# Prosimian Taxon Advisory Group
# Mixed-Species Exhibit Manual
# 2011



ASSOCIATION OF ZOOS & AQUARIUMS

# Prosimian TAG Mixed Species Manual

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# INTRODUCTION

## BACKGROUND INFORMATION

After the first ever *Eulemur* SSP Masterplan was published in 2007, many institutions and managers began to ask the *Eulemur* SSP steering committee members how they could incorporate *Eulemur* into their prosimian exhibits to create more dynamic exhibits with multiple species. Also, as space is always at a premium, the Prosimian TAG began to ask how they could create more space for the managed species by utilizing the available exhibit space with multiple exhibits. The TAG was interested in determining which species could cohabitate peacefully or with minor intervention, and also, if reproduction was feasible in mixed-species exhibits. After the 2008 Prosimian TAG meeting, the TAG decided to implement a survey of all prosimian holders in AZA to determine if some of these questions could be answered.

Mixed lemur exhibits have become very popular within the zoo community during the last few years, with more and more zoos planning to set up similar exhibits in the near future (Webster 2000). In this manual, there are many factors described that contribute to success of mixed species exhibits with prosimians. Some have found that the success of a mixed exhibit depends on the group structure and individual characters of the animals involved (Zeigler 2002) and that the chance of success may increase if breeding does not occur in the first year (Bollen 1996), if individuals in the group are single sex, or if no reproduction occurs in the exhibit at all. The need for mixed-species exhibits in the future is evident. Increasing co-housing of some species can increase space for expanding captive populations (Coffman 1996). With limited breeding occurring in some species or individuals, mixed species bachelor groups are one method of managing extra males and can serve as a genetic reservoir for the population (Romano and Vermeer 2003). Another advantage of mixing prosimians is that it frees up space, allowing new species to be brought into the collection (Webster 2000), particularly those that are priorities to the TAG.

There are many considerations that should be taken when deciding to create a mixed-species exhibit with prosimians, such as species that are in need of increased housing, propagation, and recommendations by prosimian TAG RCP, SSP coordinators, and studbook keepers, availability, diurnal verses nocturnal, and many others (Villers and Lent 1993). Combining animals that occupy the same ecological niche should be avoided (Manna et al. 2007). Not only should the various species be considered thoroughly in advance, but also individual animals' temperaments must be considered and monitored closely to make the process successful (Webster 2000). Finally, any institution thinking of setting up a mixed-species exhibit, especially where the mixing of more than two species is involved, should not underestimate the amount of keeper and staff time needed, not only to do proper introductions between individuals and groups but also to continually ensure that things run smoothly as seasons and group dynamics change (Webster 2000).

The TAG hopes that this manual will be a useful reference for all institutions considering adding prosimians to their collection, to those that hope to increase their collection, or even simply enrich their animals, or to those re-evaluating their space by creating new dynamic exhibits.

## HOW TO USE THIS MANUAL

1) There are three tables listing **successful** mixed-species exhibits involving prosimians. The first table, "Table of Successful Mixed Prosimian Groups," summarizes groups that include multiple species of prosimian. It is organized alphabetically by common name. This table may be useful if you are planning to mix multiple prosimian species in a single exhibit. The second and third tables summarize data on exhibits that mixed prosimians with non-prosimians. The second table is organized alphabetically by prosimian common name and may be useful if you plan to introduce non-prosimians to an existing prosimian group. The third table is organized alphabetically by non-prosimian common name and may be useful if you plan to introduce prosimians to a non-prosimian exhibit. Each table lists the institution that housed each mixed-species group.

2) Detailed summaries of the successful groups listed alphabetically by institution can be found after the tables. These summaries include details on introduction, group composition, and husbandry.

3) Summaries of unsuccessful mixed-species groups are also listed alphabetically by institution. These include details on group composition and any additional information regarding why the groups were unsuccessful.

4) Survey results summarize how zoo managers define a successful mixed-species exhibit, as well as the factors that are believed to contribute to the success or break-down of a mixed-species group.

5) The fourth table lists captive mixed-species groups that are found in literature. However, this does not necessarily imply that groups were successful.

6) The fifth and final table summarizes species that are found sympatrically in the wild. Species that naturally coexist may be more likely to form successful mixed-species groups in captivity, although this may not always be the case.

7) The final discussion summarizes factors to consider when planning a mixed-species exhibit.

8) Appendix 1 provides an observation protocol that can be used to study social interactions in a mixed-species group. Use this protocol to establish concrete data and effectively determine how well your prosimian species are acclimating to their new exhibit. This protocol can be modified to fit the needs of different institutions.

   Appendix 2 summarizes results from studies of mixed-species introductions at Point Defiance Zoo and Aquarium in Tacoma, WA and Disney's Animal Kingdom in Orlando, FL. Each institution used the same or similar methods as those described in Appendix 1.

# SURVEY METHODS

Surveys were collected by phone and email from September 2008 through February 2009. The survey form and questions are shown below. After surveys were collected, data were summarized by question, and the open-ended questions were coded into response categories.

1. Person Conducting Interview _____
2. Date _____
3. Institution Information
    a. Institution Name _____
    b. Name of person completing interview_____
4. General mixed-species exhibit information
    a. Does your institution currently house/exhibit prosimians in a mixed-species setting? (Exhibits with at least 1 species of prosimian and another species) **Yes/No**
    b. Has your institution previously housed/exhibited prosimians in a mixed-species setting different than your current exhibit/s? (Exhibits with at least 1 species of prosimian and another species) **Yes/No**
    (**If No for both, you do not need to answer any more questions**)
5. Current mixed-species exhibits of prosimians at your institution.
    Questions 5 & 6 will be used to describe the mixed-species grouping that your institution **currently** manages. Historical information about this group will be requested in subsequent questions. Answer question 5 & 6 for each **current** group/exhibit. (Include prosimian species as well as other non-prosimian species in description)
    Group Identification:

| Species | Number/Sex | Current Age | Breed Rec | Method of Contraception |
|---|---|---|---|---|
| | | | | |
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| | | | | |
| | | | | |

    a. How long has this group successfully been mixed (include dates if possible)?
    b. How do you describe success, in general, in a mixed-species prosimian group?
    c. How do you describe success for this particular group?
    d. Is this group mixed at all times? **Yes/No**
    e. If not together all the time, what are the reasons that you separate the group? (Choose 1 or more)
        - Daily feeding
        - Night housing
        - Seasonal housing

        i. Are there any other reasons for separating these individuals?
        **Yes / No**

1. If Yes- Describe.

ii. When the group is reunited after being separated does aggression occur? **Yes / No**
   1. If Yes- Describe the situation of separation.
   2. Choose the level(s) of aggression present.
      - Non-contact aggression (chasing, threat posture, stink fight, etc.)
      - Contact aggression (biting, pouncing, cuffing, etc)
      - Displacement
      - Vocalizations
   3. Describe the duration, or length of time, this aggression is present.

f. Have individuals ever successfully copulated or exhibited reproductive behavior, while housing in the mixed species exhibit? (This question is only applicable to exhibits with both sexes.) **Yes / No**
   i. If Yes- has pair successfully conceived or become pregnant while being housed in the mixed species exhibit? **Yes / No**
   ii. If Yes- has pair successfully given birth while being housed in the mixed species exhibit? **Yes / No**
   iii. If Yes- has pair successfully reared offspring in mixed-species setting? **Yes / No**
   iv. If No- Is pair removed from group for breeding season? **Yes / No**
      1. If Yes- Have they copulated outside of mixed-species setting? **Yes / No**
      2. If Yes- Have they successfully conceived or become pregnant outside of the mixed-species setting? **Yes / No**
      3. If Yes- Has pair given birth when outside of mixed-species setting? **Yes / No**
      4. If Yes- Has pair successfully reared offspring outside of the mixed-species setting? **Yes / No**
      5. If Yes- what phase of reproductive activity were pair and/or offspring reintroduced back to mixed-species setting and describe reintroduction (aggression, length of time of separation, age of offspring, etc.)?
      6. Are there any other situations during breeding season when an individual is separated from group (male, female and infant, individual from other species, etc.)? **Yes / No**
         a. If Yes- Describe.

g. Have you changed the composition of this group since it was first created (i.e. animals out, new individuals introduced in, birth/death)? **Yes / No**

1. If Yes- Describe the history of the composition changes of this group. Include approximate dates if possible, as well as description of introduction of new animals to group.
2. If Yes- Were there changes in the stability of the group?
   **Yes / No**
   1. If Yes- Describe.

6. What 3 things (in your opinion) contribute to the success of this particular group?
   a. _____
   b. _____
   c. _____
7. Describe the composition of past mixed-species groups. This should include information for groups at your institution that were not included in the description of answer 5g. Describe changes through time of the groups.

| Species | Number/Sex | Age when broken up | Breed Rec | Method of Contraception |
|---|---|---|---|---|
| | | | | |
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Dates of each grouping/length of time together:

a. Are there mixed-species groups that your institution attempted to create that were not successful? Yes / No
   i. If Yes- Describe.

| Species | Number/Sex | Age when attempted | Method of Contraception |
|---|---|---|---|
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8. What 3 things (in your opinion) contribute to the breaking apart (or failure) of a mixed-species prosimian group?
   a. _____
   b. _____
   c. _____

# TABLE OF SUCCESSFUL MIXED PROSIMIAN GROUPS

| Species | Lemur Species Mixes (Current and Past) | Institutions |
|---|---|---|
| Aye-aye (*D. madagascariensis)* | Coquerel's mouse lemur (*M. coquereli*) | Denver Zoo; Duke Lemur Center; San Francisco Zoo |
| | pygmy loris (*N. pygmaeus*) | Duke Lemur Center |
| | slow loris (*N. coucang*) | Duke Lemur Center |
| Black lemur *(E. m. macaco)* | black-and-white ruffed lemur *(V. variegata)* | Bramble Park Zoo; Dallas Zoo; Duke Lemur Center; Hattiesburg Zoo; Little Rock Zoo; Louisville Zoo; Santa Ana Zoo; San Francisco Zoo; Sedgwick County Zoo |
| | blue-eyed black lemur (*E. m. flavifrons*) | Duke Lemur Center; Little Rock Zoo; San Francisco Zoo |
| | crowned lemur *(E. coronatus)* | Duke Lemur Center; Hattiesburg Zoo |
| | mongoose lemur (*E. mongoz*) | Brookfield Zoo |
| | red-collared brown lemur (*E. collaris*) | Dallas Zoo; Duke Lemur Center |
| | red ruffed lemur *(V. rubra)* | Dallas Zoo; Hattiesburg Zoo; Louisville Zoo; Miami Metrozoo; Roger Williams Park Zoo; San Francisco Zoo |
| | ring-tailed lemur *(L. catta)* | Bramble Park Zoo; Brookfield Zoo; Dallas Zoo; Hattiesburgh Zoo; Henson Robinson Zoo; Little Rock Zoo; Louisville Zoo; Miami Metrozoo; Point Defiance Zoo; Saint Louis Zoo; Santa Ana Zoo; San Francisco Zoo; Sedgwick County Zoo |
| | white-fronted lemur (*E. albifrons*) | Duke Lemur Center |
| Black-and-white ruffed lemur *(V. variegata)* | black lemur *(E. m. macaco)* | Bramble Park Zoo; Dallas Zoo; Duke Lemur Center; Little Rock Zoo; San Francisco Zoo; Santa Ana Zoo; Sedgwick County Zoo |
| | blue-eyed black lemur (*E. m. flavifrons*) | Bronx Zoo; Little Rock Zoo; San Francisco Zoo |
| | brown lemur (*E. fulvus*) | Omaha's Henry Doorly Zoo |
| | crowned lemur *(E. coronatus)* | Chehaw Wild Animal Park; Hattiesburg Zoo |
| | greater bushbaby (*Otolemur sp.*) | Santa Ana Zoo |
| | red-collared brown lemur (*E. collaris*) | Binder Park Zoo; Brevard Zoo; Dallas Zoo; Duke Lemur Center |
| | red ruffed lemur *(V. rubra)* | Buffalo Zoological Gardens; Chehaw Wild Animal Park; Dallas Zoo; Greenville Zoo; Hattiesburg Zoo; Louisville Zoo; Micke Grove Zoo; Omaha's Henry Doorly Zoo; San Francisco Zoo; Woodland Park Zoo; Zoo Atlanta |
| | red-fronted lemur (*E. rufus*) | Pueblo Zoo |

| Species | Lemur Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | ring-tailed lemur *(L. catta)* | Binder Park Zoo; Bramble Park Zoo; Brevard Zoo; Busch Gardens Tampa; Chehaw Wild Animal Park; Cheyenne Mountain Zoo; Dallas Zoo; Detroit Zoological Society; Duke Lemur Center; Hattiesburg Zoo; Jacksonville Zoo; Little Rock Zoo; Louisville Zoo; Micke Grove Zoo; Pueblo Zoo; San Francicso Zoo; Santa Ana Zoo; Sedgwick County Zoo; Woodland Park Zoo; Zoo Atlanta |
| Blue-eyed black lemur *(E. m. flavifrons)* | black lemur (*E. m. macaco*) | Duke Lemur Center; Little Rock Zoo; San Francisco Zoo |
| | black-and-white ruffed lemur (*V. variegata*) | Bronx Zoo; Little Rock Zoo; San Francisco Zoo |
| | red ruffed lemur *(V. rubra)* | Cameron Park Zoo; Duke Lemur Center; Indianapolis Zoo; San Francisco Zoo |
| | ring-tailed lemur *(L. catta)* | Cameron Park Zoo; Cleveland Metroparks Zoo; Duke Lemur Center; Little Rock Zoo; Oakland Zoo; San Francisco Zoo |
| | Sanford's brown lemur (*E. sanfordi*) | Duke Lemur Center |
| Brown lemur (*E. fulvus)* | black-and-white ruffed lemur (*V. variegata*) | Omaha's Henry Doorly Zoo |
| | red-fronted brown lemur (*E. rufus*) | Duke Lemur Center |
| | red ruffed lemur (*V. rubra*) | Omaha's Henry Doorly Zoo |
| | ring-tailed lemur *(L. catta)* | Alameda Park Zoo; Como Park Zoo |
| Brown lemurs (*E. fulvus)* hybrids | red-collared brown lemur (*E. collaris*) | Omaha's Henry Doorly Zoo |
| | ring-tailed lemur *(L. catta)* | Denver Zoo; Duke Lemur Center; Omaha's Henry Doorly Zoo |
| Coquerel's mouse lemur (*M. coquereli*) | aye-aye (*D. madagascariensis*) | Denver Zoo; Duke Lemur Center; San Francisco Zoo |
| | fat-tailed dwarf lemur (*C. medius*) | Cincinnati Zoo; Cleveland Metroparks Zoo |
| | Peter's mouse lemur (*M. myoxinus*) | Cleveland Metroparks Zoo |
| | pygmy loris (*N. pygmaeus*) | Duke Lemur Center |
| | slow loris (*N. coucang* or *bengalensis*) | Memphis Zoo |
| Coquerel's sifaka (*P. coquereli)* | mongoose lemur (*E. mongoz*) | Omaha's Henry Doorly Zoo |
| | red ruffed lemur *(V. rubra)* | Duke Lemur Center |
| Crowned lemur *(E. coronatus)* | black lemur *(E. m. macaco)* | Duke Lemur Center |
| | black-and-white ruffed lemur *(V. variegata)* | Chehaw Wild Animal Park; Hattiesburg Zoo |
| | red-fronted brown lemur (*E. rufus*) | Houston Zoo |
| | red ruffed lemur *(V. rubra)* | Chehaw Wild Animal Park; Hattiesburg Zoo |

| Species | Lemur Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | ring-tailed lemur *(L. catta)* | Chehaw Wild Animal Park; Hattiesburg Zoo; Houston Zoo; Indianapolis Zoo |
| | white-fronted lemur *(E. albifrons*) | Cincinnati Zoo |
| Fat-tailed dwarf lemur (*C. medius*) | Coquerel's mouse lemur (*M. coquereli*) | Cincinnati Zoo; Cleveland Metroparks Zoo |
| | grey bamboo lemur *(H. griseus griseus*) | Cleveland Metroparks Zoo |
| | lesser bushbaby (*G. moholi*) | Duke Lemur Center |
| | mouse lemur (*Microcebus sp.*) | Cincinnati Zoo |
| | Peter's mouse lemur (*M. myoxinus*) | Cleveland Metroparks Zoo |
| | pygmy loris (*N. pygmaeus*) | Duke Lemur Center |
| Greater bushbaby (*O. garnetti* or *crassicaudatus)* | black-and-white ruffed lemur *(V. variegata)* | Santa Ana Zoo |
| | black lemur (*E. m. macaco*) | Santa Ana Zoo |
| | ring-tailed lemur *(L. catta)* | Santa Ana Zoo |
| Grey mouse lemur (*M. murinus*) | slender loris (*L. tardigradus*) | Duke Lemur Center |
| Lesser bushbaby (*G. moholi* or *senegalensis)* | fat-tailed dwarf lemur (*C. medius*) | Duke Lemur Center |
| | potto (*P. potto*) | Cincinnati Zoo; Cleveland Metroparks Zoo |
| | pygmy loris (*N. pygmaeus*) | Duke Lemur Center; Cleveland Metroparks Zoo |
| Mongoose lemur (*E. mongoz)* | black lemur *(E. m. macaco)* | Brookfield Zoo |
| | Coquerel's sifaka (*P. coquereli*) | Omaha's Henry Doorly Zoo |
| | potto *(P. potto)* | Cincinnati Zoo |
| | red-bellied lemur (*E. rubriventer*) | Roger Williams Park Zoo |
| | red ruffed lemur (*V. rubra*) | Myakka City Lemur Reserve; Natural Science Center of Greensboro |
| | ring-tailed lemur *(L. catta*) | Brookfield Zoo; Calgary Zoo; Myakka City Lemur Reserve; Natural Science Center of Greensboro |
| | Sanford's brown lemur (*E. sanfordi*) | Myakka City Lemur Reserve |
| Potto (*P. potto*) | mongoose lemur *(E. mongoz)* | Cincinnati Zoo |
| | lesser bushbaby (*G. moholi* or *senegalensis)* | Cincinnati Zoo; Cleveland Metroparks Zoo |
| Pygmy loris (*N. pygmaeus)* | aye-aye (*D. madagascariensis*) | Duke Lemur Center |
| | Coquerel's mouse lemur (*M. coquereli*) | Duke Lemur Center |
| | fat-tailed dwarf lemur (*C. medius*) | Duke Lemur Center |
| | lesser bushbaby (*G. moholi*) | Duke Lemur Center; Cleveland Metroparks Zoo |
| | slender loris (*L. tardigradus*) | Bronx Zoo; Brookfield Zoo; Cleveland Metroparks Zoo |
| | slow loris (*N. coucang*) | Minnesota Zoo; Oglebay's Good Zoo |
| Red-bellied lemur (*E. rubriventer)* | mongoose lemur (*E. mongoz*) | Roger Williams Park Zoo |
| | ring-tailed lemur *(L. catta)* | Duke Lemur Center; Palm Beach Zoo |

