

Publications on SSP Gorillas 2000-2008

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BEHAVIOR

Allen, M. (2006). A real life “King Kong” story: training an assertive 1.0 western lowland gorilla and making the most of Birmingham Zoo’s animal training course. *Animal Keeper’s Forum*, 33 (10): 438-443.

The continuous professional growth of Birmingham Zoo has led to a major focus on animal training with the intention of enhancing animal husbandry. The goal was to train Jamie, an assertive male gorilla, to accept an injection so as to immobilize him for a routine physical exam without darting him. As Jamie’s training has evolved, he has been able to transfer his assertive energy to constructive interactions with keepers.

Kuhar, C.W., Stoinski, T.S., Lukas, K.E., Maple, T.L. (2006). Gorilla behavior index revisited: age, housing and behavior. *Applied Animal Behavior Science*, 96 (3-4): 315-326.

This study assessed behavioral profiles of 119 male gorillas using the Gorilla Behavior Index (GBI) and paired this assessment with behavior data on 25 male gorillas from an ongoing analysis of multi-male gorilla groups in North America. This comparison was made to determine if the GBI could be predictive of behavior patterns, with the hope that this could eventually be utilized to aid in the management of multi-male gorilla groups. Two facts are evident from these data: (1) further work needs to be done to verify that the GBI is indeed assessing traits and not current behavioral states and (2) any relationships with behavior frequency are relatively weak.

Mallavarapu, S., Stoinski, T.S., Bloomsmith, M., Maple, T.L. (2006). Postconflict behavior in captive western lowland gorillas (*Gorilla gorilla gorilla*). *American Journal of Primatology*, 68: 789-801.

Postconflict (PC) behaviors, including reconciliation and consolation, have been observed in many primate and several nonprimate species. The majority of the affiliative interactions observed for both reconciliation and consolation were social proximity, which suggests that unlike most nonhuman primates, proximity, rather than physical contact, may be the main mechanism for resolving conflicts in western lowland gorillas.

Ross, S.R., Lukas, K.E. (2006). Use of space in a non-naturalistic environment by chimpanzees and lowland gorillas. *Applied Animal Behavior Science*, 96 (1-2): 143-152.

This study examined patterns of space use by 14 gorillas and six chimpanzees housed in similar non-naturalistic environments at Lincoln Park Zoo in Chicago, IL. Both species showed preferences for doorways, corners and the mesh barriers adjacent to keeper areas.

These data supplement data from wild populations of apes and provide information useful for those seeking to design new ape enclosures or renovate existing facilities.

Kuhar, C.W., Bettinger, T., Laudenslager, M. (2005). Salivary cortisol and behaviour in an all-male group of western lowland gorillas (*Gorilla g. gorilla*). *Animal Welfare*, 14 (3): 187-193.

Nearly 300 h of behavioural data and over 400 saliva samples were collected from three young adult, male western lowland gorillas to document the feasibility and effectiveness of using salivary cortisol as an index of HPA activation in gorillas. Although no clear relationship between behaviour and cortisol concentrations was established, these results indicate that salivary cortisol is an effective technique for documenting HPA activity over an extended period of time, as it allows for detection of diurnal variation as well as acute changes in salivary cortisol concentrations.

Crosby, J., Lukas, K.E. (2004). A case study of primiparous maternal and infant gorilla (*Gorilla gorilla gorilla*) behavior. *Journal of Applied Animal Welfare Sciences*, 7 (3): 145-162.

A primiparous mother and her infant were subjects of a longitudinal study at Lincoln Park Zoo. The infant was largely responsible for maintaining social proximity, rarely leaving the mother and frequently approaching her. Maternal affiliative and nonaffiliative behaviors fluctuated throughout the death. Over time, both decreased. The results of this study suggest that allowing flexibility in judging maternal conduct can be of benefit to successful gorilla husbandry.

