Innovative Techniques in Population Demography to Improve Captive Management of Western Lowland Gorillas

L.J. Faust,[1] S.D. Thompson,[1] J.E. Earnhardt,[1] M. Sherman,[1] E. Brown,[1] and S. Ryan[1]

Population management of captive species usually relies on an integration of genetics and demography to guide populations toward sustainability and stability. The captive population of western lowland gorillas (*Gorilla gorilla gorilla*), while well on its way to meeting these goals, has demographic issues that complicate management and threaten the future stability of the program. We use a stage-based demographic model to explore the population's demographic issues in light of current management and future goals.

Historically, gorillas were often exhibited as single individuals, a practice which has become undesirable because of the goal of providing humane, appropriate social and behavioral groups for animals kept in captivity. More recently, gorillas have been managed in a more naturalistic polygynous social system: a single male monopolizes a group of breeding and nonbreeding females for many years. As a result, an increasing number of males must be placed in all-male bachelor groups, a process which complicates both genetic and demographic management of the population. In highly sociable polygynous species such as gorillas, frequent introductions of males which might be necessitated by genetic management (because of the desire to maximize genetic representation), are difficult because the process of introduction is often lengthy and complicated. Thus single males must be left in breeding groups for long periods of time, and bachelor males are not offered opportunities to move into breeding groups very often. Bachelor groups are often difficult to form and maintain because of the behavioral challenges of introducing unfamiliar males, forming stable relationships, and coping with changes as individuals mature. Because of this they often require a great deal of energy and time from keeper and curatorial staff. Although the attitude is changing, institutions have been reluctant to take on the unique challenges of housing such groups, and preferred breeding groups to bachelor groups.

The bachelor male management issue occurs when the sex ratio is even (50% males:50% females), and is exacerbated by any bias towards males in the sex ratio. An earlier study of captive mammal populations (Faust and Thompson, 2000) has suggested that long random runs of bias in birth sex ratio may result in even more severe surpluses of males in certain time periods. The population of North American gorillas has experienced two such runs, with 10 years of female-biased birth sex ratios from 1970-1980, directly followed by 12 years of male-biased birth sex ratios from 1981-1992. These biases are still evident in the age cohorts from those time periods, with 25 males:36 females still living from the 1970s cohort, and 53 males:42 females still living from the 1980s cohort.

The possibility of experiencing such runs in the future makes population management and accurate planning for future space needs an important process. Previously there has been no need for demographic management because the population was far below its captive carrying capacity; as the population approaches this ceiling, currently set at over 400 individuals, it will be essential to fully consider the issue of surplus males in demographic analyses. We use a stage-based demographic model to address the management challenges of a polygynous species such as gorillas. The stage approach allows us to include a bachelor stage, an approach that is impossible in traditional age-based analyses. The model was parameterized with demographic data from the North American gorilla studbook (Wharton, 1999). We utilized Vensim, a visual modeling program that allows the user to conceptualize, parameterize, and simulate complex dynamic systems (Ventana Systems, 1999). We ran simulations of current population structure and management practices for 25 years. Our model confirms that, as the population continues growing, we can expect the bachelor male surplus to become more of a management problem. Our model projects the need to house 50 bachelor males in 25 years; this forecast was increased if sex ratio is biased at all towards males or if the breeding group sex ratio is altered from the baseline value of 1 male:4 females. Depending on the number of males housed in a bachelor group (usually 2-4), this means planning for between 10 and 30 bachelor groups in the upcoming years. Our model illustrates the continuing importance of this bachelor male issue in the future, and the need to continue planning and assessing our management and husbandry practices with bachelor male groups. By using a comprehensive model such as this every few years, we can make more accurate management decisions by anticipating the effects of sex ratio bias on population structure and the space needs for breeding and nonbreeding groups.

References

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[1]*Department of Conservation and Science, Lincoln Park Zoo, Chicago, Illinois*