| Species | Lemur Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | Sanford's brown lemur (*E.sanfordi*) | Duke Lemur Center |
| Red-collared brown lemur (*E. collaris)* | black lemur (*E. m. macaco*) | Dallas Zoo; Duke Lemur Center |
| | black-and-white ruffed lemur *(V. variegata)* | Binder Park Zoo; Brevard Zoo; Dallas Zoo; Duke Lemur Center |
| | hybrid brown lemur (*E.* hybrid) | Omaha's Henry Doorly Zoo |
| | red-ruffed lemur *(V. rubra)* | Caldwell Zoo; Lowry Park Zoo |
| | ring-tailed lemur *(L. catta)* | Binder Park Zoo; Brevard Zoo; Bronx Zoo; Caldwell Zoo; Dallas Zoo; Disney's Animal Kingdom; Indianapolis Zoo; Lowry Park Zoo; Omaha's Henry Doorly Zoo |
| | Sanford's brown lemur (*E. sanfordi*) | Duke Lemur Center |
| | white-fronted lemur (*E. albifrons*) | Duke Lemur Center |
| Red-fronted brown lemur (*E. rufus)* | brown lemur (*E. fulvus*) | Duke Lemur Center |
| | black-and-white ruffed lemur *(V. variegata)* | Duke Lemur Center; Pueblo Zoo |
| | black lemur (*E. m. macaco*) | Duke Lemur Center |
| | crowned lemur (*E. coronatus*) | Houston Zoo |
| | red-collared brown lemur (*E. collaris*) | Duke Lemur Center |
| | red ruffed lemur *(V. rubra)* | Jackson Zoo |
| | ring-tailed lemur *(L. catta)* | Birmingham Zoo; Busch Gardens; Duke Lemur Center; Houston Zoo; Pueblo Zoo; Smithsonian National Zoo |
| Red ruffed lemur *(V. rubra)* | black lemur *(E. m. macaco)* | Dallas Zoo; Duke Lemur Center; Miami Metrozoo; Roger Williams Park Zoo; San Francisco Zoo |
| | black-and-white ruffed lemur *(V. variegata)* | Buffalo Zoological Gardens; Chehaw Wild Animal Park; Dallas Zoo; Greenville Zoo; Hattiesburg Zoo; Jacksonville Zoo; Louisville Zoo; Micke Grove Zoo; Omaha's Henry Doorly Zoo; San Francisco Zoo; Woodland Park Zoo; Zoo Atlanta |
| | blue-eyed black lemur (*E. m. flavifrons*) | Cameron Park Zoo; Indianapois Zoo; San Francisco Zoo |
| | brown lemur (*E. fulvus*) | Omaha's Henry Doorly Zoo |
| | red-collared brown lemur (*E. collaris*) | Dallas Zoo; Duke Lemur Center; Tampa's Lowry Park Zoo |
| | Coquerel's sifaka (*P. coquereli*) | Duke Lemur Center |
| | crowned lemur *(E. coronatus)* | Chehaw Wild Animal Park; Hattiesburg Zoo |
| | mongoose lemur (*E. mongoz*) | Myakka City Lemur Reserve; Natural Science Center of Greensboro |
| | red-fronted brown lemur (*E. rufus*) | Jackson Zoo |

| Species | Lemur Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | ring-tailed lemur (*L. catta*) | Caldwell Zoo; Calgary Zoo; Cameron Park Zoo; Chehaw Wild Animal Park; Dallas Zoo; Gladys Porter Zoo; Hattiesburg Zoo; Jacksonville Zoo; Louisville Zoo; Miami Metrozoo; Micke Grove Zoo; Minnesota Zoo; Myakka City Lemur Reserve; Natural Science Center of Greensboro; North Carolina Zoological Park; Riverbanks Zoo & Garden; San Francisco Zoo; Tampa's Lowry Park Zoo; Wildlife Safari; Woodland Park Zoo; Zoo Atlanta |
| | Sanford's brown lemur (*E. sanfordi*) | Myakka City Lemur Reserve |
| | Verreaux's sifaka (*P. verreauxi*) | Duke Lemur Center |
| Ring-tailed lemur *(L. catta)* | black lemur *(E. m. macaco)* | Bramble Park Zoo; Brookfield Zoo; Dallas Zoo; Hattiesburgh Zoo; Henson Robinson Zoo; Little Rock Zoo; Louisville Zoo; Miami Metrozoo; Point Defiance Zoo; Saint Louis Zoo; Santa Ana Zoo; San Francisco Zoo; Sedgwick County Zoo |
| | black-and-white ruffed lemur *(V. variegata)* | Binder Park Zoo; Bramble Park Zoo; Brevard Zoo; Busch Gardens Tampa; Chehaw Wild Animal Park; Cheyenne Mountain Zoo; Dallas Zoo; Detroit Zoological Society; Duke Lemur Center; Hattiesburg Zoo; Jacksonville Zoo; Little Rock Zoo; Louisville Zoo; Micke Grove Zoo; Pueblo Zoo; San Francicso Zoo; Santa Ana Zoo; Sedgwick County Zoo; Woodland Park Zoo; Zoo Atlanta |
| | blue-eyed black lemur (*E. m. flavifrons*) | Cameron Park Zoo; Cleveland Metroparks Zoo; Duke Lemur Center; Little Rock Zoo; Oakland Zoo; San Francisco Zoo |
| | brown lemur (*E. fulvus*) | Alameda Park Zoo; Como Park Zoo; |
| | brown lemur hybrids (*E. fulvus* hybrids) | Denver Zoo; Duke Lemur Center; Omaha's Henry Doorly Zoo |
| | crowned lemur *(E. coronatus)* | Chehaw Wild Animal Park; Hattiesburg Zoo; Houston Zoo; Indianapolis Zoo |
| | greater bushbaby (*Otolemur sp.*) | Santa Ana Zoo |
| | mongoose lemur (*E. mongoz*) | Brookfield Zoo; Calgary Zoo; Myakka City Lemur Reserve; Natural Science Center of Greensboro |
| | red-bellied lemur (*E. rubriventer*) | Duke Lemur Center; Palm Beach Zoo |

| Species | Lemur Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | red-collared brown lemur (*E. collaris)* | Binder Park Zoo; Brevard Zoo; Bronx Zoo; Caldwell Zoo; Dallas Zoo; Disney's Animal Kingdom; Indianapolis Zoo; Lowry Park Zoo; Omaha's Henry Doorly Zoo |
| | red-fronted brown lemur (*E. rufus*) | Birmingham Zoo; Busch Gardens; Duke Lemur Center; Houston Zoo; Pueblo Zoo; Smithsonian National Zoo |
| | red ruffed lemur *(V. rubra)* | Caldwell Zoo; Calgary Zoo; Cameron Park Zoo; Chehaw Wild Animal Park; Dallas Zoo; Gladys Porter Zoo; Hattiesburg Zoo; Jacksonville Zoo; Louisville Zoo; Miami Metrozoo; Micke Grove Zoo; Minnesota Zoo; Myakka City Lemur Reserve; Natural Science Center of Greensboro; North Carolina Zoological Park; Riverbanks Zoo & Garden; San Francisco Zoo; Tampa's Lowry Park Zoo; Wildlife Safari; Woodland Park Zoo; Zoo Atlanta |
| | Sanford's brown lemur (*E. sanfordi*) | Myakka City Lemur Reserve |
| Sanford's brown lemur (*E. sanfordi*) | blue-eyed black lemur (*E. m. flavifrons*) | Duke Lemur Center |
| | mongoose lemur (*E. mongoz*) | Myakka City Lemur Reserve |
| | red-bellied lemur (*E. rubriventer*) | Duke Lemur Center |
| | red ruffed lemur (*V. rubra*) | Myakka City Lemur Reserve |
| | ring-tailed lemur (*L. catta*) | Myakka City Lemur Reserve |
| Slender loris (*L. tardigradus*) | grey mouse lemur (*M. murinus*) | Duke Lemur Center |
| | pygmy lors *(N. pygmaeus)* | Bronx Zoo; Brookfield Zoo; Cleveland Zoo |
| Slow loris (*N. coucang* or *bengalensis)* | aye-aye (*D. madagascariensis*) | Duke Lemur Center |
| | Coquerel's mouse lemur (*M. coquereli*) | Memphis Zoo |
| | pygmy loris *(N. pygmaeus)* | Minnesota Zoo; Oglebay's Good Zoo |
| Verreaux's sifaka (*P. verreauxi*) | red-ruffed lemur (*V. rubra*) | Duke Lemur Center |
| White-fronted lemur (*E. albifrons*) | black lemur (*E. m. macaco*) | Duke Lemur Center |
| | crowned lemur *(E. coronatus)* | Cincinnati Zoo |
| | red-collared brown lemur *(E. collaris)* | Duke Lemur Center |

# SUCCESSFUL GROUPS OF PROSIMIANS MIXED WITH NON-PROSIMIANS

(sorted by Prosimian)

NON-PROSIMIAN SPECIES MIXED WITH PROSIMIANS

A number of species, including many non-primate species, have been exhibited with Prosimians. Please note that although small in size and primarily vegetarian, *Eulemur* have been known to capture and consume smaller animals. Small birds and their eggs are likely targets of *Eulemur* attention and are likely to be consumed (AZA Prosimian TAG, in review).

| Species | Non-Prosimian Species Mixes (Current and Past) | Institutions |
|---|---|---|
| Aye-aye (*D. madagascariensis*) | Madagascar giant jumping rats (*Hypogeomys antimena*) | Philadelphia Zoo |
| | straw-colored fruit bat (*Eidolon helvum*) | Omaha's Henry Doorly Zoo |
| Black lemur *(E. m. macaco)* | African porcupine *(Hystrix cristata)* | Santa Ana Zoo |
| | blue duiker *(Philantomba monticola)* | Hattiesburg Zoo |
| | dik dik (*Madoqua sp.*) | Santa Ana Zoo |
| | Madagasar big head turtles (*Erymnochelys madagascariensis*) | Omaha's Henry Doorly Zoo |
| | rock hyrax *(Procavia capensis)* | Santa Ana Zoo |
| | trumpeter hornbill *(Ceratogymna bucinator)* | Santa Ana Zoo |
| Black-and-white ruffed lemur *(V. variegata)* | African porcupine *(Hystrix cristata)* | Busch Gardens Tampa; Santa Ana Zoo |
| | blue duiker *(Philantomba monticola)* | Hattiesburg Zoo |
| | cattle egret (*Bubulcus ibis*) | Omaha's Henry Doorly Zoo |
| | D'Arnaud's barbet (*Trachyphonus darnaudii*) | Cheyenne Mountain Zoo |
| | dik dik (*Madoqua sp.*) | Santa Ana Zoo |
| | East African grey-crowned cranes (*Balearica regulorum gibbericeps*) | Gladys Porter Zoo |
| | emerald starling (*Lamprotornis iris*) | Cheyenne Mountain Zoo |
| | Galapagos tortoise (*Chelonoidis nigra*) | Bramble Park Zoo |
| | Greater adjutant stork (*Leptoptilos dubius*) | |
| | hippos (*Hippopotamus amphibious*) | Busch Gardens Tampa |
| | Jackson's hornbill (*Tockus jacksoni*) | Bramble Park Zoo |
| | leopard tortoise (*Stigmochelys pardalis*) | Cheyenne Mountain Zoo |
| | lilac-breasted roller (*Coracias caudatus*) | Cheyenne Mountain Zoo |
| | Madagascar ibis (*Lophotibis cristata*) | Omaha's Henry Doorly Zoo |
| | Madagascar teal (*Anas bernieri*) | Omaha's Henry Doorly Zoo |
| | meerkat (*Suricatta suricatta*) | Lincoln Children's Zoo |
| | pheasants (*Phasianidae*) | Bramble Park Zoo |
| | radiated tortoises *(Astrochelys radiata)* | Bramble Park Zoo |
| | rock hyrax *(Procavia capensis)* | Santa Ana Zoo |

| Species | Non-Prosimian Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | spur-thighed tortoise (*Testudo graeca*) | Cheyenne Mountain Zoo |
| | trumpeter hornbill *(Ceratogymna bucinator)* | Santa Ana Zoo |
| | various waterfowl | Houston Zoo |
| | vulturine guineafowl *(Acryllium vulturinum)* | Brevard Zoo |
| Brown lemur hybrid (*E. fulvus* hybrid) | Radiated tortoises *(Astrochelys radiata)* | Omaha's Henry Doorly Zoo |
| Coquerel's mouse lemur (*M. coquereli*) | African brush-tailed porcupine (*Atherurus africanus*) | Lincoln Children's Zoo |
| Coquerel's sifaka (*P. coquereli)* | Radiated tortoises (*Astrochelys radiata*) | Houston Zoo |
| Crowned lemur *(E. coronatus)* | Blue duiker *(Philantomba monticola)* | Hattiesburg Zoo |
| | Hottentot teal (*Anas hottentota*) | Houston Zoo |
| | Madagasar big head turtles (*Erymnochelys madagascariensis*) | Houston Zoo |
| Fat-tailed dwarf lemur (*C. medius*) | Madagascar giant jumping rats (*Hypogeomys antimena*) | Bronx Zoo |
| Greater bushbaby *(O. garnetti* or *crassicaudatus)* | aardvark *(Orycteropus afer*) | Cincinnati Zoo; Memphis Zoo |
| | African porcupine (*Hystrix cristata*) | Santa Ana Zoo |
| | brush-tailed porcupine (*Atherurus sp.*) | Memphis Zoo |
| | dik dik (*Madoqua sp.*) | Santa Ana Zoo |
| | giant fruit bat (*Pteropus sp.*) | Cincinnati Zoo |
| | meerkat (*Suricata suricatta*) | Omaha's Henry Doorly Zoo |
| | rock hyrax *(Procavia capensis)* | Omaha's Henry Doorly Zoo; Santa Ana Zoo |
| | springhaas (*Pedetes capensis*) | Memphis Zoo |
| | trumpeter hornbill *(Ceratogymna bucinator)* | Santa Ana Zoo |
| Grey mouse lemur (*M. murinus*) | lesser Madagascar hedgehog tenrecs (*Echinops telfairi*) | Bronx Zoo |
| | Madagascar giant jumping rats (*Hypogeomys antimena*) | Bronx Zoo |
| Lesser bushbaby (*G. moholi* or *senegalensis)* | aardvark (*Orycteropus afer*) | Cincinnati Zoo |
| | African hedgehog (*Atelerix frontalis*) | Lincoln Park Zoo |
| | African hedgehog tenrec (*Tenrecinae* family) | Bronx Zoo; Cincinnati Zoo |
| | bay duiker (*Cephalophus dorsalis*) | Bronx Zoo |
| | black-and-rufous elephant shrew (*Rhynchocyon petersi*) | Cleveland Metroparks Zoo |
| | brush-tail porcupine (*Atherurus sp.*) | Bronx Zoo |
| | Egyptian fruit bat (*Rousettus aegyptiacus*) | Cincinnati Zoo |
| | fruit bat (*Eidolon sp.*) | Woodland Park Zoo |
| | Indian flying fox (*Pteropus giganteus)* | Cincinnati Zoo |
| | Rodrigues flying fox *(Pteropus rodricensis*) | Bronx Zoo |