Maestripereri, D., Ross, S.R. (2004). Sex differences in play among western lowland gorilla (*Gorilla gorilla gorilla*) infants: implications for adult behavior and social structure. *American Journal of Physical Anthropology*, 123 (1): 52-61.

Given the marked sexual dimorphism in gorilla body size and the role assumed by the male in protecting the group from conspecifics and predators, the motor-training hypothesis of play predicts that male infants should exhibit higher frequencies of social play than female infants, and that males should prefer to play with other males. Given that adult female gorillas are strongly attracted to adult breeding males and form only weak social bonds with unrelated adult females, the social-relationship hypothesis of play predicts that female infants should prefer to play with males. Consistent with the hypotheses, male infants played more than female infants did, and both male and female infants preferred to play with males rather than with females.

Stoinski, T.S., Kuhar, C.W., Lukas, K.E., Maple, T.L. (2004). Social dynamics of captive western lowland gorillas living in all-male groups. *Behaviour*, 141: 169-195.

This study examined the social interactions of 25 male western lowland gorillas living in nine captive all-male groups. The results of this study are similar to those found for all-male groups of mountain gorillas in the wild and demonstrate that all-male groups can be a cohesive social unit in this species. They also raise the questions of why all-male groups have

rarely been observed in wild populations and how social, ecological and anthropogenic factors influence male sociality.

Stoinski, T.S., Lukas, K.E., Kuhar, C.W., Maple, T.L. (2004). Factors influencing the formation and maintenance of all-male gorilla groups in captivity. *Zoo Biology*, 23: 189-203.

The social housing of males is of particular importance for captive managers of polygynous species. In this work, nine areas are highlighted that are believed to be important to the successful formation and maintenance of all-male gorilla groups. It is hoped that by identifying bachelor males early in life and establishing cooperative management plans across institutions, zoos will be able to provide beneficial, long-term social situations for all male gorillas in captivity.

Brock-Pfeiffer, D. 2003. An update on Little Rock Zoo's multi-male gorilla group: ten years and counting. *Gorilla Gazette*, 16(1): 31-32.

This article details the successes and pitfalls of managing a multi-male gorilla group over a ten-year period. The learning experience of managing this group has led to insight about dealing with multiple gorilla males, which may inform management of other similar groups.

Lukas, K.E., Hoff, M.P., Maple, T.L. (2003). Gorilla behavior in response to systematic alternation between zoo enclosures. *Applied Animal Behavior Science*, 81 (4): 367-386.

To determine the effects of relative novelty on captive gorilla behavior, the regular alternation of two groups between complex naturalistic enclosures was studied at Zoo Atlanta. Gorillas increased locomotion, social distance, use of grass areas, and visibility to the public in their "Away" exhibit compared to their "Home" exhibit. Regularly alternating gorillas between zoo exhibits is a form of environmental enrichment that can increase gorillas' use of exhibit space and increase activity level.

Lukas, K.E., Stoinski, T.S., Burks, K., Snyder, R., Bexell, S., Maple, T.L. (2003). Nest building in captive *Gorilla gorilla gorilla*. *International Journal of Primatology*, 24 (1): 103-124.

Nest building was observed in 17 gorillas during three periods: summer baseline, winter baseline, and winter treatment, in which the amount of available nesting material was doubled. The results suggest that providing adequate materials to captive gorillas for nest building may facilitate performance of species-typical nest-building, minimize competition among individuals for nesting sites and materials, and permit individual thermoregulation.

Stoinski, T.S., Hoff, M.P., Maple, T.L. (2003). Proximity patterns of female western lowland gorillas during the six months after parturition. *American Journal of Primatology*, 61: 61-72.

Social partner preferences were examined in captive western lowland mothers during the six months after parturition. Juveniles and females were the primary members of the new

mothers' social network. Given current hypotheses that infanticide may be limited in western lowland gorillas, the social partner preferences observed here may be indicative of patterns in wild populations.

Cox, C., DuBois, T., Renzetti, V. 2002. Effects of supplemental feeding enrichment on gorilla (*Gorilla gorilla gorilla*) activity at the Los Angeles zoo. *American Journal of Primatology*, 57: 83.

