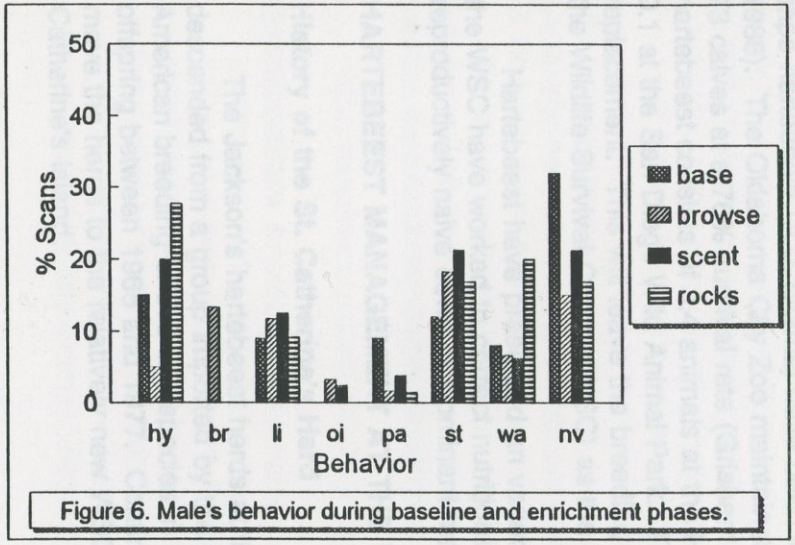

Figure 6. Male's behavior during baseline and enrichment phases.

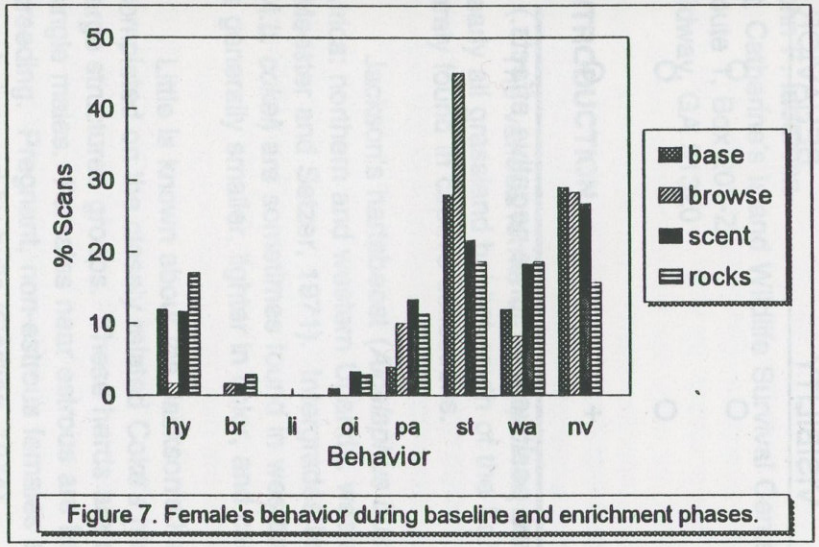

Figure 7. Female's behavior during baseline and enrichment phases.

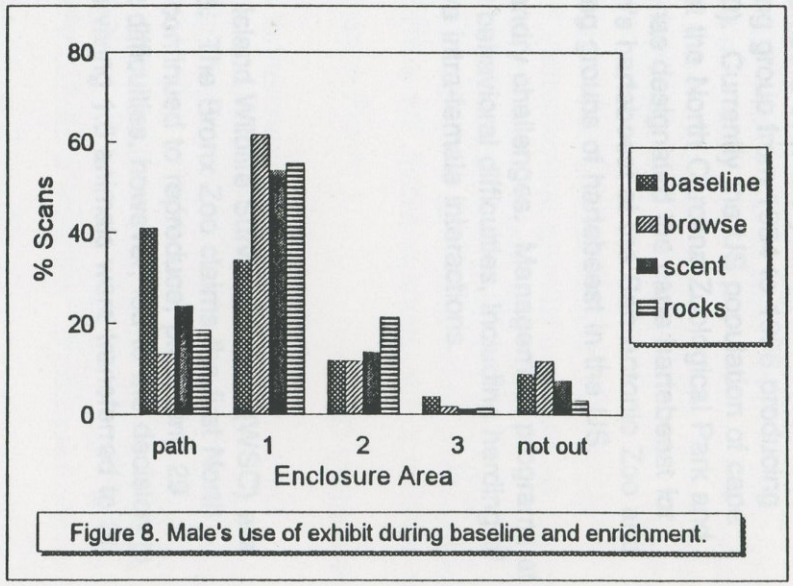

Figure 8. Male's use of exhibit during baseline and enrichment.

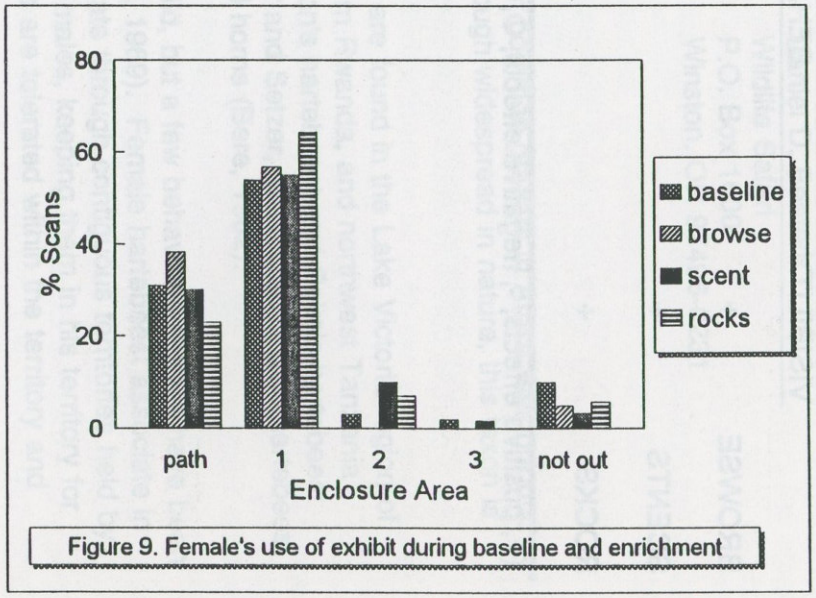

Figure 9. Female's use of exhibit during baseline and enrichment

TABLE 1. Summary of effects of enrichment treatments on behavior and visibility of each rhino.

	MALE		FEMALE	
	VISIBILITY	BEHAVIOR	VISIBILITY	BEHAVIOR
BROWSE	+	+	O	O
SCENTS	+	+	O	O
ROCKS	+	+	+	O

(+, positive effects; -, negative effects; O, no effects, or some positive and some negative effects.)