| Species | Non-Prosimian Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | Ruwenzori long-haired fruit bat (*Rousettus lanosus*) | Cincinnati Zoo |
| | springhaas (*Pedetes capensis*) | Cincinnati Zoo; Lincoln Park Zoo; Milwaukee County Zoo; Woodland Park Zoo |
| Mongoose lemur (*E. mongoz)* | aardvark (*Orycteropus afer*) | Cincinnati Zoo |
| | agouti (*Dasyprocta sp.*) | Memphis Zoo |
| | giant fruit bat (*Pteropus sp.*) | Cincinnati Zoo |
| | giant jumping rat (*Hypogeomys antimena*) | Omaha's Henry Doorly Zoo |
| | Gunther's dik dik (*Madoqua guentheri*) | Calgary Zoo |
| | Madagascar giant jumping rats (*Hypogeomys antimena*) | Philadelphia Zoo |
| | various African waterfowl | Calgary Zoo |
| | various African birds (hammerkop, rollers, barbets, ibis, spoonbill, hornbills, etc.) | Calgary Zoo |
| | wombat (*Vombatidae* family) | Memphis Zoo |
| Potto (*P. potto*) | aardvark (*Orycteropus afer*) | Cincinnati Zoo |
| | African four-toed hedgehog (*Atelerix albiventris*) | Franklin Park Zoo |
| | black-and-rufous elephant shrew (*Rhynchocyon petersi*) | Cleveland Metroparks Zoo |
| | Egyptian fruit bat (*Rousettus aegyptiacus*) | Cincinnati Zoo |
| | Ruwenzori long-haired fruit bat (*Rousettus lanosus*) | Cincinnati Zoo |
| | springhaas (*Pedetes capensis*) | Cincinnati Zoo |
| Pygmy loris (*N. pygmaeus)* | black-naped fruit dove (*Ptilinopus melanospila*) | Oglebay's Good Zoo |
| | Bleeding-heart dove (*Gallicolumba luzonica*) | Oglebay's Good Zoo |
| | crested wood partridge (*Rollulus rouloul*) | Oglebay's Good Zoo |
| | Indian flying fox (*Pteropus giganteus*) | Moody Gardens |
| | greater Malayan chevrotain (*Tragulus napu*) | Cleveland Zoo; Moody Gardens |
| | Indian flying fox (*Pteropus giganteus*) | Oglebay's Good Zoo |
| | Indian star tortoise (*Geochelone elegans*) | Oglebay's Good Zoo |
| | Madagascar giant jumping rats (*Hypogeomys antimena*) | Philadelphia Zoo |
| | Northern tree shrew (*Tupaia belangeri*) | Cleveland Zoo; El Paso Zoo |
| | Prevost's squirrels (*Callosciurus prevostii*) | Minnesota Zoo |
| | Palawan peacock pheasant (*Polyplectron emphanum*) | Moody Gardens |
| | mouse deer (*Tragulus sp.*) | Bronx Zoo |
| | striped possum (*Dactylopsila trivirgata*) | Cleveland Zoo |
| | Tokay gecko (*Gekko gekko*) | Oglebay's Good Zoo |

| Species | Non-Prosimian Species Mixes (Current and Past) | Institutions |
|---|---|---|
| Red-collared brown lemur (*E. collaris)* | blue coua (*Coua caerulea*) | Bronx Zoo |
| | coscoroba swan (*Coscoroba coscoroba*) | Disney's Animal Kingdom |
| | fody birds (*Foudia madagascariensis*) | Bronx Zoo |
| | grey-headed lovebird (*Agapornis canus*) | Bronx Zoo |
| | lesser flamingo (*Phoeniconaias minor*) | Disney's Animal Kingdom |
| | radiated tortoises *(Astrochelys radiata)* | Omaha's Henry Doorly Zoo |
| | tortoises (various species) | Bronx Zoo |
| | various waterfowl | Disney's Animal Kingdom |
| | Vasa parrot (*Coracopsis vasa*) | Bronx Zoo |
| | vulturine guineafowl *(Acryllium vulturinum)* | Brevard Zoo |
| Red-fronted lemur (*E. rufus)* | Egyptian geese (*Alopochen aegyptiacus*) | Busch Gardens |
| | hippos (*Hippopotamus amphibious*) | Busch Gardens |
| | hooded mergansers (*Mergus cucullatus*) | Busch Gardens |
| | Hottentot teal (*Anas hottentota*) | Houston Zoo |
| | Madagasar big head turtles (*Erymnochelys madagascariensis*) | Houston Zoo |
| Red ruffed lemur *(V. rubra)* | African porcupine *(Hystrix cristata)* | Kansas City Zoo |
| | black swan (*Cygnus atratus*) | Fresno Chaffee Zoo |
| | blue duiker *(Philantomba monticola)* | Hattiesburg Zoo |
| | cattle egret (*Bubulcus ibis*) | Omaha's Henry Doorly Zoo |
| | greater adjutant stork (*Leptoptilos dubius*) | Gladys Porter Zoo |
| | Gunther's dik dik (*Madoqua guentheri*) | Calgary Zoo |
| | Madagascar ibis (*Lophotibis cristata*) | Omaha's Henry Doorly Zoo |
| | Madagascar teal (*Anas bernieri*) | Omaha's Henry Doorly Zoo |
| | radiated tortoises *(Astrochelys radiata)* | Kansas City Zoo |
| | various African birds | Calgary Zoo |
| | various African waterfowl | Calgary Zoo; Gladys Porter Zoo |
| | various small avian species | Omaha's Henry Doorly Zoo |
| Ring-tailed lemur *(L. catta)* | African porcupine *(Hystrix cristata)* | Kansas City Zoo; Santa Ana Zoo |
| | black swan (*Cygnus atratus*) | Fresno Chaffee Zoo |
| | black-necked swan (*Cygnus melanocoryphus*) | Safari West |
| | blue coua (*Coua caerulea*) | Bronx Zoo |
| | blue duiker *(Philantomba monticola)* | Hattiesburg Zoo |
| | colobus monkeys (*Colobus guereza*) | Henry Vilas Zoo |
| | coscoroba swan (*Coscoroba coscoroba*) | Disney's Animal Kingdom |
| | D'Arnaud's barbet (*Trachyphonus darnaudii*) | Cheyenne Mountain Zoo |
| | dik dik (*Madoqua sp.*) | Santa Ana Zoo |
| | East African grey-crowned crane (*Balearica regulorum gibbericeps*) | Gladys Porter Zoo |
| | Egyptian geese (*Alopochen aegyptiacus*) | Busch Gardens |
| | emerald starling (*Lamprotornis iris*) | Cheyenne Mountain Zoo |

| Species | Non-Prosimian Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | fody birds (*Foudia madagascariensis*) | Bronx Zoo |
| | grey-headed lovebird (*Agapornis canus*) | Bronx Zoo |
| | Galapagos tortoise (*Chelonoidis nigra*) | Bramble Park Zoo |
| | greater adjutant stork (*Leptoptilos dubius*) | Gladys Porter Zoo |
| | Gunther's dik dik (*Madoqua guentheri*) | Calgary Zoo |
| | hippos (*Hippopotamus amphibious*) | Busch Gardens |
| | hooded mergansers (*Mergus cucullatus*) | Busch Gardens |
| | hornbill (*Bucerotidae*) | Omaha's Henry Doorly Zoo |
| | Hottentot teal (*Anas hottentota*) | Houston Zoo |
| | Jackson's hornbill (*Tockus jacksoni*) | Bramble Park Zoo |
| | Leopard tortoise (*Stigmochelys pardalis*) | Cheyenne Mountain Zoo |
| | lesser flamingo (*Phoeniconaias minor*) | Disney's Animal Kingdom |
| | lilac-breasted roller (*Coracias caudatus*) | Cheyenne Mountain Zoo |
| | Madagasar big head turtles (*Erymnochelys madagascariensis*) | Houston Zoo |
| | pheasants (*Phasianidae*) | Bramble Park Zoo |
| | radiated tortoises *(Astrochelys radiata)* | Bramble Park Zoo; Kansas City Zoo; Los Angeles Zoo; Oglebay's Good Zoo; Omaha's Henry Doorly Zoo; Phoenix Zoo |
| | radjah shelduck (*Tadorna radjah*) | Happy Hollow Zoo |
| | rock hyrax *(Procavia capensis)* | Santa Ana Zoo |
| | spur-thighed tortoise *(Testudo graeca)* | Cheyenne Mountain Zoo |
| | tortoises (various species) | Bronx Zoo |
| | trumpeter hornbill *(Ceratogymna bucinator)* | Santa Ana Zoo |
| | various African birds | Calgary Zoo |
| | various small avian species | Omaha's Henry Doorly Zoo |
| | various waterfowl | Calgary Zoo; Disney's Animal Kingdom; Gladys Porter Zoo |
| | Vasa parrot (*Coracopsis vasa*) | Bronx Zoo |
| | vulturine guineafowl *(Acryllium vulturinum)* | Brevard Zoo |
| Slender loris (*L. tardigradus*) | mouse deer (*Tragulus sp.*) | Bronx Zoo; Cincinnati Zoo |
| | Northern tree shrew (*Tupaia belangeri*) | Cleveland Zoo |
| | striped possum (*Dactylopsila trivirgata*) | Cleveland Zoo |
| | three-banded armadillo (*Tolypeutes sp.*) | Memphis Zoo |
| Slow loris (*N. coucang* or *bengalensis)* | African crested porcupine (*Hystrix cristata*) | Minnesota Zoo |
| | African hedgehog (*Atelerix frontalis*) | Woodland Park Zoo |
| | Asian small-clawed otter (*Aonyx cinerea*) | Houston Zoo |
| | black-naped fruit dove (*Ptilinopus melanospila*) | Oglebay's Good Zoo |
| | Bleeding-heart dove (*Gallicolumba luzonica*) | Oglebay's Good Zoo |
| | blue-bellied rollers (*Coracias cyanogaster*) | Houston Zoo |
| | crested wood partridge (*Rollulus rouloul*) | Oglebay's Good Zoo |

| Species | Non-Prosimian Species Mixes (Current and Past) | Institutions |
|---|---|---|
| | Indian flying fox (*Pteropus giganteus*) | Moody Gardens; Oglebay's Good Zoo |
| | greater Malayan chevrotain (*Tragulus napu*) | Moody Gardens; Oglebay's Good Zoo |
| | Indian star tortoise (*Geochelone elegans*) | Oglebay's Good Zoo |
| | mouse deer (*Tragulus sp.*) | Bronx Zoo; Cincinnati Zoo; Lee Richardson Zoo |
| | Palawan peacock pheasant (*Polyplectron emphanum)* | Moody Gardens |
| | Prevost's squirrels (*Callosciurus prevostii*) | Houston Zoo; Moody Gardens; Minnesota Zoo |
| | Southern three-banded armadillo (*Tolypeutes matacus*) | Woodland Park Zoo |
| | Tokay gecko (*Gekko gekko*) | Oglebay's Good Zoo |
| | Various species of fish | Houston Zoo |

# SUCCESSFUL GROUPS OF PROSIMIANS MIXED WITH NON-PROSIMIANS

(sorted by non-Prosimians)

| Non-Prosimian Species (Current and Past) | Prosimian Species | Institutions |
|---|---|---|
| Aardvark *(Orycteropus afer*) | greater bushbaby *(O. garnetti* or *crassicaudatus)* | Cincinnati Zoo; Memphis Zoo |
| | lesser bushbaby (*G. moholi* or *senegalensis)* | Cincinnati Zoo |
| | mongoose lemur (*E. mongoz)* | Cincinnati Zoo |
| | potto (*P. potto*) | Cincinnati Zoo |
| African brush-tailed porcupine (*Atherurus africanus*) | Coquerel's mouse lemur (*M. coquereli*) | Lincoln Children's Zoo |
| African four-toed hedgehog (*Atelerix albiventris*) | potto (*P. potto*) | Franklin Park Zoo |
| | lesser bushbaby (*G. moholi* or *senegalensis)* | Lincoln Park Zoo |
| | slow loris (*N. coucang* or *bengalensis)* | Woodland Park Zoo |
| African hedgehog tenrec (*Tenrecinae* family) | lesser bushbaby (*G. moholi* or *senegalensis)* | Bronx Zoo; Cincinnati Zoo |
| African porcupine *(Hystrix cristata)* | black lemur *(E. m. macaco)* | Santa Ana Zoo |
| | black-and-white ruffed lemur *(V. variegata)* | Busch Gardens Tampa; Santa Ana Zoo |
| | greater bushbaby *(O. garnetti* or *crassicaudatus)* | Santa Ana Zoo |
| | red ruffed lemur *(V. rubra)* | Kansas City Zoo |
| | ring-tailed lemur *(L. catta)* | Kansas City Zoo; Santa Ana Zoo |
| | slow loris (*N. coucang* or *bengalensis)* | Minnesota Zoo |
| Agouti (*Dasyprocta sp.*) | mongoose lemur (*E. mongoz)* | Memphis Zoo |
| Asian small-clawed otter (*Aonyx cinerea*) | slow loris (*N. coucang* or *bengalensis)* | Houston Zoo |
| Bay duiker (*Cephalophus dorsalis*) | lesser bushbaby (*G. moholi* or *senegalensis)* | Bronx Zoo |
| Black swan (*Cygnus atratus*) | red ruffed lemur *(V. rubra)* | Fresno Chaffee Zoo |
| | ring-tailed lemur *(L. catta)* | Fresno Chaffee Zoo |
| Black-and-rufous elephant shrew (*Rhynchocyon petersi*) | potto (*P. potto*) | Cleveland Metroparks Zoo |
| | bushbaby (*G. moholi*) | Cleveland Metroparks Zoo |
| Black-naped fruit dove (*Ptilinopus melanospila*) | pygmy loris (*N. pygmaeus)* | Oglebay's Good Zoo |
| | slow loris (*N. coucang* or *bengalensis)* | Oglebay's Good Zoo |

| Non-Prosimian Species (Current and Past) | Prosimian Species | Institutions |
|---|---|---|
| Black-necked swan (*Cygnus melanocoryphus*) | ring-tailed lemur *(L. catta)* | Safari West |
| Bleeding-heart dove (*Gallicolumba luzonica*) | pygmy loris (*N. pygmaeus)*<br>slow loris (*N. coucang* or *bengalensis)* | Oglebay's Good Zoo<br>Oglebay's Good Zoo |
| Blue coua (*Coua caerulea*) | red-collared brown lemur (*E. collaris)*<br>ring-tailed lemur (*L. catta*) | Bronx Zoo<br>Bronx Zoo |
| Blue-bellied rollers (*Coracias cyanogaster*) | slow loris *(N. coucang* or *bengalensis*) | Houston Zoo |
| Blue duiker *(Philantomba monticola)* | black lemur *(E. m. macaco)*<br>black-and-white ruffed lemur *(V. variegata)*<br>crowned lemur *(E. coronatus)*<br>red ruffed lemur *(V. rubra)*<br>ring-tailed lemur *(L. catta)* | Hattiesburg Zoo<br>Hattiesburg Zoo<br>Hattiesburg Zoo<br>Hattiesburg Zoo<br>Hattiesburg Zoo |
| Brush-tail porcupine (*Atherurus sp.*) | greater bushbaby (*O. garnetti* or *crassicaudatus*)<br>lesser bushbaby (*G. moholi* or *senegalensis)* | Memphis Zoo<br>Bronx Zoo |
| Cattle egret (*Bubulcus ibis*) | black-and-white ruffed lemur (*V. variegata*)<br>red ruffed lemur (*V. rubra*) | Omaha's Henry Doorly Zoo<br>Omaha's Henry Doorly Zoo |
| Colobus monkeys (*Colobus guereza*) | ring-tailed lemur *(L. catta)* | Henry Vilas Zoo |
| Coscoroba swan (*Coscoroba coscoroba*) | red-collared brown lemur (*E. collaris)*<br>ring-tailed lemur *(L. catta)* | Disney's Animal Kingdom<br>Disney's Animal Kingdom |
| Crested wood partridge (*Rollulus rouloul*) | pygmy loris (*N. pygmaeus)*<br>slow loris (*N. coucang* or *bengalensis)* | Oglebay's Good Zoo<br>Oglebay's Good Zoo |
| D'Arnaud's barbet (*Trachyphonus darnaudii*) | black-and-white ruffed lemur *(V. variegata)*<br>ring-tailed lemur *(L. catta)* | Cheyenne Mountain Zoo<br>Cheyenne Mountain Zoo |
| Dik dik *(Madoqua sp.)* | black lemur *(E. m. macaco)*<br>greater bushbaby *(O. garnetti* or *crassicaudatus)*<br>ring-tailed lemur *(L. catta)*<br>black-and-white ruffed lemur *(V. variegata)* | Santa Ana Zoo<br>Santa Ana Zoo<br>Santa Ana Zoo<br>Santa Ana Zoo |
| East African grey-crowned crane (*Balearica regulorum gibbericeps*) | ring-tailed lemur *(L. catta)*<br>black-and-white ruffed lemur *(V. variegata)* | Gladys Porter Zoo<br>Gladys Porter Zoo |

| Non-Prosimian Species (Current and Past) | Prosimian Species | Institutions |
|---|---|---|
| Egyptian fruit bat (*Rousettus aegyptiacus*) | lesser bushbaby (*G. moholi* or *senegalensis)* | Cincinnati Zoo |
| | potto (*P. potto*) | Cincinnati Zoo |
| Egyptian geese (*Alopochen aegyptiacus*) | red-fronted lemur (*E. rufus)* | Busch Gardens |
| | ring-tailed lemur *(L. catta)* | Busch Gardens |
| Emerald starling (*Lamprotornis iris*) | black-and-white ruffed lemur *(V. variegata)* | Cheyenne Mountain Zoo |
| | ring-tailed lemur *(L. catta)* | Cheyenne Mountain Zoo |
| Fody birds (*Foudia madagascariensis*) | red-collared brown lemur (*E. collaris)* | Bronx Zoo |
| | ring-tailed lemur *(L. catta)* | Bronx Zoo |
| Indian flying fox (*Pteropus giganteus*) | lesser bushbaby (*G. moholi* or *senegalensis)* | Cincinnati Zoo |
| | pygmy loris (*N. pygmaeus)* | Moody Gardens; Oglebay's Good Zoo |
| | slow loris (*N. coucang* or *bengalensis)* | Moody Gardens; Oglebay's Good Zoo |
| Fruit bat (*Eidolon sp.*) | lesser bushbaby (*G. moholi* or *senegalensis)* | Woodland Park Zoo |
| Galapagos tortoise (*Chelonoidis nigra*) | black-and-white ruffed lemur *(V. variegata)* | Bramble Park Zoo |
| | ring-tailed lemur *(L. catta)* | Bramble Park Zoo |
| Giant fruit bat (*Pteropus sp.*) | greater bushbaby *(O. garnetti* or *crassicaudatus)* | Cincinnati Zoo |
| | mongoose lemur (*E. mongoz)* | Cincinnati Zoo |
| Greater adjutant stork (*Leptoptilos dubius*) | black-and-white ruffed lemur *(V. variegata)* | Gladys Porter Zoo |
| | ring-tailed lemur *(L. catta)* | Gladys Porter Zoo |
| Greater Malayan chevrotain (*Tragulus napu*) | pygmy loris (*N. pygmaeus)* | Cleveland Zoo; Moody Gardens |
| | slow loris (*N. coucang* or *bengalensis)* | Moody Gardens; Oglebay's Good Zoo |
| Grey-headed lovebird (*Agapornis canus*) | red-collared brown lemur (*E. collaris)* | Bronx Zoo |
| | ring-tailed lemur (*L. catta*) | Bronx Zoo |
| Gunther's dik dik (*Madoqua guentheri*) | mongoose lemur (*E. mongoz)* | Calgary Zoo |
| | red ruffed lemur *(V. rubra)* | Calgary Zoo |
| | ring-tailed lemur *(L. catta)* | Calgary Zoo |
| Hippos (*Hippopotamus amphibious*) | black-and-white ruffed lemur *(V. variegata)* | Busch Gardens |
| | red-fronted lemur (*E. rufus)* | Busch Gardens |
| | ring-tailed lemur *(L. catta)* | Busch Gardens |
| Hooded mergansers (*Mergus cucullatus*) | red-fronted lemur (*E. rufus)* | Busch Gardens |
| | ring-tailed lemur *(L. catta)* | Busch Gardens |