In order to give greater challenge to captive gorillas, the effects of providing three types of food-seeking/feeding opportunities in addition to standard provisioning of leafy browse and scattered safflower seeds was tested. Four gorillas regularly engaged in R&R and there was a relationship between enrichment items and its frequency. As all supplementary enrichment increased the time spent in foraging and feeding, these gorillas appear to be utilizing R&R to prolong the sensations associated with treats rather than as an activity associated with boredom.

Stoinski, T.S., Czekala, N., Lukas, K.L., Maple, T.L. (2002). Urinary androgen and corticoid levels in captive, male western lowland gorillas (*Gorilla g. gorilla*): age- and social group-related differences. *American Journal of Primatology*, 56: 73-83.

Urinary androgen and corticoid levels were measured for 52 captive male western lowland gorillas to examine age-related variance and potential differences resulting from various social situations. The increased levels of corticoids in solitary-housed males suggest this management strategy might not be optimal, although more data are needed. Additionally, the significantly greater levels of androgens and corticoids in young adult male gorillas may present management challenges, and thus zoos may need to consider increasing the flexibility of their current management practices with respect to males.

Stoinski, T.S., Hoff, M.P., Maple, T.S. (2002). The effects of structural, environmental, and social variables on visibility in western lowland gorillas. *Environment and Behavior*, 34: 493-507.

The current study evaluated how structural preferences, temperature, and social factors affected the visibility of four groups of gorillas to the public. Temperature and visibility were linearly related, with increasing temperatures corresponding with decreasing visibility.

Burks, K., Bloomsmith, M., Forthman, D., Maple, T.L. (2001). Managing the socialization of an adult male gorilla (*Gorilla gorilla gorilla*) with a history of social deprivation. *Zoo Biology*, 20 (5): 347-358.

In this study of one male gorilla with a 30-year history of social deprivation, the rate of aggression was assessed quantitatively during a four-step socialization procedure. This four-step socialization process was found to be effective in managing aggression in this case. In addition to documenting the successful socialization of a socially deprived adult male gorilla, the empirical process used in this case argues for scientific management of other introductions.

Ross, S.K., Barger, N., Ganas, J., Lukas, K.E., Nichols, C., Megna, N., Stoinski, T., Maestripieri, D. (2001). Maternal scaffolding of offspring behavior in Western lowland gorillas. *American Journal of Primatology*, 54 (1): 31.

This study investigated variability in maternal behavior, with particular emphasis on maternal encouragement/discouragement of offspring behavior (scaffolding), in lowland gorillas. These findings suggest that mothers do not take an active role in shaping the behavior of their infants, particularly with older offspring, but that infants are quite active in requesting the mother's participation in their activities and in observing and repeating their mother's behavior.

Stoinski, T.S., Hoff, M.P., Maple, T.L. (2001). Habitat use and structural preferences of captive western lowland gorillas: the effect of environmental and social variables. *International Journal of Primatology*, 22 (3): 431-447.

This study documented four years of habitat use and structure preferences of western lowland gorillas at Zoo Atlanta. There was no difference in habitat use and structural preferences due to age, sex, and rearing history, but social factors appear to play a role. The results are similar to those found a decade earlier in the same population and to other studies of space use in apes, but are the first to include significant temperature effects.

Stoinski, T.S., Hoff, M.P., Lukas, K.E., Maple, T.L. (2001). A preliminary behavioral comparison of two all-male gorilla groups. *Zoo Biology*, 20 (1): 27-49.

This study examined the behavioral profiles of two all-male groups of captive lowland gorillas to provide information on this type of housing situation. The behavioral profiles of the animals in this study were similar to those found in bachelor groups of wild mountain gorillas.

Gibeault, S., MacDonald, S.E. (2000). Spatial memory and foraging competition in western lowland gorillas (*Gorilla gorilla gorilla*). *Primates*, 41 (2): 147-160.