| Non-Prosimian Species (Current and Past) | Prosimian Species | Institutions |
|---|---|---|
| Hornbill (*Bucerotidae*) | ring-tailed lemur *(L. catta)* | Omaha's Henry Doorly Zoo |
| Indian star tortoise (*Geochelone elegans*) | pygmy loris (*N. pygmaeus)*<br>slow loris (*N. coucang* or *bengalensis)* | Oglebay's Good Zoo<br>Oglebay's Good Zoo |
| Jackson's hornbill (*Tockus jacksoni*) | black-and-white ruffed lemur *(V. variegata)*<br>ring-tailed lemur *(L. catta)* | Bramble Park Zoo<br>Bramble Park Zoo |
| Leopard tortoise (*Stigmochelys pardalis*) | black-and-white ruffed lemur *(V. variegata)*<br>ring-tailed lemur *(L. catta)* | Cheyenne Mountain Zoo<br>Cheyenne Mountain Zoo |
| Lesser flamingo (*Phoeniconaias minor*) | red-collared brown lemur (*E. collaris)*<br>ring-tailed lemur *(L. catta)* | Disney's Animal Kingdom<br>Disney's Animal Kingdom |
| Lesser Madagascar hedgehog tenrecs (*Echinops telfairi*) | grey mouse lemur (*M. murinus*) | Bronx Zoo |
| Lilac-breasted roller (*Coracias caudatus*) | black-and-white ruffed lemur *(V. variegata)*<br>ring-tailed lemur *(L. catta)* | Cheyenne Mountain Zoo<br>Cheyenne Mountain Zoo |
| Madagasar big head turtles (*Erymnochelys madagascariensis*) | black lemur (*E. m. macaco*)<br>crowned lemur (*E. coronatus*)<br>red-fronted brown lemur (*E. rufus*)<br>ring-tailed lemur (*L. catta)* | Omaha's Henry Doorly Zoo<br>Houston Zoo<br>Houston Zoo<br>Houston Zoo |
| Madagascar giant jumping rats (*Hypogeomys antimena*) | aye-aye (*D. madagascariensis*)<br>fat-tailed dwarf lemur (*C. medius*)<br>grey mouse lemur (*M. murinus*)<br>mongoose lemur (*E. mongoz*)<br>pygmy loris (*N. pygmaeus*) | Philadelphia Zoo<br>Bronx Zoo<br>Bronx Zoo<br>Omaha's Henry Doorly Zoo; Philadelphia Zoo<br>Philadelphia Zoo |
| Madagascar ibis (*Lophotibis cristata*) | black-and-white ruffed lemur (*V. variegata*)<br>red ruffed lemur (*V. rubra*) | Omaha's Henry Doorly Zoo<br>Omaha's Henry Doorly Zoo |
| Madagascar teal (*Anas bernieri*) | black-and-white ruffed lemur (*V. variegata*)<br>red ruffed lemur (*V. rubra*) | Omaha's Henry Doorly Zoo<br>Omaha's Henry Doorly Zoo |
| Meerkat (*Suricata suricatta*) | black-and-white ruffed lemur *(V. variegata)*<br>greater bushbaby (*O. garnetti*) | Lincoln Children's Zoo<br>Omaha's Henry Doorly Zoo |
| Mouse deer (*Tragulus sp.*) | pygmy loris (*N. pygmaeus)*<br>slender loris (*L. tardigradus*)<br>slow loris (*N. coucang* or *bengalensis)* | Bronx Zoo<br>Bronx Zoo; Cincinnati Zoo<br>Bronx Zoo; Cincinnati Zoo; Lee Richardson Zoo |
| Northern tree shrew (*Tupaia belangeri*) | pygmy loris (*N. pygmaeus)*<br>slender loris (*L. tardigradus*) | Cleveland Zoo; El Paso Zoo<br>Cleveland Zoo |

| Non-Prosimian Species (Current and Past) | Prosimian Species | Institutions |
|---|---|---|
| Palawan peacock pheasant (*Polyplectron emphanum*) | pygmy loris (*N. pygmaeus)*<br>slow loris (*N. coucang* or *bengalensis)* | Moody Gardens<br>Moody Gardens |
| Pheasants (*Phasianidae*) | black-and-white ruffed lemur *(V. variegata)*<br>ring-tailed lemur *(L. catta)* | Bramble Park Zoo<br>Bramble Park Zoo |
| Prevost's squirrels (*Callosciurus prevostii*) | pygmy loris (*N. pygmaeus)*<br>slow loris (*N. coucang* or *bengalensis)* | Minnesota Zoo<br>Houston Zoo; Moody Gardens; Minnesota Zoo |
| Radiated tortoises *(Astrochelys radiata)* | brown lemur hybrid (*E. fulvus* hybrid)<br>black-and-white ruffed lemur *(V. variegata)*<br>Coquerel's sifaka (*P. coquereli*)<br>red-collared brown lemur (*E. collaris*)<br>red ruffed lemur *(V. rubra)*<br>ring-tailed lemur *(L. catta)* | Omaha's Henry Doorly Zoo<br>Bramble Park Zoo<br>Houston Zoo<br>Omaha's Henry Doorly Zoo<br>Kansas City Zoo<br>Bramble Park Zoo; Kansas City Zoo; Los Angeles Zoo; Oglebay's Good Zoo; Omaha's Henry Doorly Zoo; Phoenix Zoo |
| Radjah shelduck (*Tadorna radjah*) | ring-tailed lemur *(L. catta)* | Happy Hollow Zoo |
| Rock hyrax *(Procavia capensis)* | black lemur *(E. m. macaco)*<br>black-and-white ruffed lemur *(V. variegata)*<br>greater bushbaby *(O. garnetti* or *crassicaudatus)*<br>ring-tailed lemur *(L. catta)* | Santa Ana Zoo<br>Santa Ana Zoo<br>Omaha's Henry Doorly Zoo; Santa Ana Zoo<br>Santa Ana Zoo |
| Rodrigues flying fox *(Pteropus rodricensis*) | lesser bushbaby (*G. moholi* or *senegalensis)* | Bronx Zoo |
| Ruwenzori long-haired fruit bat (*Rousettus lanosus*) | lesser bushbaby (*G. moholi* or *senegalensis)*<br>potto (*P. potto*) | Cincinnati Zoo<br>Cincinnati Zoo |
| Southern three-banded armadillo (*Tolypeutinae matacus*) | slow loris (*N. coucang* or *bengalensis)* | Woodland Park Zoo |
| Springhaas (*Pedetes capensis*) | greater bushbaby *(O. garnetti* or *crassicaudatus)*<br>lesser bushbaby (*G. moholi* or *senegalensis)*<br>potto (*P. potto*) | Memphis Zoo<br>Cincinnati Zoo; Lincoln Park Zoo; Milwaukee County Zoo; Woodland Park Zoo<br>Cincinnati Zoo |
| Spur-thighed tortoise (*Testudo graeca*) | black-and-white ruffed lemur *(V. variegata)*<br>ring-tailed lemur *(L. catta)* | Cheyenne Mountain Zoo<br>Cheyenne Mountain Zoo |

| Non-Prosimian Species (Current and Past) | Prosimian Species | Institutions |
|---|---|---|
| Straw-colored fruit bat (*Eidolon helvum*) | aye-aye (*D. madagascariensis*) | Omaha's Henry Doorly Zoo |
| Striped possum (*Dactylopsila trivirgata*) | pygmy loris (*N. pygmaeus)*<br>slender loris (*L. tardigradus*) | Cleveland Zoo<br>Cleveland Zoo |
| Three-banded armadillo (*Tolypeutes sp.*) | slender loris (*L. tardigradus*) | Memphis Zoo |
| Tokay gecko (*Gekko gekko*) | pygmy loris (*N. pygmaeus)*<br>slow loris (*N. coucang* or *bengalensis)* | Oglebay's Good Zoo<br>Oglebay's Good Zoo |
| Tortoises (various species) | red-collared brown lemur (*E. collaris)*<br>ring-tailed lemur *(L. catta)* | Bronx Zoo<br>Bronx Zoo |
| Trumpeter hornbill *(Ceratogymna bucinator)* | black lemur *(E. m. macaco)*<br>black-and-white ruffed lemur *(V. variegata)*<br>greater bushbaby *(O. garnetti* or *crassicaudatus)*<br>ring-tailed lemur *(L. catta)* | Santa Ana Zoo<br>Santa Ana Zoo<br>Santa Ana Zoo<br>Santa Ana Zoo |
| Various African birds (hammerkop, rollers, barbets, ibis, spoonbill, hornbills, etc.) | mongoose lemur (*E. mongoz)*<br>ring-tailed lemur *(L. catta)*<br>red ruffed lemur *(V. rubra)* | Calgary Zoo<br>Calgary Zoo<br>Calgary Zoo |
| Various African waterfowl | mongoose lemur (*E. mongoz)*<br>red ruffed lemur *(V. rubra)* | Calgary Zoo<br>Calgary Zoo |
| Various species of fish | slow loris (*N. coucang* or *benglaensis*) | Houston Zoo |
| Various small avian species | red ruffed lemur *(V. rubra)*<br>ring-tailed lemur *(L. catta)* | Omaha's Henry Doorly Zoo<br>Omaha's Henry Doorly Zoo |
| Various waterfowl | Bblack-and-white ruffed lemur *(V. variegata)*<br>red-collared brown lemur (*E. collaris)*<br>red ruffed lemur (*V. rubra*)<br>ring-tailed lemur *(L. catta)* | Houston Zoo<br>Disney's Animal Kingdom<br>Gladys Porter Zoo<br>Calgary Zoo; Disney's Animal Kingdom; Gladys Porter Zoo |
| Vasa parrot (*Coracopsis vasa*) | red-collared brown lemur (*E. collaris)*<br>ring-tailed lemur (*L. catta*) | Bronx Zoo<br>Bronx Zoo |
| Vulturine guineafowl *(Acryllium vulturinum)* | black-and-white ruffed lemur *(V. variegata)*<br>red-collared brown lemur (*E. collaris)*<br>ring-tailed lemur *(L. catta)* | Brevard Zoo<br>Brevard Zoo<br>Brevard Zoo |
| Wombat (*Vombatidae* family) | mongoose lemur (*E. mongoz)* | Memphis Zoo |

# SUCCESSFUL MIXED-SPECIES EXHIBIT SUMMARIES

## Alameda Park Zoo

Alamogordo, New Mexico
*Current Species*: 2.0 ring-tailed lemur (*L. catta*) – adults, intact
1.0 brown lemur (*E. fulvus*) – adult, intact

This group has been together since approximately 2005. They are not routinely separated. If animals were separated, no aggression had been noted upon reintroduction.

There have been several group composition changes, some of which did affect the stability of the group, including:

- The original group was 1.1 ring-tailed lemur and 1.1 brown lemur. In approximately 2004, the female brown lemur died. When she died, the pair of ring-tailed lemurs began antagonizing the male brown lemur. A few years later, the female ring-tailed lemur died.
- A male ring-tailed lemur was brought in for some time. He was eventually swapped out for a different male ring-tailed lemur. When the first new male ring-tailed lemur was brought in, there was still some aggression toward the brown lemur. When that male was with another new male, the group became more stable.

New animals were introduced by placing a vari-kennel in the exhibit with the new animal inside. If no aggression was observed after a few hours, the new animal was released into the exhibit with existing animals. No aggression was observed during any of the previously mentioned introductions.

## Aquarium and Rainforest at Moody Gardens, Inc.

Galveston, Texas
*Historical group 1:* 1.0 slow loris (*N. bengalensis*) – adult, intact
1.2 Prevost's squirrel (*Callosciurus prevostii*) – breeding group

This group was together approximately four years. The group was separated after successful reproduction occurred with the squirrels, and there became too much competition for the loris. He was then moved into the next group listed.

*Historical group 2:* 1.0 slow loris (*N. bengalensis*) – adult, intact
1.1 greater Malayan chevrotain (*Tragulus napu*) – adult pair, female implanted
1.0 Palawan peacock pheasant (*Polyplectron emphanum*) – adult
2.0 Indian flying fox (*Pteropus giganteus*) – adults, intact

This group was together approximately four months. The slow loris was moved from the previous exhibit to this group. Due to the exhibit size and the nature of the other taxa in this exhibit, this grouping seemed to work much better. They were separated due to a hurricane and subsequent evacuation of the animal collection. The slow loris was relocated to a mixed-species group at the Houston Zoo.

*Historical group 3*: 1.1 pygmy loris (*N. pygmaeus*) – adult, breeding pair
1.1 greater Malayan chevrotain (*Tragulus napu*) – adult pair, female implanted
1.0 Palawan peacock pheasant (*Polyplectron emphanum*) – adult
2.0 Indian flying fox (*Pteropus giganteus*) – adults

The pygmy lorises were housed in this group less than one year. The exhibit was a caged aviary and the female loris escaped into the main part of the rainforest exhibit. Once she was recaptured, the pair was moved into a holding area until modifications to the exhibit could be made. However, during this time, there was successful breeding so they were not moved back to the exhibit. They are now housed as a pair, with the male offspring in an adjacent cage. They were evacuated to Houston Zoo for four months, and are now residing in a holding that is set up for breeding.

## Binder Park Zoo

Battle Creek, Michigan
*Current Species*: 1.2 ring-tailed lemur (*L. catta*) – adult, breeding group
1.1 black-and-white ruffed lemur (*V. variegata*) – adult, breeding pair
1.1 red-collared brown lemur (*E. collaris*) – adult, breeding pair

The outdoor exhibit for these species is approximately 16,875 $ft^3$.

This group has been together since April 2006. They are separated at night for feedings, to monitor individuals, and to give them a break from each other. They are also separated occasionally due to chasing by the male ruffed lemur. When the animals are reintroduced, there has been some chasing. This can last 20 minutes or more, but occurs infrequently.

The group previously housed 0.2 collared lemur. One female was exchanged for a male to create a breeding pair. No reproduction has yet to be observed. This change has not affected the stability of the group.

## Birmingham Zoo

Birmingham, Alabama
*Current Species*: 1.2 red-fronted lemur (*E. rufus*) – adult, non-breeding group, females contracepted with Depo-Provera® injections
1.1 ring-tailed lemur (*L. catta*) – adult, non-breeding pair, female contracepted with Depo-Provera® injections

This group has been together since February 2008. They are separated daily for ¼ of their diet. ¾ of the diet is fed while they are all together. At night, they are separated approximately 50% of the time, but only if it is cold enough to lock animals inside so that no aggression between species occurs. They are separated seasonally. Some displacement and non-contact aggression has been noted upon reintroduction. It is usually short, approximately two minutes long, and is often food related.

There have not been any changes in the group composition or changes in stability of the group over the years. Reproductive behaviors and copulations have occurred in the group, but no pregnancies have occurred due to the contraception in use.

## Bramble Park Zoo

Watertown, South Dakota

**Group 1**

*Current Species:* 4.0 ring-tailed lemur (*L. catta*)
4.0 Jackson's hornbills (*Tockus jacksoni*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

**Group 2**

*Current Species:* 1.0 black lemur (*E.m. macaco*) - older adult, intact
0.1 black-and-white ruffed (*V. variegata*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

*Historical group 1:* 5.0 ring-tailed lemur (*L. catta*) – adults, intact
1.0 black lemur (*E. m. macaco*) – older adult, intact

This group was established in the spring of 2005 for an unknown amount of time. They were together 24 hours a day with no aggression noted. This was consistently an all-male group. The black lemur bonded with two of the ring-tailed lemurs, so there were two mini-groups in the exhibit. However, in cooler temperatures, they all went to the same area.

There were some changes to the group composition over the years. These did not seem to affect the stability of the group. There were initially eight ring-tailed lemurs, but three were lost over time. The ring-tailed lemurs were assembled from two different institutions. Introductions were done slowly, with just one or two individuals at a time. The exhibit is large with a lot of cover and resting areas. At the beginning, space was an issue within the group of ring-tailed lemurs, but now with a smaller group there is a more space for them to move.

*Historical group 2:*
Ring-tailed lemur (*L. catta*), Black-and-white ruffed lemur (*V. variegata*), Jackson's hornbill (*Tockus jacksoni*), Pheasants (*Phasianidae*), Radiated tortoise (*Astrochelys radiata*), Galapagos tortoise (*Chelonoidis nigra*)

It is unknown how long this group was together. The ring-tailed lemurs would occasionally ride the tortoises. There was some food competition between lemurs and hornbills, however there were no issues with the ground-dwelling birds. The lemurs spent the majority of their time in the trees. Most of the lemurs worked well with the larger birds. The black lemur has killed and eaten small native birds, such as sparrows.

## Brevard Zoo

Melbourne, Florida

*Current Species:* 2.0 ring-tailed lemur (*L. catta*) – adults, intact
1.0 red-collared brown lemur (*E. collaris*) – adult, intact
1.4 black-and-white ruffed lemur (*V. variegata*) – adult, breeding pair
3.0 vulturine guineafowl (*Acryllium vulturinum*) – adults

This group has been together since May 2008. They are separated daily for feeding in their individual crates. They may also be separated and/or removed from their exhibit for medical procedures or due to inclement weather. Some brief, non-contact aggression in the form of vocalizing and displacement is noted upon reintroduction, but the interactions are usually brief, lasting for only 5-10 minutes.

There was originally no reproduction while in the mixed group; however the black-and-white ruffed lemurs were seen breeding while in quarantine and have subsequently bred.

There have been many changes in individual animals since 2006. None of these changes resulted in any major issues with the stability of the group.

- In November 2006, 1.0 black-and-white ruffed lemur moved out.
- In October 2007, 0.1 collared lemur was transferred out. Then in November 2007, a different 0.1 collared lemur was brought in. She was removed from the group in December 2007.
- In June 2008, 1.0 black-and-white ruffed lemur was brought in. Another pair of 1.1 black-and-white ruffed lemurs were added in May 2008.
- In December 2008, another 1.0 ring-tailed lemur left the group.
- In 2011, the red-collared brown lemur was sent to another institution.

## Bronx Zoo

Bronx, New York

**Group 1**

*Current Species*: 2.0 blue-eyed black lemurs (*E. flavifrons*) – adults
2.0 black-and-white ruffed lemurs (*V. variegata*) – adults

This group has been together since December 2008. They are separated during the summer for exhibit purposes. During the winter, the black-and-white ruffed lemurs are brought into holding with the blue-eyed black lemurs. They are separated during the day, while the blue-eyed black lemurs are in an exhibit. They are reunited when the blue-eyed blacks are brought back into holding for the night. There are brief bouts of non-contact aggression when they are reunited, including displacement of the blue-eyed blacks by the ruffeds. The blue-eyed blacks respond by vocalizing at the ruffeds. They generally maintain respectable boundaries from each other.

**Group 2**

*Current Species:* 0.8 ring-tailed lemurs (*L. catta*) – juvenile and adult females
2.1 red-collared brown lemurs (*E. collaris*) – adult pair, juvenile male
4.0 tortoises

fody birds (*Foudia madagascariensis*)
blue couas (*Coua caerulea*)
grey-headed lovebirds (*Agapornis canus*)
Vasa parrots (*Coracopsis vasa*)

This group has been together since 2008. There is little to no aggression within the group. The tortoises and birds are on exhibit with the lemurs. The female collared lemur will play/groom with the ring-tailed lemurs. The male collared lemur will become protective of the baby. They are separated for daily feedings and night housing, but there is no aggression upon reintroduction. Separation for night housing began after the collared lemurs gave birth.

The collared lemur infant was conceived and born while in the mixed species group. He is now being parent-reared within the mixed species group.

**Group 3**

*Current Species:* 0.9 ring-tailed lemurs (*L. catta*) – juvenile and adult females
1.1 red-collared brown lemurs (*E. collaris*) – breeding pair
tortoise spp
fody birds (*Foudia madagascariensis*)
blue couas (*Coua caerulea*)
grey-headed lovebirds (*Agapornis canus*)
Vasa parrots (*Coracopsis vasa*)

This group has been together since 2008. There is little to no aggression within the group. The tortoises and birds are on exhibit with the lemurs. They are separated for daily feedings and night housing, but there is no aggression upon reintroduction.

**Group 4**

*Current species:* 1.1 pygmy loris (*N. pygmaeus*)
1.0 slender loris (*L. tardigradus*)
1.1 mouse deer (*Tragulus sp.*)

These species have been housed and exhibited together since 2006.

**Group 5**

*Current species:* 2.0 grey mouse lemur (*M. murinus*)
Up to 0.0.8 lesser Madagascar hedgehog tenrecs (*Echinops telfairi*)

These species have been housed and exhibited together since the late 1960s.

**Group 6**

*Current species:* 0.2 fat-tailed dwarf lemur (*C. medius*)
1.1.1 Madagascar rat (*Hypogeomys antimena*)

This group has been together since March 2009.

**Group 7**
*Current species:* 1.1 grey mouse lemur (*M. murinus*)
Madagascar rat (*Hypogeomys antimena*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

**Group 8**
*Current species:* 1.0 lesser bushbaby (*G. moholi*)
lesser Madagascar hedgehog tenrec (*Echinops telfairi*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

*Historical group 1:* 1.1 lesser bushbaby (*G. moholi*)
1.1 brush-tail porcupine (*Atherurus sp.*)
0.2/1.1 mouse deer (*Pteropus rodricensis*)
0.0.2 bay duiker (*Cephalophus dorsalis*)

These species have been housed and exhibited together since the late 1960s. The biggest obstacle with this arrangement was that the bushbaby had high incidence of dental disease associated with the consumption of the other species food. The building in which they were exhibited was closed, resulting in the disbanding of this grouping.

*Historical group 2:* 1.1 slow lorises (*N. coucang*)
0.2/1.1 mouse deer (*Tragulus sp.*)

These species have been housed and exhibited together since the mid-1980s until approximately 2010.

## Brookfield Zoo

Chicago, Illinois
*Current species*: 0.4 ring-tailed lemur (*L. catta*) – adults
2.0 mongoose lemur (*E. mongoz*) – adults, intact

The outside exhibit space for this group is approximately 3,168 $ft^3$, with an indoor exhibit of 4,224 $ft^3$ and an indoor holding of 2,400 $ft^3$.

This group has been together since September 2007. They are not separated, except during medical procedures and treatments. No aggression has been noted upon reintroduction. The individuals in this group initially were distant from each other, however they have now become accustomed to each other. There have been occasional short bouts of chasing, but this happens infrequently.

An initial attempt at putting this group together, when there were 0.5 ring-tailed lemurs and 1.1 black lemurs, was unsuccessful due to aggression between a dominant 0.1 ring-tailed lemur and 0.1 black

lemur. After these two animals died, the introduction was tried again and 1.0 black lemur was successfully introduced to the group. The group has been stable since this introduction; however the black lemur passed away in 2009.

*Historical group 1:* 1.1 black lemur (*E. m. macaco*)
2.0 mongoose lemur (*E. mongoz*)

This group was together for an unknown amount of time.

*Historical group 2*: 1.1 or 0.1 slender loris (*L. tardigradus*) – non-breeding group
1.1 or 1.0 pygmy loris (*N. pygmaeus*) – non-breeding group

Many different groupings of these individuals occurred between 2003 and 2008. They were mixed together to provide non-breeding socialization. The final pairing was with 0.1 slender loris and 0.1 pygmy loris. They initially remained separate from each other, but eventually became accustomed to each other. Occasional short bouts of chasing were observed, but nothing serious. They were separated only for medical procedures and treatments. They were together until the slender loris died.

Past mixed groups did show some aggression, most occurring towards males that were showing sexual interest. Aggression came from the same species female, and occasionally from other species. Females would chatter at them and at times lunge at them when the males would follow persistently. There was typically no contact aggression. Same species aggression has been noted as lasting 3-4 days. When aggression became intense, the animals were separated. They would be reunited when following was persistent. It is suspected that aggression was related to female cycling. This was not a mixed species issue as much as a single species management issue in a mixed species setting.

The slender loris did conceive while in the mixed species group, but the infant was cannibalized shortly after birth.

## Buffalo Zoological Garden

Buffalo, New York

*Current species:* black-and-white ruffed lemurs (V*. variegata*) – adult
red ruffed lemur (V*. rubra*) – adult

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## Busch Gardens

Tampa, Florida

*Current species:* 2.3 ring-tailed lemur (*L. catta*) – adult, breeding group, younger male castrated
1.3 red-fronted lemur (*E. rufus*) – adult, non-breeding group, male vasectomized
1.0 or 0.2 hippos (*Hippopotamus amphibious*) – adults

2.2 Egyptian geese (*Alopochen aegyptiacus*) – adults
3.2 hooded mergansers (*Mergus cucullatus*) – adults

This group has been together since October 2007. They are all together while on exhibit, though each group has claimed a portion of the habitat as their territory. The lemur groups are separated into two enclosures, by species, for overnight housing. There has been no aggression noted upon reintroduction in the mornings. There has been no reproduction in this group, though the ring-tailed lemurs do have breeding recommendations, and have shown reproductive behavior.

The group was initially formed in 2004, when 1.0 ring-tailed lemur was introduced to 0.3 ring-tailed lemurs. In 2006, another pair of ring-tailed lemurs was added to the group. The red-fronted lemurs were added to the group in 2007. Also in 2007, 0.1 ring-tailed lemur died.

*Historical group 1*: 1.1 black-and-white ruffed lemur (*V. variegata*) – adults, male castrated
1.1 African crested porcupine (*Hystrix cristata)* – non-breeding pair

This group was together from February 2007 until September 2008, when the enclosure was closed.

*Historical group 2*: 1.2 black-and-white ruffed lemur (*V. variegata*) – adults, male castrated
1.4 ring-tailed lemur (*L. catta*) – adults, male castrated
1.0 or 0.2 hippos (*Hippopotamus amphibious*) – adults

This group was together from June until October 2002. They were filling an empty exhibit temporarily.

## Caldwell Zoo

Tyler, Texas
*Historical group*: 0.2 red-collared brown lemur (*E. collaris*) – adult, non-breeding group, females implanted with MGA
5.0 ring-tailed lemur (*L. catta*) – adult non-breeding group
1.1 red ruffed lemur (*V. rubra*) – adult non-breeding group, female contracepted with MGA

This group was together for several years. They lived together without issues until changes were made to their island exhibit, and the ring-tailed lemurs were changed to create a breeding group. See section on Unsuccessful Groups for details on the disintegration of the group.

## Calgary Zoo

Calgary, Alberta, Canada
*Current Species*: 1.0 ring-tailed lemur (*L. catta*) – adult
1.1 mongoose lemur (*E. mongoz*) – non-breeding pair, female possibly implanted
~25 mixed African waterfowl
~20 mixed African birds (hammerkop, rollers, barbets, ibis, spoonbill, hornbills, etc.)
1.1 Gunther's dik dik (*Madoqua guentheri*)

The indoor exhibit for these species is approximately 139,968 $ft^3$ with a separate holding stall for the lemurs of 960 $ft^3$.

The majority of this group has been together since 2004. The ring-tailed lemur was added back to the exhibit in 2008. They are kept together, except for short periods when the mongoose and ring-tailed lemurs are shifted into holding and separated for cleaning and/or training. There is no aggression upon reintroduction.

The mongoose lemurs copulate regularly, but the female is contracepted to prevent pregnancy. The waterfowl and other birds have bred and raised offspring successfully on many occasions.

*Historical group:* 2.1 ring-tailed lemur (*L. catta*) – adult pair with juvenile male, non-breeding group, surgical contraception
1.2 red ruffed lemur (*V. rubra*) – older adults, non-breeding group, surgical contraception
~20 mixed African waterfowl
~30 mixed African birds (mousebirds, rollers, barbets, ibis, spoonbill, hornbills, etc.)
1.1 Gunther's dik dik (*Madoqua guentheri*)

This exhibit was put together in 2002. Initially, there was only 1.0 adult ring-tailed lemur in the group. This worked for approximately a year or more. Then 1.1 rescued ring-tailed lemurs were brought in (a female and her young son). The young male ring-tailed lemur was very mischievous, resulting in injury to several birds. The mother and son ring-tailed lemurs were then removed from the exhibit.

## Cameron Park Zoo

Waco, Texas

*Current Species*: 1.1 blue-eyed black lemur (*E. m. flavifrons*) – adult, breeding pair
1.2 ring-tailed lemur (*L. catta*) – adult, non-breeding group
1.1 red ruffed lemur (*V. rubra*) – older adult

This group was put together in July 2002. Each species is housed in a separate stall at night. There is occasional aggression from the black lemurs towards the others, but it lasts less than a minute. It generally consists of non-contact aggression and vocalizing.

There have been several changes to the group composition since 2002. Group stability has not been affected throughout the changes.

- The exhibit opened in 2002 with 1.1 red ruffed lemur, however, the male died in September 2004. Another 1.0 red ruffed lemur was added in April 2006, and subsequently died in September 2006.
- Originally in 2002, there were 1.3 ring-tailed lemur. 0.0.2 ring-tailed lemur were born in 2003. Later that year, 1.1.2 died from toxoplasmosis. In 2004, a new pair of 1.1 ring-tailed lemurswas brought in to make the group 1.3. Then, 1.1 left for another institution to breed. A new 1.0 ring-tailed was brought in. In early 2009, 0.1 died from age related issues.
- The same pair of blue-eyed black lemurs has been in the group since 2002.

- New animals are introduced inside the barn with the new member in a crate. They are then let out of the crate inside the stall. The group is introduced back to the exhibit one species at a time.

Reproduction has occurred within the group. The original group of ring-tailed lemurs showed reproductive behaviors, including copulatory behavior that resulted in two offspring. The female conceived and gave birth in the exhibit. The offspring were raised in the mixed species group.

## Chehaw Wild Animal Park

Albany, Georgia

*Current species*: 4.1.1 ring-tailed lemur (*L. catta*) – non-breeding group, age ranges from adult to infant
1.1 black-and-white ruffed lemur (*V. variegata*) – adult, non-breeding pair, female contracepted with Depo-Provera® injections
2.0 red ruffed lemur (*V. rubra*) – older adults
2.2 crowned lemur (*E. coronatus*) – adult, non-breeding group, males castrated

This group is held in an outdoor exhibit 360,000 $ft^3$ with an indoor exhibit of 1,280 $ft^3$, and attached holding of 1,152 $ft^3$.

This group has been together since 2004. They do not interact much, but the female black-and-white lemur will kill infants, so she is separated when the other lemurs have had offspring. Some of the individuals are also separated for night housing. They still have visual access to each other, though. There is no aggression upon reintroduction.

There has been successful reproduction in this exhibitfor both the ring-tailed lemurs and the crowned lemurs. The ring-tailed lemurs successfully raised offspring in the exhibit, but the crowned lemurs had problems with the female black-and-white lemur. The crowned lemurs were then removed from the exhibit, and separated into pairs for breeding season. They successfully reproduced and raised offspring while separated. The crowned lemurs are alternated on exhibit with the female black-and-white ruffed lemur while they have infants.

The group composition has changed multiple times. The exhibit started with 2.1 red ruffed lemurs. When the female died, another female was added, then, she died. The black-and-white ruffed lemur group started with 2.1, then, one of the males died. The ring-tailed lemur group started with 4.0. Two tubally ligated females were added to the group. They were removed and a breeding female was added. She was later removed. The crowned lemurs started with 2.2. One of the males was kicked out of the group. One pair had offspring, which were later removed.

There have been changes in the stability of the group throughout all of the composition changes. The original female red ruffed lemur was spayed. She interacted fine with the female black-and-white ruffed lemur. When the new female red ruffed lemur was added after the first one died, there was aggression from the black-and-white ruffed female. Husbandry protocols were changed so they were not out on exhibit together because of this.

*Historical group*: 3.0 red ruffed lemur (*V. rubra*) – teenagers
1.2 ring-tailed lemur (*L. catta*) – adults

This group was together approximately five to six years. The female ring-tailed lemur didn't breed for the first three years. They were put into a free range environment, where she became reproductively successful.

## Cheyenne Mountain Zoo

Colorado Springs, Colorado
*Current Species*: 2.0 black-and-white ruffed lemur (*V. variegata*) – adult
4.0 ring-tailed lemur (*L. catta*) – non-breeding group, adult pair and juvenile offspring

This group has been together since 2008. They are together all of the time, with no aggression issues. The ring-tailed lemurs were reproductively successful in their previous mixed species group (see below). The composition has changed over time, with incoming black-and-white ruffed lemur, and a change in ring-tailed lemur group structure.

*Historical group 1:* 2.2 ring-tailed lemur (*L. catta*)
D'Arnaud's barbet (*Trachyphonus darnaudii*)
Emerald starling (*Lamprotornis iris*)
Leopard tortoise (*Stigmochelys pardalis*)
Lilac-breasted roller (*Coracias caudatus*)
Spur-thighed tortoise (*Testudo graeca*)

*Historical group 2*: 1.1 black-and-white ruffed lemur (*V. variegata*)
D'Arnaud's barbet (*Trachyphonus darnaudii*)
Emerald starling (*Lamprotornis iris*)
Leopard tortoise (*Stigmochelys pardalis*)
Lilac-breasted roller (*Coracias caudatus*)
Spur-thighed tortoise (*Testudo graeca*)

## Cincinnati Zoo

Cincinnati, Ohio
*Current Species*: 2.0 greater bushbaby (*O. garnetti*)
Flying fox/giant fruit bat (*Pteropus sp.*)
Aardvark (*Orycteropus afer*)

Cincinnati has had a number of mixed species groups, particularly nocturnals, over the past twenty years. There is limited data about the success/failure of the groups, but the information that is available is noted beneath each group.