Spatial memory and foraging competition were investigated in three mother/offspring pairs of western lowland gorillas using a naturalistic foraging task at the Toronto Zoo. The high accuracy of five of the subjects and the lack of a consistent adjacency pattern suggest that the animals did in fact use spatial memory.

COGNITION

Anderson, U., Stoinski, T.S., Bloomsmith, M., Smith, A., Marr, M.J., Maple, T.L. (2006). Aging, relative numerosness judgment and summation in young and old western lowland gorillas. *Journal of Comparative Psychology*, 119: 285-295.

The relationship between age, relative numerosness judgment, and summation was investigated in 11 Western lowland gorillas (*Gorilla gorilla gorilla*). All gorillas selected the larger pair of objects more often than chance, and the old were less accurate and slower than were the young. For most gorillas, performance in relative numerosness judgment with

training and summation was comparable with previous reports in chimpanzees and orangutans.

Poss, S., Kuhar, C.W., Stoinski, T.S., Hopkins, B. (2006). Differential use of attentional and visual communicative signaling by orangutans (*Pongo pygmaeus*) and gorillas (*Gorilla gorilla*) in response to the attentional status of a human. *American Journal of Primatology*, 68: 978-992.

This study investigated the communicative abilities of 10 orangutans and seven western lowland gorillas, and particularly focused on their sensitivity to the attentional state of a human experimenter when choosing from a repertoire of both auditory and visual communication strategies. The overall results indicate that both gorillas and orangutans are sensitive to the attentional state of a human experimenter and use appropriate communicative signals to gain that individual's attention.

Hopkins, W.D., Stoinski, T.S., Lukas, K.E., Ross, S.R., Wesley, M.J. (2003). Comparative assessment of handedness for a coordinated bimanual task in chimpanzees (*Pan*), gorillas (*Gorilla*), and orangutans (*Pongo*). *Journal of Comparative Psychology*, 117 (3): 302-308.

Hand preferences for a coordinated bimanual task were assessed in a sample of 31 captive gorillas and 19 captive orangutans and were compared with chimpanzee hand preferences in subjects that were matched on the basis of age, sex, and rearing history. The results indicate significant species differences with chimpanzees showing population-level right-handedness and orangutans showing population-level left-handedness. The gorillas showed a nonsignificant trend toward right-handedness.

Vonk, J., MacDonald, S. (2002). Natural concepts in a juvenile gorilla at three levels of abstraction. *Journal of the Experimental Analysis of Behavior*, 78: 315-332.

In the present investigation, a young captive female gorilla was trained at three levels of abstraction (concrete, intermediate, and abstract) involving sets of photographs representing natural categories (e.g., orangutans vs. humans, primates vs. nonprimate animals, animals vs. foods). The gorilla acquired discriminations at all three levels of abstraction, but showed unambiguous transfer only with the concrete and abstract stimulus sets.

Stoinski, T., Wrate, J., Ure, N., Whiten, A. (2001). Imitative learning by captive western lowland gorillas (*Gorilla gorilla gorilla*) in a simulated food-processing task. *Journal of Comparative Psychology*, 115(3): 272-281.

Although field studies have suggested the existence of cultural transmission of foraging techniques in primates, identification of transmission mechanisms has remained elusive. To test experimentally for evidence of imitation in the current study, gorillas were exposed to an artificial fruit foraging task. The gorillas' responses were most similar to those of chimpanzees.

HEALTH

Hope, K., Murray, S., Harris, C., Sanchez, C., Boedeker, N., Rosenthal, S., Kersey, D., Murphy, H., Kutinsky, I., Padilla, L. 2008. Brain natriuretic peptide as novel diagnostic and prognostic indicator of cardiac disease in gorillas: two case reports.

In a preliminary study to determine the value of BNP as a diagnostic test and prognostic indicator for cardiac disease in gorillas, banked blood from the two adult male gorillas at the Smithsonian National Zoological Park was analyzed for BNP levels and compared with ultrasound examinations taken at the same time. The retrospective analysis of BNP levels in these two cases suggests that BNP may be a novel and effective method of diagnosing and monitoring cardiac disease in gorillas.

Mylniczenko, N.D., Murrey, S.S., Smith, S., Sewall, L.W., Facchini, F. 2008. Management of a uterine leiomyoma in a western lowland gorilla (*Gorilla gorilla gorilla*). Presented at American Association of Zoo Veterinarians Conference, Los Angeles, CA.

A 46-yr-old female western lowland gorilla presented for metrorrhagia. Uterine fibroid embolization (UFE) was subsequently performed and the animal had no complications from the procedure. At a 4-mo recheck, the uterine mass had a significant reduction in size and the animal continued to be amenorrheic. UFE appears to be a minimally invasive technique that can potentially halt ongoing menorrhagia and can be an effective alternative to treating uterine leiomyomas without surgical intervention.

Spelman, L.H., MGVP veterinary staff. 2008. Orphaned mountain gorillas: now there are four. Presented at American Association of Zoo Veterinarians Conference, Los Angeles, CA.

After an infant mountain gorilla was confiscated from poachers in December 2004, MGVP, Inc. and their main conservation partners, DFGFI (Dian Fossey Gorilla Fund International), ORTPN (Office Rwandais de Tourisme et Parcs Nationaux), ICCN (Institut Congolaise pour la Conservation de la Nature) and IGCP (International Gorilla Conservation Programme.) formed a scientific committee to make recommendations for the disposition of this gorilla. The partners ultimately agreed to provide short-term housing and veterinary care for orphaned gorillas representing two subspecies—mountain and eastern plains, or Grauer's, gorillas. The cases histories of this gorilla and three additional ones that have since been confiscated show that with proper veterinary care, this species can survive in captivity. But difficult questions remain regarding their future. After living in close contact with people and another gorilla subspecies, they may be carriers of infections not yet identified. Whether or not the orphans exhibit the full range of normal gorilla behaviors is another important consideration. Even if accepted by a wild gorilla family group, their reactions to human visitors may be unpredictable. The partnership has also established an orphaned gorilla scientific technical committee. The committee is considering all options for the orphans, including reintroduction and long-term sanctuary housing.

Baitchman, E.J., Calle, P.P., Clippinger, T.L., Deem, S.L., James, S.B., Raphael, B.L., Cook, R.A. (2006). Preliminary evaluation of blood lipid profiles in captive western lowland gorillas (*Gorilla gorilla gorilla*). *Journal of Zoo and Wildlife Medicine*, 37 (2): 126-129.

Published serum cholesterol values in captive western lowland gorillas are much higher than human ranges, with a national mean of 7.36 mmol/L (284 mg/dl, $n=863$). Establishment of a database of blood lipid values for captive gorillas with correlative analysis of animals with known atherosclerosis status may help to identify sensitive predictors of coronary heart disease risk.

Schmidt, D., Ellersieck, M.R., Cranfield, M.R., Karesh, W.B. (2006). Cholesterol values in free-ranging gorillas (*Gorilla gorilla gorilla* and *Gorilla beringei*) and Bornean orangutans (*Pongo Pygmaeus*). *Journal of Zoo and Wildlife Medicine*, 37 (3): 292-300.

This focus of this study was to determine if cholesterol values in captive apes were typical, influenced by captive management, or both. Mountain gorillas did not differ significantly from free-ranging western lowland gorillas in cholesterol, triglyceride, high-density lipoprotein cholesterol, or low-density lipoprotein cholesterol concentrations, indicating mountain gorilla values could be a model for western lowland gorillas. The higher total cholesterol and low-density lipoprotein cholesterol concentrations in captive apes may predispose them to cardiovascular disease and might be attributed to diet, limited energy expenditure, and genetics.