*Historical Group 1*: Lesser bushbaby (*Galago sp.*)
African hedgehog tenrec (*Tenrecinae* family)

*Historical Group 2*: Lesser bushbaby (*G. senegalensis*)
Indian flying fox (*Pteropus giganteus*)
Egyptian fruit bats (*Rousettus aegyptiacus*)
Aardvark (*Orycteropus afer*)

*Historical Group 3*: Lesser bushbaby (*G. senegalensis*)
Potto (*P. potto*)
Springhaas (*Pedetes capensis*)

*Historical Group 4*: Potto (*P. potto*)
Egyptian fruit bat (*Rousettus aegyptiacus*)
Aardvark (*Orycteropus afer*)
This group was broken up because the female potto began eating the baby bats.

*Historical Group 5*: Potto (*P. potto*)
Lesser bushbaby (*G. senegalensis*)
Ruwenzori long-haired fruit bat (*Rousettus lanosus*)
This was a good exhibit with lots of interactions. Breeding occurred in both species during this mix.

*Historical Group 6*: Melanistic greater bushbabies (*O. crassicaudatus* or *garnetti*)
Giant fruit bat (*Pteropus sp.*)
Aardvark (*Orycteropus afer*)

*Historical Group 7*: Mongoose lemur (*E. mongoz*)
Potto (*P. potto*)
The mongoose lemurs did not ever breed in this group.

*Historical Group 8:* Mongoose lemur (*E. mongoz*)
Giant fruit bat (*Pteropus sp.*)
Aardvark (*Orycteropus afer*)
The mongoose lemurs did not breed in this group.

*Historical Group 9*: Fat-tailed dwarf lemur (*C. medius*)
Coquerel's mouse lemur (*M. coquereli*)
Breeding occurred in both of these species while they were mixed together.

*Historical Group 10*: Fat-tailed dwarf lemur (*C. medius*)
Mouse lemur (*Microcebus sp.*)
The mouse lemurs did not breed in this mixed group.

*Historical Group 11*: White-fronted lemur (*E. albifrons*)
Crowned lemur (*E. coronatus*)

*Historical Group 12*: Slender loris (*L. tardigradus*)
Mouse deer (*Tragulus sp.*)
No breeding occurred in this group

*Historical Group 13*: Slow loris (*N. coucang or bengalensis*)
Mouse deer (*Tragulus sp.*)
The slow loris did breed while in this group.

## Cleveland Metroparks Zoo

Cleveland, Ohio

**Group 1**

*Current species*: 0.1 pygmy loris (*N. pygmaeus*) – adult
1.0 Northern tree shrew (*Tupaia belangeri*) – adult

This group has been together since 2007. They are housed together continuously, with the exception of temporary removal for health checks or exhibit work. There has been no aggression when they are reunited. The only change to this group occurred when one tree shrew was swapped out for another.

**Group 2**

*Current species*: 1.0 pygmy loris (*N. pygmaeus*) – adult
1.0 bushbaby (*G. moholi*) – adult
1.0 Northern tree shrew (*Tupaia belangeri*) – adult

This current group has been together since 2011, with the loris and tree shrew together since approximately 2007. They are housed together continuously, with the exception of temporary removal for health checks or exhibit work. There has been no aggression when they are reunited or upon introduction of the bushbaby to the loris. The loris did have to adjust to the increased activity by the bushbaby, but not stress or aggression is currently observed. The only change to this group occurred when one tree shrew was swapped out for another.

**Group 3**

*Current species*: 1.1 potto (*P. potto*) – breeding pair
1.1 black-and-rufous elephant shrew (*Rhynchocyon petersi*) – breeding pair
0.2 bushbaby (*G. moholi*) – breeding female and offspring

The potto and shrew have been together since October of 2008. They have been housed together continuously. The bushbabies were added later. The potto are a breeding pair, but have not successfully reproduced. The shrews have raised one offspring in the exhibit, and the bushbabies have had one stillborn and have reared one offspring in the mixed species grouping.

**Group 4**

*Current species*: 1.3 ring-tailed lemur (*L. catta*) – older, breeding group
1.0 blue-eyed black lemur (*E. m. flavifrons*) – intact male

This group is housed together seasonally on an island exhibit. The ring-tail lemurs are older, and have not had any recent reproductive success.

*Historical group 1*: 1.0 pygmy loris (*N. pygmaeus*)
1.1 greater Malayan chevrotain (*Tragulus napu*)
This group was together for 2 years.

*Historical group 2*: 1.1 slender loris (*L. tardigradus*)
1.1 pygmy loris (*N. pygmaeus*)
2.1 striped possum (*Dactylopsila trivirgata*)
This group was together for 2 years.

*Historical group 3*: 3.0 fat-tailed dwarf lemur (*C. medius*)
0.2 grey bamboo lemur (*H. griseus griseus*)
This group was together for 1 year.

*Historical group 4*: 1.1 Coquerel's mouse lemur (*M. coquereli*)
1.1 Peter's mouse lemur (*M. myoxinus*)
1.1 fat-tailed dwarf lemur (*C. medius*)
This group was together for 2 years.

## Como Park Zoo

Saint Paul, Minnesota
*Historical group:* ring-tailed lemur (*L. catta*) – breeding group, females contracepted with MGA implant when not breeding
brown lemur (*E. fulvus*) – breeding group, females contracepted with MGA implant when not breeding

This group was together from 1984-2003. It was split due to a change in management direction at the institution, not due to any animal issues or concerns. Breeding occurred based on SSP/TAG recommendations, and the females were contracepted when no recommendation was given. One species had six individuals, and the other species had seven individuals. The records are unclear regarding the actual group composition, however The group composition did change over time. Successful reproduction occurred in the exhibit, with females of both species giving birth and rearing the offspring in the mixed-species group..

## Dallas Zoo

Dallas, Texas
*Current Species*: 2.0 ring-tailed lemur (*L. catta*) – adults, 1 male castrated
1.1 red-collared brown lemur (*E. collaris*) – adults, female contracepted with Depo-Provera® injections
2.0 black-and-white ruffed lemur (*V. variegata*) – adults

This group has been together since April 2008. They are separated at night and occasionally for training. The younger 1.0 black-and-white ruffed lemur does not allow keepers to enter the exhibit with him, so he is shifted into holding when necessary. This can occur as little as once per day, or several times, depending on the need. When he is returned to the exhibit, chasing does occasionally occur if either the red-collared or ring-tailed lemurs are nearby. He will also make contact with the older ruffed lemur, but it is usually only dominance mounting or pushing him – no biting or cuffing. He will displace the smaller lemurs, but rarely does the older ruffed lemur get displaced. There is always vocalizing between the ruffed lemurs. The whole demonstration can last from a few seconds up to a minute or more.

There has been no reproduction within this mixed species group since it was formed. One individual female collared brown lemur died.

*Historical group*: 2.2 black lemur (*E. macaco*) – females contracepted
2.1 black-and-white ruffed lemur (*V. v. variegata*) – female had an ovariohysterectomy
0.2 red-collared brown lemur (*E. collaris*)
1.0 red ruffed lemur (*V. v. rubra*)
3.0 ring-tailed lemur (*L. catta*)

This group went through several changes from 1996-2003. The red ruffed was removed in Dec. 1996. 0.2 black lemur were removed in June and July 1997. The female black-and-white ruffed was removed in Dec. 1998. 1.0 black lemur was removed in Mar. 1999. In Feb. 2000, a new 1.0 red ruffed lemur was added to the group. In Jun. 2001, 1.0 black-and-white ruffed lemur was removed. 1.0 ring-tailed lemur was removed in Jul. 2001. In May 2002, 1.0 red ruffed lemur was removed. All of the remaining lemurs were removed from the exhibit at this time for renovations. During this time, the remaining 1.0 black lemur was removed. After Jun. 2003, the remaining lemurs, including 0.2 collared lemur, 1.0 black-and-white ruffed lemur, and 2.0 ring-tailed lemur were returned to the lemur building and exhibit. All of the lemurs that were removed from the group during this time span were removed due to death of the animal.

In Nov. 2003, the group was split up by species due to the addition of 1.0 collared lemur, 2.0 black-and-white ruffed lemur, and 1.0 ring-tailed lemur. Attempts were made to mix 3.0 black-and-white ruffed and the collared lemur group, but this was unsuccessful due to the male collared lemur consistently getting chased out of the exhibit.

In 2005, the collared lemurs gave birth to 1.2 offspring. They were held off exhibit during this time. Due to maternal fighting, the 2.4 collared lemur were split into two groups of 1.2.

In 2006, 2.0 ring-tailed lemur were introduced to 1.2 collared lemur. This group was mixed until Apr. 2008. In Oct. 2007, 1.1 collared lemur were shipped out, and in Jul. 2008, 1.0 black-and-white ruffed lemur was shipped out.

## Denver Zoological Gardens

Denver, Colorado
*Current Species*: 7.0 ring-tailed lemur (*L. catta*) – adult group
1.0 brown lemur hybrid (*E. fulvus* hybrid) – adult

The outside exhibit space for this group is approximately 75,852 $ft^3$, with an indoor exhibit of 2,640 $ft^3$ and an indoor holding stall of 800 $ft^3$.

This group has been together since April 2001. They arrived at Denver as a group. The group is only separated if there is aggression that results in injuries. Tension usually begins in mid-winter and continues into spring. It is usually the subordinate animal that ends up being injured. When a lemur is injured to the extent that it requires medical intervention, the injured animal is housed separately until they are healed enough to get along with the group. Occasionally, they will get short time outs if there is fighting or chasing to an extent that a lemur could be injured.

When the lemurs are reintroduced, there may be small amounts of chasing. Rarely have they had to separate for a longer time and then do slow introductions again due to aggression. Other forms of aggression (including contact and non-contact, displacement, and vocalizations) occur very rarely. The length of separation due to aggression in the group is variable depending on the incident. It has been for as long as several weeks and as short as a few hours. None of this has resulted in long-term stability issues.

There has been no reproduction within this group.

*Historical group*: 1.0 aye-aye (*D. madagascariensis*) – adult male
1.1 Coquerel's mouse lemur (*M. coquereli*) – adult, breeding pair

This group was together from 1996-1997. The mouse lemurs were a breeding pair of young adults. No problems were noted. The group was separated because the male aye-aye was sent to another institution.

## Detroit Zoological Society

Royal Oak, Michigan
*Current Species*: 3.1 ring-tailed lemur (*L. catta*)
2.3 black-and-white ruffed lemur (*V. variegata*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## Disney's Animal Kingdom

Lake Buena Vista, Florida
*Current Species*: 2.0 ring-tailed lemur (*L. catta*) – intact males
2.0 red-collared brown lemur (*E. collaris*) – adult, castrated males
1.1 coscoroba swans (*C. coscoroba*) – sibling adults, have nested, but no offspring
12.7 lesser flamingos (*Phoeniconaias minor*) – breeding flock

Various waterfowl species

The outdoor part of the exhibit is approximately 16,200 $ft^3$, with two indoor holding stalls totaling 1,440 $ft^3$.

This group has been together since 2000. There has been variation in bird species within the exhibit, including a pair of woolly-necked storks, as well as a large breeding flock of greater flamingos. The flamingos are mainly in the waterway around the exhibit, but do occasionally go onto the land area of the exhibit. The lemur group is mixed at all times. They are separated from the bird species at night, when the lemurs are brought into their night house. The only time lemurs are separated from each other is for medical procedures (short term for recovery), or during medical treatment (longer periods if animal stays at the hospital for treatment). There has been no aggression upon reintroduction to the group.

There has been no reproduction in this group. The swans have shown nesting and breeding behaviors, and have laid and incubated eggs several times, but no offspring were produced.

There have been several changes to the composition of the group over the years. In 2000, the group consisted of 3.1 red-collared lemur and 2.0 ring-tailed lemur. In 2001, the father and oldest collared lemur son were removed from the group due to aggression, leaving the mother and youngest collared lemur son and 2.0 adult ring-tailed lemur. At the end of 2001, the father was returned to the group and the oldest son was sent away. There were no difficulties reintroducing the father to the group. A short time later, the female collared lemur died. In 2006, 1.0 ring-tailed lemur died and another 1.0 ring-tailed lemur died in early 2010. The 2 new male ring-tailed lemur came into the group in 2011 with no problems. There were no changes in the stability of the relationship between the two species. They don't intermingle much.

## Duke Lemur Center

Raleigh-Durham, North Carolina

Duke houses multiple mixed-species groups, in both free-ranging and fully enclosed habitats. Each group is listed separately. There are frequent changes to groups based on year and season.

**Group 1**

*Current Species*: 1.0 fat-tailed dwarf lemur (*C. medius*) – older adult
1.1 slender loris (*L. tardigradus*) – adult breeding pair
1.0 grey mouse lemur (*M. murinus*) – adult

This group has been together since spring of 2007. They each utilize different areas of the exhibit, and have different enough feeding habits so there is little competition. They are mixed at all times. Reproductive behavior has been observed, but no offspring have been produced. If offspring are produced, the mother and offspring are separated until the infant is old enough to move around on its own.

There have been some composition changes in this group. The female slender loris was born in this exhibit when her mother was housed with a different 0.1 fat-tailed dwarf lemur, 1.1 lesser bushbabies, and 0.1 pygmy loris. When the infant was discovered, the mother and baby were removed from the group. They were gradually reintroduced when the infant was approximately two months old. This group also had 0.1 Coquerel's mouse lemur and various grey mouse lemurs at different times. All changes to the group were due to death or moves for breeding recommendations, not due to any aggression issues.

**Group 2**

*Current Species*: 1.2 crowned lemur (*E. coronatus*) – adult breeding pair w/ post-reproductive female
1.2 ring-tailed lemur (*L. catta*) – adult, non-breeding group – females contracepted with Depo-Provera® injections

This group has been together since 2008. The two female ring-tailed lemurs were introduced to the crowned lemurs a few months before the male ring-tailed lemur was added to the group. They are fed in two different locations, but they can still interact with each other. They are not separated otherwise. The only aggression noted is initiated by the 3-year old female ring-tailed lemur, and consists mainly of non-contact aggression. Aggression occurs during training and feeding times. Once training is over, the aggression ends. No reproduction has occurred in this group.

The composition of this group has changed a few times since 2002. Prior to the introduction of the ring-tailed lemurs, the crowned lemurs were housed with 2.0 Tattersall's sifaka (*Propithecus tattersalli*) and a second 1.0 crowned lemur. The crowned lemurs were contracepted with Depo-Provera® at the time. Over time, these three animals were removed. The female crowned lemur was swapped out due to breeding recommendations in November. This did not affect the group stability.

**Group 3**

*Current Species*: 3.4 ring-tailed lemur (*L. catta*) – mixed age group, one female contracepted with Depo-Provera® injections, and two breeding recommendations
1.1 red-fronted brown lemur (*E. rufus*) – adult, non-breeding pair – female contracepted with Depo-Provera® injections

This group has been together since the summer of 2008. Two of the male ring-tailed lemurs were separated to prevent breeding, based on SSP breeding recommendations. The breeding group has not gone through an entire breeding season yet, so there is no information on reproductive behavior. The two species do not frequently interact; each occupy different spaces in the exhibit. This is a free ranging group, so they have plenty of space. In cases where they do interact, the brown lemurs tend to be more dominant and the ring-tailed lemurs react submissively. The only change to this group occurred when a female ring-tailed lemur was removed in October 2009. This did not affect the stability of the group.

**Group 4**

*Current Species*: 4.2 Coquerel's sifaka (*P. coquereli*) – breeding pair with offspring
2.3 red ruffed lemur (*V. rubra*) – breeding pair with offspring

This group has been together since September 2008. The adult red ruffed lemurs were with the sifakas prior to the ruffed lemurs having offspring without incident. There has been some minor aggression from the dominant females of each species, but it has not escalated beyond slight chasing. They are separated for feedings, as well as overnight, due to the presence of the infants. They were also separated in the winter months due to heating issues in their enclosure. There has been no aggression upon reintroduction.

Both species have exhibited reproductive behavior resulting in offspring. They are separated for the birth and the first few months of rearing, but once they are old enough to get around the enclosure safely, the group is put back together. Older male sifaka children have been removed from the group due to aggression from their father. Sifaka have been born in the group yearly. The red ruffed lemurs first conceived in 2008.

**Group 5**

*Current Species*: 1.0 aye-aye (*D. madagascariensis*) – older adult
1.1 pygmy lorises (*N. pygmaeus*) – older adults, breeding pair

This group has been together since June 2008. They are not separated at any time. There has been some minor competition over food, but it is generally just displacement. The aye-aye will move away when the lorises approach. The lorises have produced offspring in the past in other mixed species exhibits, but have yet to breed since being placed in their current housing. Both are advanced in age, so they may be post-reproductive.

**Group 6**

*Current Species*: 1.0 slender loris (*L. tardigradus*) – older adult
1.0 Grey mouse lemur (*M. murinus*) – older adult

This group has been together since August 2008. They have been observed sleeping next to each other. They are together except during cleaning, at which point, they are housed in individual kennels. There is no aggression noted when they are reunited.

There was originally a female slender loris in the group as well. The lorises were allowed to breed, but no offspring was produced, possibly due to advanced age and poor health of the female. The female passed away in October 2008.

**Group 7**

*Current Species*: 1.0 black lemur (*E. m. macaco*) – older adult
0.1 white-fronted brown lemur (*E. albifrons*) – geriatric adult, contracepted with Depo-Provera® prior to ovariohysterectomy in 2005

This group has been together since 1995-1996, with many group composition changes. The current grouping has been together since 2004. They are together all of the time, and they show companion behaviors.

The group started with 1.0 black lemur and 1.0 red-collared brown lemur. 1.0 red ruffed lemur was added in June 1997. They were moved, as a group, to different housing in October 1997, but 1.0 black lemur kept escaping, so he was moved elsewhere and housed alone.He was then put with other black lemur males before being alone again, and was then introduced to his current cagemate, 0.1 white-fronted brown lemur. The female white-fronted lemur was only housed with other white-fronted lemurs prior to being introduced to the black lemur.

**Group 8**

*Current Species*: 1.0 red-collared brown lemur (*E. collaris*) – geriatric adult
0.1 white-fronted brown lemur (*E. albifrons*) – geriatric adult, contracepted via ovariohysterectomy

This group started in 1993, with several group composition changes. The current grouping has been together since 2006. They are together all of the time and occasionally exhibit companion behaviors.

From 1993-2004, this group consisted of 1.0 red-collared brown lemur and 1.0 ring-tailed lemur. 1.0 black-and-white ruffed lemur was added to the group for a short time in 1999 with no problems. In 2004, the ring-tailed lemur male was moved due to a breeding recommendation. 0.1 red-bellied lemur (*E. rubriventer*) was in the group from August 2005 – May 2006. She was contracepted with an MGA implant during this time. She was separated from the group to be paired with 1.0 red-bellied lemur. The female white-fronted brown lemur was added in May 2006. None of these changes have affected the stability of the group.

**Group 9**

*Current Species*: 1.5 ring-tailed lemur (*L. catta*) – breeding group with juvenile offspring
1.1 blue-eyed black lemur (*E. m. flavifrons*) – breeding pair

This group has been together since June 2005. They are currently in a free-range setting in a large forested area. They are separated for daily feeding, as well as by species overnight when it is necessary. They are also separated seasonally. Displacement does occur when the group is reunited. The blue-eyed black lemurs will displace the ring-tailed lemurs from the area to approximately five yards away. There is no contact aggression.

Both species have exhibited reproductive behavior within this group. They are usually separated and brought indoors before conception due to winter conditions. They are housed separately by species during the winter, which encompasses most of the breeding season. They have successfully reared offspring in the mixed group, though. The infants are generally a few weeks to up to two months old when they are reintroduced to the free-range area and the other species. The forested area allows for family groups to be isolated, coming together only at feeding times. Some charging and/or shoving between males can occur, but it is usually a short bout.

There have been some composition changes in this group. The blue-eyed black lemur family was originally housed with a non-breeding group of 2.1 ring-tailed lemurs. These were swapped out for the breeding group. There were no changes in the stability of the group when this occurred.

**Group 10**

*Current Species*: 1.0 aye-aye (*D. madagascariensis*) – older adult
1.0 pygmy loris (*N. pygmaeus*) – adult
1.0 Coquerel's mouse lemur (*M. coquereli*) – adult

This group has been together since April 2007. The pygmy loris was put with the aye-aye in 2005, and the mouse lemur was introduced in 2007. They are mixed together all of the time. For a few months, the aye-aye was removed due to stress created by living in the public exhibit room. He was returned when red lights and window shades were implemented to prevent light filtration. There was no aggression when the animals were reunited.

**Group 11**

*Current Species*: 1.1 fat-tailed dwarf lemur (*C. medius*) – adult breeding pair
0.1 lesser bushbaby (*G. moholi*) – adult
1.0 pygmy loris (*N. pygmaeus*) – adult

This group has been together since March 2003. The male dwarf lemur was released to free-range with the bushbaby and pygmy loris in September 2008. The female dwarf lemur was slowly introduced to the free-range group due to fighting with the male dwarf lemur. The dwarf lemurs are occasionally separated from the group for research projects. There is no aggression upon reintroduction of the animals. These animals will share food bowls without aggression, and are all maintaining proper weights. They will occasionally sleep together.

The male pygmy loris bred with a female, who became pregnant, but was removed from the group before giving birth. She was not put back in the group due to aggression from the male loris. She was later found to have advanced cancer, which may have contributed to the failure of the reintroduction.

The group initially consisted of a breeding pair of lesser bushbabies, 0.2 dwarf lemur, and 1.0 pygmy loris. One of the female dwarf lemurs died in July 2003, and a male 1.0 dwarf lemur was introduced for breeding. He did not get along with 0.2 dwarf lemur, but did well with the bushbabies and pygmy loris. The bushbabies successfully reproduced during this time.

**Group 12**

*Current Species*: 0.1 aye-aye (*D. madagascariensis*) – adult
0.1 slow loris (*N. coucang*) – adult

This group has been together since October 2007. They are mixed together all of the time. They do not appear to compete over space or food. In 2008, when the aye-aye was cycling, they were given access to a room with 1.0 aye-aye in it for breeding. The aye-aye did not become pregnant, though. There were no interactions with the slow loris during this time.

**Group 13**

*Current Species*: 2.2 Verreaux's sifaka (*P. verreauxi*) – breeding pair with offspring
3.3 red ruffed lemur (*V. rubra*) – breeding pair with offspring, female offspring are contracepted with MGA implants

This group has been together since 2005. They are separated daily for feeding, as well as for night housing if they need to be locked in overnight. They are also separated seasonally. There has been no aggression when the group has been reunited. Individuals behave normally when in close proximity to each other, and they often respond to the alarm calls of the other species.

Both of these groups have had successful reproduction both within and outside of the mixed group. The sifaka are separated for the initial child rearing. They breed in the free-range enclosure in the summer, and are then put back out while they are weaning offspring the following spring. They are not housed in the free-range enclosure during the winter. The red ruffed lemurs have given birth in the free-range enclosure.

The group composition has changed over the years with the birth of both sifaka and ruffed lemur offspring in 2007. Also, three of the red ruffed lemurs were removed in 2008. The red ruffed lemurs were previously housed in this enclosure with a group of blue-eyed black lemurs and ring-tailed lemurs.

**Group 14**

*Current Species*: 1.0 aye-aye (*D. madagascariensis*) – adult
0.1 slow loris (*N. coucang*) – adult

This group has been together since May 2008. They are mixed at all times. They sleep together most nights, share food, and walk past each other regularly with no problems.

**Group 15**

*Current Species*: 1.0 aye-aye (*D. madagascariensis*) – older adult
1.0 pygmy loris (*N. pygmaeus*)

This group has been together since December 2007. They are mixed at all times, without any aggression or negative behaviors being observed. They have shown interest in each other's food and have been seen eating together without incident.

**Group 16**

*Current Species*: 1.0 black lemur (*E. m. macaco*) – older adult
0.1 crowned lemur (*E. coronatus*) – older adult, probably post-reproductive, she was on Depo-Provera® for approximately 10 years

This pair has been together since January 2005. They are mixed at all times, and do exhibit companion behaviors. They have also been observed exhibiting reproductive behaviors – the male actively marks her and has been seen mounting her.

**Group 17**

*Current Species*: 1.0 blue-eyed-black lemur (*E. m. flavifrons*)
0.1 Sanford's brown lemur (*E. sanfordi*) – contracepted via tubal ligation, was on Depo-Provera® prior to that

This pair has been together since March 2008. They are separated for daily feedings in order to manage the weight of the blue-eyed black lemur. They generally show greeting behaviors when they are reunited.

The Sanford's lemur was previously housed with 1.0 red-collared brown lemur. They were together from September 2007 until March 2008, when the red-collared lemur was transferred. She has also free-ranged with other red-collared brown lemurs, crowned lemurs, and bamboo lemurs.

**Group 18**

*Current Species*: 1.0 red-bellied lemur hybrid (*E. rubriventer*) – older adult, neutered
0.1 Sanford's brown lemur (*E. sanfordi*) – geriatric adult, blind

This pair has been together since April 2007. They exhibit companion behaviors and are mixed at all times.

The red-bellied lemur was previously with 1.0 Sanford's brown lemur. This male was also neutered. He was also housed with 1.0 ring-tailed lemur for a month in 1999. From 1999 until 2002, he was housed with a different Sanford's brown lemur.

**Group 19**

*Current Species*: 0.1 red-collared brown lemur (*E. collaris*) – older adult, considered post-reproductive, was on Depo-Provera® from 1993-2000
1.0 black lemur (*E. m. macaco*) – older adult, permanently disabled

This pair has been together since June 2004. They exhibit companion behaviors and are mixed at all times.

**Group 20**

*Current Species*: 0.1 black lemur (*E. m. macaco*) – geriatric adult, contracepted via ovariohysterectomy
1.0 red-collared brown lemur (*E. collaris*) – adult
0.1 black-and-white ruffed lemur (*V. variegata*) – adult

This group has been together since October 2006. The black-and-white ruffed lemur usually sleeps alone, but is seen mutually grooming with the red-collared lemur. The collared lemur sometimes sleeps with the black lemur, but they are rarely seen grooming each other. The black-and-white ruffed

lemur is separated daily for feeding. There is some displacement and non-contact aggression towards her when they are reunited; It is usually instigated by the red-collared lemur. He will approach to chase or nip at her heels, but does not follow through with the behavior. It generally lasts 2-3 seconds. The collared lemur often scent-marks the black-and-white ruffed lemur, as well, but no reproductive behavior has occurred.

There have been many changes to the group composition. It originally started in 1991, with 1.1 black-and-white ruffed lemur. This changed in 2000 with the addition of 1.1 black lemur. They were removed after a month, because the male black lemur was aggressive towards the female black-and-white. Also, in 2000, 1.0 ring-tailed lemur and 1.0 red-fronted lemur were added to the group. The male black-and-white ruffed lemur was neutered in 2004. In 2005, 1.0 red-fronted lemur was removed, and 0.1 black lemur and 1.0 red-collared brown lemur were added. In 2006, the male black-and-white ruffed lemur died, and later in the year, the ring-tailed lemurs were removed due to breeding recommendations.

**Group 21**

*Current Species*: 1.0 blue-eyed black lemur (*E. m. flavifrons*) – adult
0.1 black lemur (*E. m. macaco*) - adult

No additional information about introductions, timing, reproduction, or social dynamics in this group.

**Group 22**

*Current Species*: 1.0 red-fronted brown lemur (*E. rufus*) – adult
0.1 brown lemur (*E. fulvus*) - adult

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## El Paso Zoo

El Paso, Texas

*Historical Group*: 1.1 pygmy loris (*N. pygmaeus*) – adult female, young male, no breeding recommendation, female implanted in Fall/Winter of 2008
0.1 Northern tree shrew (*Tupaia belangeri*)

It is unknown how long this group was together. The male pygmy loris was removed from the exhibit due to aggression toward the female. The female loris remained with the Northern tree shrew for another 3-4 months, before the tree shrew was removed to another exhibit space. There were no issues or aggression noted between the loris and the tree shrew.

## Franklin Park Zoo

Boston, Massachusetts

*Current Species*: 1.0 potto (*P. potto*) – adult breeding male
0.1 African four-toed hedgehog (*Atelerix albiventris*) – aged between 1-2

This mixed exhibit has been in place for some time. The hedgehogs change out every 3-5 years, due to short lifespans. The current hedgehog has been in the exhibit since 2007. The only separations occur when there is a breeding pair of potto present. Reproductive behavior resulting in conception has occurred. The female is removed approximately 1-2 months before birth to prevent interference with the offspring by the male potto. They are kept separate until approximately 5 months after the offspring is born. The female is then reintroduced back to the male without the offspring. There has been no aggression upon reintroduction of the female.

Other than the situations described above, there has been only one group composition change. A few years ago an attempt was made to introduce two male pottos to elicit breeding, but it was unsuccessful due to fighting between the males.

## Fresno Chaffee Zoo

Fresno, California

*Current Species*: 2.2 red ruffed lemur (*V. rubra*) – adult breeding group, no current contraception, females previously contracepted with MGA implant
1.1 black swans (*Cygnus atratus*) – adult, non-breeding pair

This group has been together since December 2006. The group is together all of the time, unless there are medical issues. There is no aggression upon reintroduction. There has only been one change in group composition. In October 2008, 1.0 red ruffed lemur transferred to another institution. This did not change the group stability.

There has been no reproduction while in the mixed-species setting. The females were contracepted when the exhibit was initially put together.

*Historical group*: 1.2 ring-tailed lemur (*L. catta*) – adult group, male castrated
1.1 black swans (*Cygnus atratus*) – non-breeding, adult pair

It is unknown how long this group was together.

## Gladys Porter Zoo

Brownsville, Texas

**Group 1**

*Current Species*: 0.3 ring-tailed lemur (*L. catta*)
2.1 red ruffed lemur (*V. rubra*)
various waterfowl
greater adjutant stork (*Leptoptilos dubius*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

**Group 2**

*Current Species*: 2.4 red ruffed lemur (*V. rubra*)

various waterfowl

*Historical Group*: ring-tailed lemurs (*L. catta*)
East African grey-crowned cranes (*Balearica regulorum gibbericeps*)

These groups have been together since at least the 1980s, possibly since the 1970s. They are together all of the time. It is likely that at one time black-and-white ruffed lemurs were housed with the large bird species, but records are unclear. The ring-tailed lemurs have been housed with storks and cranes at different times as well.

## Greenville Zoo

Greenville, South Carolina
*Current Species*: 1.0 red ruffed lemur (*V. rubra*) – intact adult male
2.0 black-and-white ruffed lemur (*V. variegata*) – intact adult males

This group has been together since 1986. The animals were all young when they were introduced. Rarely, there is a small amount of aggression between the species. When they need to be kept inside due to weather, the red ruffed lemur is sometimes separated because of this. There are no issues with aggression upon reintroduction.

Before the red ruffed lemur was introduced to the group, a third male black-and-white ruffed lemur was present. He was removed in 1984. This change did not affect the group stability.

## Happy Hollow Zoo

San Jose, California
*Historical Group*: 3.2 ring-tailed lemur (*L. catta*) – adult non-breeding group
1.1 radjah shelducks (*Tadorna radjah*) – unknown ages

This group was together approximately 3 years. The ducks were added to the exhibit because they were quite aggressive to other ducks, so they were removed from a mixed species aviary. There was very little interaction between the lemurs and the ducks. The exhibit was broken up when additional holding became available for the ducks.

## Hattiesburg Zoo

Hattiesburg, Mississippi
*Current Species*: 2.1 ring-tailed lemur (*L. catta*) – older non-breeding group
2.0 crowned lemur (*E. coronatus*) – castrated adult males
1.0 black-and-white ruffed lemur (*V. variegata*) – adult male
1.0 red ruffed lemur (*V. rubra*) – adult male
0.1 blue duiker (*Philantomba monticola*)

This group has been together since May 2008. There is very little interaction between the lemurs and the hoofstock. The lemurs spend some time socializing with each other, but not a lot. There is

potential for increased aggression in holding, where the space is more limited, therefore, they are separated for night housing. There is also the potential for more aggression during feeding times, so they are separated then as well. No aggression has been noted upon reintroduction.

This mixed group setting has been established since at least 1999, possibly earlier. At one point, there were also 2.0 black lemur (*E. m. macaco*) in the mix of species. There have also been more individuals of ring-tailed lemurs, ruffed lemurs, and crowned lemurs, but always males, and never more than 2 or 3 individuals of each species. The group stability has always been good.

## Henry Vilas Zoo

Madison, Wisconsin

*Current Species*: 4.1 ring-tailed lemur (*L. catta*) – adult, non-breeding group, males neutered
2.3 colobus monkeys (*Colobus guereza*) – adult, non-breeding group, males neutered

This group has been together more than 10 years. They are kept together most all of the time. One geriatric female stays in exhibit for treatment. The only other time they are separated is for illness or injury. There has been no aggression noted upon reintroduction.

There have been several group composition changes with minimal changes in stability. Initially there were 5 ring-tailed lemurs, but individuals were lost due to age and injury. The group was initially an adult female and her offspring. The original colobus group was 2.4. The only group changes have been due to attrition. During initial introductions, the ring-tailed lemurs were put on exhibit first, and then the colobus monkeys were added.

The colobus monkeys have given birth and raised young in the mixed-species exhibit. The ring-tailed lemur group is a non-breeding group.

## Henson Robinson Zoo

Springfield, Illinois

*Current Species*: 1.0 ring-tailed lemur (*L. catta*) – neutered
2.2 black lemur (*E. m. macaco*) – older, non-breeding group, older female spayed, younger female contracepted with Depo-Provera® injections

This group has been together since June 2008. Two of the black lemurs have been separated periodically due to cycling and heightened aggression. Typically, no aggression has been noted upon reintroduction, but it depends on how long they are separated. If there is aggression, a longer reintroduction period is incorporated. There has been no breeding within the group.

This group has been in flux since exhibit was built in 1996. It started with 2.0 male ring-tailed lemurs. These were sent out and 3 new ring-tailed lemurs were added to the group in 2001. Younger animals became a problem at this time. In October 2001, 1.0 young ring-tailed lemur was moved out of the group. An attempt to put the group back together was made in January 2002. This was successful for a while, but then dominance issues and fighting in the ring-tailed lemurs developed. In December

2004, a big fight developed and 2.0 ring-tailed lemur were taken out of the group and kept separate. One ring-tailed lemur was left in the group. In October 2005, the 2.0 ring-tailed lemur were added back in, first with a howdy in the enclosure, then released into the group. Chasing and hair pulling was still observed. After 3 weeks, the dominant male ring-tailed lemur was pulled out, then was put back in after a few days time out. He still fought with all the other individuals in the group, both the ring-tailed and black lemurs. He was then left in the group and the other 2.0 ring-tailed lemur were kept separate. This change reduced the aggression problems.

The two ring-tailed lemurs that were eventually pulled out of the group had come from Duke Lemur Center, where they were free-ranging. The smaller exhibit size may have contributed to the aggression problems. During breeding season, some aggression is also noted in the black lemurs, causing occasional separation of individuals.

## Houston Zoo

Houston, Texas

**Group 1**

*Current Species*: 1.1 ring-tailed lemur (*L. catta)* – adult breeding pair
0.1 red-fronted brown lemur (*E. rufus*) – adult non-breeding female
1.0 crowned lemur (*E. coronatus*) – castrated male
Madagasar big head turtles (*Erymnochelys madagascariensis*)
Hottentot teal (*Anas hottentota*)

The original mixed species group has been together since 1993. The current composition has been together since 2010. They are kept together all of the time, though the two species separate themselves into separate night rooms when they are brought inside at the end of the day. They have shown no aggression towards each other. The three species have occasionally shown affiliative behaviors as well. The ring-tailed lemurs have been seen copulating, but no offspring have been produced yet.