Blasier, M., Travis, D., Barbiere, R. (2005). Retrospective evaluation of measles antibody titers in vaccinated captive gorillas (*Gorilla gorilla gorilla*). *Journal of Zoo and Wildlife Medicine*, 36 (2): 198-203.

Retrospective analyses of banked serum samples and medical records from captive gorillas at Lincoln Park Zoo showed that vaccination of gorillas with a human vaccine induced antibody production. This information is useful in the assessment of vaccination protocols for captive gorillas and in the implementation of preventive care in wild gorilla populations.

Fontenot, D., Terrell, S., Miller, M., Robbins, P.K., Stetter, M., Weber, M. (2005). *Clostridium septicum* myositis in a western lowland gorilla (*Gorilla gorilla gorilla*). *Journal of Zoo and Wildlife Medicine*, 36 (3): 509-511.

A 10-yr-old male gorilla with a history of conspecific bite wounds was evaluated for acute onset of depression, anorexia, and right hemiparesis. Immunohistochemical fluorescent antibody staining of muscle from the wound site was positive for *Clostridium septicum*.

Liang, D., Alvarado, T.P., Oral, D., Vargas, J.M., Denena, M.M., McCulley, J.P. (2005). Ophthalmic examination of the captive western lowland gorilla (*Gorilla gorilla gorilla*). *Journal of Zoo and Wildlife Medicine*, 36 (3): 430-433.

This study examined the captive western lowland gorilla eye as compared and contrasted with the human eye. This study suggests important similarities between western lowland

gorilla and human eyes. These similarities may allow diagnostics, techniques, and equipment for human eye surgery, such as those used for cataract extraction and intraocular lens implantation, to be successfully utilized for gorillas.

Remis, M.J., Dierenfeld, E.S. (2004). Digesta passage, digestibility, and behavior in captive gorillas under two dietary regimens. *International Journal of Primatology*, 25: 825-845.

This study examined digestive processes via chemical cobalt and chromium markers to track liquid and solids, as they passed through the guts of gorillas at the San Francisco Zoo (SFZ). In addition, the effects of variation in captive diets on intake, digesta passage, digestion and behavior were examined. The results permit a better understanding of the relationships of digestive processes to adaptation and dietary flexibility in the wild and also inform the development of dietary recommendations to improve the well-being of captive gorillas.

Whittier, C.A., Horne, W., Slenning, B., Loomis, M., Stoskopf, M.K. (2004). Comparison of storage methods for reverse-transcriptase PCR amplification of rotavirus RNA from gorilla (*Gorilla g. gorilla*) fecal samples. *Journal of Virological Methods*, 116 (1): 11-17.

Detection of enteric viral nucleic acids in preserved gorilla fecal specimens was investigated using reverse transcription polymerase chain reaction (rt-PCR). Only samples stored in guanidine thiocyanate (GT) buffer gave 100% positive results at 180 days. It is recommended that fecal samples be collected in GT for viral RNA analysis.

Neiffer, D.L., Rothschild, B.M., Marks, S.K., Urvater, J.A., Watkins, D.I. (2001). Reactive arthritis in a juvenile gorilla (*Gorilla gorilla gorilla*): effective management with long-term sulfasalazine therapy. *Journal of Zoo and Wildlife Medicine*, 32(4): 539-551.

A juvenile western lowland gorilla experienced recurrent fever, lethargy, diarrhea, and/or arthritis starting at age 6 months. At age 41 months, reactive arthritis was diagnosed. Sulfasalazine therapy effectively managed reactive arthritis in this gorilla and should be considered for similarly frequently affected animals.

HUSBANDRY

Williams, T.E. (2006). An accidental ape encounter. *Gorilla Gazette*, 50-51.

This article summarizes an incident where a male gorilla accidentally broke into an adjacent chimp enclosure. It describes the effects of this encounter on the animals and hopes to inform other institutions so they may avoid similar experiences.

Hoppe, P. (2004). Gorilla feeder bag. *Animal Keeper's Forum*, 31 (9): 392-396.

The feeder bag was made to encourage increased effort in obtaining food, similar to a puzzle feeder, but strong enough to withstand the forces of a male gorilla. Bags are mounted in the exhibit, and are used three days a week, to offer variety in food presentation.

POPULATION MANAGEMENT

Zhang, Y.W., Morin, P.A., Ryder, O.A., Zhang, Y.P. 2001. A set of human tri- and tetra-nucleotide microsatellite loci useful for population analyses in gorillas (*Gorilla gorilla gorilla*) and orangutans (*Pongo pygmaeus*). *Conservation Genetics*, 2 (4): 391-395.

The large number of microsatellite loci, together with their high variability, makes them potentially important tools for a wide variety of studies requiring Mendelian markers. In this study, the screening results of microsatellite loci in gorilla and orangutans are reported using human primers. All of the microsatellite loci from DNA extracted from one or several plucked hairs were successfully amplified. This technique is currently being used in studies of wild primates.

REPRODUCTION

Atsalis, S., Margulis, S. (2006). Sexual and hormonal cycles in geriatric *Gorilla gorilla gorilla*. *International Journal of Primatology*, 27: 1663-1687.

This study presents results from a nationwide zoo-based study on behavioral and hormonal changes in female western gorillas. This study demonstrates that both perimenopause and menopause characterize aged female gorillas, which may experience a postreproductive lifespan of >25% of their lives. Continued study of aging apes is warranted, and apes may serve as models for age related reproductive changes in humans.

Loskutoff, N., Bowsher, T., Chatfield, J., Stones, G., Ramey, J.W., Zhang, L., Putman, M., Boland, C., Wharton, D., Gardner, D.K. (2004). Ovarian stimulation, transvaginal, ultrasound-guided oocyte retrieval, ICSI and blastocyte production in sequential media in the western lowland gorilla (*Gorilla gorilla gorilla*). *Reproduction, Fertility and Development*, 16 (2): 225.

Project Summary Pending

Atsalis, S., Margulis, S., Bellem, A., Wielebnowski, N. (2004). Sexual behavior and hormonal estrus cycles in aged lowland gorillas (*Gorilla gorilla*). *American Journal of Primatology*, 62 (2): 123-132.

To evaluate whether observed cycles in proceptive behavior in aging lowland gorilla females (age 40+) at Brookfield Zoo were driven by ovarian activity, monthly behavioral data were compared to estradiol and progesterone cycles based on fecal hormone assessments. The

value of this longitudinal study is in obtaining reproductive profiles of primate females that are approaching maximum lifespan. This pilot study is part of a larger research project on reproductive senescence that will include other captive females > 35 years old, a population that is rapidly increasing in North American zoos as gorillas continue to age.

Ryan, S., Thompson, S., Roth, A., Gold, K. (2002). Effects of hand-rearing on the reproductive success of western lowland gorillas in North America. *Zoo Biology*, 21: 389-401.

This study sought to assess the potential effects of hand-rearing by evaluating the relationships among rearing type and reproductive success in the American Zoo and Aquarium Association's Species Survival Plan® for western lowland gorillas. Mother-reared (MR), zoo-born females produced more offspring and used more reproductive opportunity than hand-reared (HR) females, whereas rearing had no effect on the reproductive success of zoo-born males. Moreover, MR and partially hand-reared (PHR) females were more likely to become nurturing mothers themselves.

VISITOR STUDIES

Lukas, K.E., Ross, S.R. (2005). Zoo visitor knowledge and attitudes toward gorillas and chimpanzees. *Journal of Environmental Education*, 36 (4): 33-48.

The authors conducted an evaluation of zoo visitor knowledge and conservation attitudes toward African apes at Chicago's Lincoln Park Zoo. Higher education levels, and better performance on knowledge questions, were associated with increased knowledge of ape behavior and lower negativistic and dominionistic attitudes toward apes. These findings underscore the importance of both formal and informal educational experiences in improving knowledge of and attitudes toward African apes.