Several group composition changes occurred over the years since the group was initially put together in 1993. In 2001, a red-fronted brown lemur pair was introduced with 1.2 geriatric ring-tailed lemurs (all different individuals from the current ones). The introduction went smoothly with only very rare aggression from the male red-fronted brown lemur towards the ring-tailed lemurs, but none of it serious. By 2006, all 3 of the ring-tailed lemurs had died from illnesses or been moved to a geriatric area within the facility. In July of 2006, the current pair of ring-tailed lemurs was added to the group. There were no changes in group stability. In 2009 the male red-fronted brown lemur died, and in 2010 a castrated male crowned lemur was brought in for companionship for the female.

**Group 2**

*Current Species*: 1.0 slow loris (*N. bengalensis*)
1.1 Prevost's squirrel (*Callosciurus prevostii*)
1.1 Asian small-clawed otter (*Aonyx cinerea*)
1.1 blue-bellied rollers (*Coracias cyanogaster*)

Several species of fish

This group is exhibited in the indoor "Natural Encounters" exhibit. No additional information about introductions, timing, reproduction, or social dynamics in this group.

*Historical Group 1*: 1.1 Coquerel's sifaka (*P. coquereli*) – adult breeding pair
2.0 radiated tortoises (*Astrochelys radiata*)

The group was together only in the summer. The tortoises were brought in each winter.

*Historical Group 2*: 1.1 black-and-white ruffed lemurs (*V. variegata*) – adult breeding pair
various waterfowl

The lemurs were housed on an island in the duck lake for 3 summers and brought in for the winter.

## Indianapolis Zoo

Indianapolis, Indiana

**Group 1**

*Current Species*: 4.8 ring-tailed lemur (*L. catta*) – breeding group
2.0 collared lemur (*E. collaris*) – males intact

The outdoor exhibit size is approximately 2,400 $ft^3$ with an indoor holding space approximately the same size.

This group has been together since 2010. They are separated daily for feedings and overnight housing. In the winter they are mixed together during the day, but they are still separated at night.

**Group 2**

*Current Species*: 1.1 blue-eyed black lemur (*E. m. flavifrons*) – breeding pair
3.2 red ruffed lemur (*V. rubra*) – non-breeding group, females are contracepted with Depo-Provera® injections

The outdoor exhibit for this group is approximately 30,000 $ft^3$, with five indoor connecting stalls ranging from 400 – 840 $ft^3$.

This group was initially put together in 2002. They are separated daily for feedings and overnight housing. In the winter they are mixed together during the day, but they are still separated at night. Aggression does not typically occur once the group is stable, usually after the first year.

The blue-eyed black lemurs have shown reproductive behaviors within the mixed species group. They have not produced offspring yet. There have been a couple of group composition changes, which have resulted in changes in the stability of the group. In 2005, a male was removed. In 2008, the female blue-eyed black lemur was swapped with a new female. The stability of the group was temporarily

affected when adding in the new individuals. There were changes in their cycling pattern, resulting in extra aggression.

*Historical group 1*: 2.8 ring-tailed lemur (*L. catta*) – breeding group
1.1 crowned lemur (*E. coronatus*) – non-breeding pair, male castrated

The outdoor exhibit size is approximately 7,200 $ft^3$ with three indoor conntecting stalls ranging from 960-1960 $ft^3$.

This group was together from February 2008 until 2010. They were housed together during the day, and are usually fed together. They were separated by species overnight. In the winter, they may have been mixed together inside during the day, but are still separated at night. After the first year, aggression typically did not occur. The only other time they may have been separated was due to illness or injury.

The crowned lemurs did show reproductive behaviors, though the male was castrated. The ring-tailed lemurs have reproduced while in the mixed species group. They have given birth and raised several offspring with no difficulties. They have not been separated for any breeding season. This group was split apart when the castrated male was sent to another institution and replaced with a breeding male. The crowned lemur breeding group was separated.

*Historical group 2*: 1.2 red-collared brown lemur (*E. collaris*) – breeding group, female was previously contracepted with Depo-Provera® injections
ring-tailed lemurs (*L. catta*) – multiple individuals, sexes, ages

This group was together from 1992 until 2007. The group was stable the entire time. Once the red-collared brown lemur infants were born, everyone sat together. One red-collared brown lemur was removed for a year, and the group still went back together. The red-collared lemurs were reproductively successful within the mixed species group. The collared lemurs included 2.4 individuals at one point.

## Jackson Zoo

Jackson, Mississippi

*Current Species*: 1.1 red-fronted brown lemur (*E. rufus*) – adult, non-breeding pair, female contracepted with MGA implant
1.1 red ruffed lemur (*V. rubra*) – adult breeding pair

This group has been together since approximately 2001. They are separated at night, with no visual, tactile, or auditory access to each other. The only other reason they are separated is for medical exams, which is generally only a few hours at a time. There is some aggression upon reintroduction, but it usually consists of non-contact aggression, including vocalizations and displacement. The red ruffed lemurs are let outside about 1 minute before red-fronted brown lemurs. There is usually some aggression lasting less than 5 minutes when red-fronted brown lemurs go out and approach the feed pans. The aggression is mostly between the dominant male red ruffed and the male red-fronted.

There is occasionally some aggression from the male red-fronted lemur to the female red ruffed lemur. They all settle down for the rest of the day. Aggression seems to revolve around food accessibility.

The group composition has changed, resulting in some changes to the stability of the group. In 2008, the female red ruffed lemurs were changed due to breeding recommendations. The original female red ruffed lemur was more dominant and was not interested in the male red ruffed lemur. The male was submissive to her and there was not much interaction. When the new female was brought in, the male red ruffed lemur became more dominant and confident. He showed more territorial aggression towards the red-fronted brown lemurs. When mixing the new pair of red ruffed lemurs with the red-fronted brown lemurs, several combinations were tried. First the two males were put out and they ignored each other. Then the new female red ruffed was added; however, the male red ruffed became aggressive to male red-fronted lemur. Next, the two females were let out, and they ignored each other. Finally, both males were added back to the group and no aggression problems were noted. The red ruffed lemurs have shown reproductive behaviors, and have been observed copulating.

They would like to modify holding space so there is at least visual and auditory access overnight to perhaps decrease initial aggression in the morning when the group is put together.

## Jacksonville Zoo

Jacksonville, Florida
*Current species*: 5.0 ring-tailed lemur (*L. catta*) – intact adults
2.1 black-and-white ruffed lemur (*V. variegata*) – adult

The males of this group have been exhibited together since 1999, separated by species in holding overnight. A female black-and-white ruffed lemur joined the previously all-male group in June 2008. At that time, 2.0 black-and-white ruffed lemur were separated from each other when in the night house, alternately housed with 0.1 overnight. All lemurs continued to be exhibited together each day. This female passed away in March 2010. A second female was added in July 2011. With the second female's presence, 2.0 ruffed lemurs are more compatible and do not require separation in the night house (at least outside of breeding season).

Occasionally, one of the ring-tailed lemurs, who is diabetic, is pulled out with a companion short-term for medical treatment. There is occasionally displacement or mild aggression when the group is reunited. There is some bullying during shifting between holding and the exhibit. The ruffed lemurs are shifted out last to decrease aggression toward the ring-tailed lemurs.

Reproduction: The first female black-and-white ruffed lemur became pregnant, but aborted three fetuses in March 2010 and died the following day. Necropsy indicated marked endometrial edema, hemorrhage, and mild suppurative endometritis. The second female added has not gone through breeding season in the group yet.

When this exhibit first opened in 1999, it contained 5.0 ring-tailed lemur, 3.0 black-and-white ruffed lemur, and 3.0 red ruffed lemur. 1.0 black-and-white lemur died in 2004. The red ruffed lemurs left in April 2008 for breeding purposes. A female black-and-white was added in May 2008 but died in March

2010. These changes did mildly affect the stability of the group; however there were no significant changes in the group dynamics between species. 1.0 black-and-white ruffed lemur did go after the female, but she corrected him and there were no further issues with them.

**Kansas City Zoo**
Kansas City, MO
*Historical Group 1*: 2.0 red ruffed lemur (*V. rubra*) – adult non-breeding males
1.1 African crested porcupine (*Hystrix cristata*) – breeding pair
0.0.3 radiated tortoises (*Astrochelys radiata*)

*Historical Group 2*: 4.1 ring-tailed lemur (*L. catta*) – non-breeding group, males castrated
1.1 African crested porcupine (*Hystrix cristata*) – breeding pair
0.0.3 radiated tortoises (*Astrochelys radiata*)

It is unknown how long these groups were together. The red ruffed lemurs and ring-tailed lemurs were alternated every other day on exhibit with the porcupines and the radiated tortoises for approximately two years. The porcupines did not ever breed successfully, but the lemurs did not bother the non-prosimian species in this exhibit. The ring-tailed lemur group changed several times. First, two castrated males were split from 4.1 group and attempted to introduce to another 3.0 ring-tailed lemur group, but there was too much aggression. The female ring-tailed lemur came into the institution pregnant, and gave birth to another male. The ring-tailed lemurs and red ruffed lemurs from these groups were never introduced.

## Lee Richardson Zoo
Garden City, Kansas
*Historical Group*: 1.0 slow loris (*N. coucang*)
1.0 chevrotain (*Tragulus sp.*)

For at least two years, during the winter months, the chevrotain was housed with the slow loris.

## Lincoln Children's Zoo
Lincoln, Nebraska
*Current Species*: 1.1 Coquerel's mouse lemur (*M. coquereli*) – adult non-breeding pair
1.0 African brush-tailed porcupine (*Atherurus africanus*) – older male

This group has been together since before 2001. They are always mixed, with no aggression issues. Reproductive behavior has been observed with the mouse lemurs.

*Historical Group*: 1.1 black-and-white ruffed lemur (*V. variegata*) – young, non-breeding pair
0.3 meerkat (*Suricata suricatta*) – non-breeding group

This group was together for approximately one month while an exhibit was renovated. The lemurs would not go on the ground when the meerkats were in the exhibit. There was possibly some aggression evident from the meerkats.

## Lincoln Park Zoo

Chicago, Illinois

*Historical Group*: 2.2+ lesser bushbaby (*G. senegalensis*) – breeding group, mixed ages, no contraception
1.2+ springhaas (*Pedetes capensis*) – breeding group
1.1+ African hedgehog (*A. frontalis*)

This group was together more than 10 years. There were two exhibits with springhaas and bushbabies. The bushbaby groups in both exhibits produced offspring. The springhaas in one exhibit produced offspring. The hedgehogs produced offspring after they were added to one of the exhibits as well. The number of bushbabies fluctuated in both groups, but there were always at least 4-5 bushbabies in each group.

## Little Rock Zoo

Little Rock, Arkansas

*Current Species*: 3.1 ring-tailed lemur (*L. catta*)
0.1 black lemur (*E. m. macaco*)
1.0 blue-eyed black lemur (*E. m. flavifrons*)
2.0 black-and-white ruffed lemur (*V. variegata*)

The outdoor exhibit size for this group is approximately 57,340 $ft^3$ with an attached holding of 2,574 $ft^3$. This exhibit opened in 1997. Originally it contained 3.0 ring-tailed and 0.3 red-ruffed lemurs. A few months later 0.3 black lemurs began introductions. They were fine with the ring-tailed lemurs, but there was quite a bit of aggression with the female red-ruffed lemurs. It took over a year and some exhibit modifications before all nine members were able to stay on exhibit together. We did separate the species at night. In January of 1999, 2.0 ring-tailed lemurs were sent out due to SSP recommendations. 1.1 ring-tailed lemurs were then introduced to the group. Over the years there were a number of individual changes of all species. Some were from SSP recommendations and some were due to deaths. When the group contained 2.0 ring-tailed, 0.1 red-ruffed and 0.1 black lemurs, they were housed together 24 hours per day. Currently the group contains 2.0 black-and-white ruffed and 1.3 ring-tailed lemurs, which are separated at night. We have 1.0 blue-eyed black lemur that lives with the 1.3 ring-tailed lemurs. He has not been introduced to the black-and-white ruffed lemurs due to his declining health. The ruffed and black lemurs split time on exhibit with the ring-tailed lemurs. The ring-tailed lemurs are out all day, while the other two species each get a ½ day each. We currently have 1.0 ring- tailed lemur in Quarantine (aformer pet) that we wil introduce slowly. We are also expecting 0.1 black-and-White ruffed to breed with either of the 2.0 black-and-white ruffed lemurs
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## Los Angeles Zoo

Los Angeles, California

*Current Species*: 1.3 ring-tailed lemur (*L. catta*) – adult, non-breeding group, male is vasectomized
3.0 radiated tortoise (*Asterochelys radia*) – adults

This group has been together since Fall 2008. The two species do not really interact, but are occasionally seen near each other. They are kept together all of the time, unless the weather becomes too cold for the tortoises to remain on exhibit. No aggression has been noted upon reintroduction.

## Louisville Zoological Garden

Louisville, Kentucky
*Current Species*: 3.0 ring-tailed lemur (*L. catta*) – adult intact males
1.0 red ruffed lemur (*V. rubra*) – adult intact male
2.0 black-and-white ruffed lemur (*V. variegata*) – adult intact males

This group has been together since 2002. They are separated regularly for overnight housing. No aggression has been noted upon reintroduction. The only other time they are separated is for medical reasons. There have been some composition changes over the years. One of the black-and-white ruffed lemur males was switched out. The group also at one time had a pair of black lemurs (*E. m. macaco*), but the male died and the female was sent to another institution. No problems with group stability occurred during these changes. There has been no reproduction in the mixed species group.

## Lowry Park Zoo

Tampa, Florida
*Current Species*: 1.3 ring-tailed lemur (*L. catta*) – mixed ages breeding group, two non-breeding females contracepted with MGA implants
1.1 red-collared brown lemur (*E. collaris*) – older, non-breeding pair, female contracepted with Depo-Provera® injections
1.1 red ruffed lemur (*V. rubra*) – juvenile, non-breeding pair, female separated when cycling

This group has been together approximately since late 2007. They are separated daily for feeding, as well as by species for night housing. The female red ruffed lemur is also separated from the 1.0 red ruffed lemur when she is cycling to prevent conception. They are alternately placed on exhibit with the rest of the group. At night, one is held in the stall, the other is in an enclosed hallway behind the stall. While in the night house, the lemurs all have visual access to orangutans and silver langurs. No aggression has been noted when the lemur group is put back together on exhibit.

There has been successful reproduction of the red-collared lemurs while in this mixed species group. The female gave birth overnight while they were separated from the other species. They were reintroduced to the mixed species group within a few days with no issues. The offspring was reared in the mixed species group.

There has been one main group composition change, which improved the stability in the group. The group previously contained a different female red ruffed lemur. In 2006, she was changed out for a

new female. The initial female was very dominant and aggressive toward the ring-tailed lemurs. When she was removed, stability improved in the group. With the previous red ruffed lemur, there was a definite hierarchy with the red ruffed lemurs at the top then the ring-tailed lemurs. The red-collared lemurs stayed neutral. When the younger pair of red ruffed lemurs came, the ring-tailed lemurs became more dominant.

## Memphis Zoo

Memphis, Tennessee

**Group 1:**

*Current Species*: 1.1 mongoose lemur (*E. mongoz*)
agoutis (*Dasyprocta sp.*)
wombat (*Vombatidae* family)

This group has been together since approximately 2006. They are housed together all of the time. Feedings are monitored to ensure all animals are getting the proper amount of diet.

**Group2:**

*Current Species*: 0.1 slow loris (*N. coucang* or *bengalensis*)
Coquerel's mouse lemurs (*M. coquereli*)

These animals have been together since at least 2004. They were put together to eliminate having singly housed animals. They are not separated. They have been observed sleeping together. The group used to contain 1.1 slow lorises.

**Group 3:**

*Current Species*: 1.0 greater bushbaby (*O. garnetti* or *crassicaudatus*)
1.1 aardvarks (*Orycteropus afer*)
1.0 brush-tailed porcupine (*Atherurus sp.*)

It is unknown how long this group has been together. The bushbaby is the dominant animal in the trees of this exhibit. There was some initial stress when the group was put together, as well as some mild interactions between the bushbaby and the porcupine. No aggression has been noted.

**Group 4:**

*Current Species*: 1.0 greater bushbaby (*O. garnetti* or *crassicaudatus*)
0.0.1 springhaas (*Pedetes capensis*)

This group was put together because the male bushbabies could not be housed together, and to conserve exhibit space. There have been some interactions between the springhaas and the bushbaby.

*Historical group*: slender loris (*L. tardigradus*)
three-banded armadillo (*Tolypeutes sp.*)

It is unknown how long this group was together. There were no issues while they were together.

## Miami Metrozoo

Miami, Florida

*Current Species*: 1.1 black lemur (*E. m. macaco*) – adult, non-breeding pair
2.0 red ruffed lemur (*V. rubra*) – adult males
1.3 ring-tailed lemur (*L. catta*) – adult, non-breeding group

The outdoor exhibit for these animals is approximately 18,000 $ft^3$, with an attached holding of 200 $ft^3$.

This group has been together since approximately 2003. They are separated within the exhibit for feeding due to competition from local ibis. They do not show any aggression when they are reintroduced. The red ruffed lemurs stay up in the trees.

There have been some changes in the group composition, such as the loss of one male ring-tailed lemur, but there were no changes in the stability of the group. There was a different black lemur female in the group previously, and a male red ruffed lemur passed away. The black lemurs were separated from the rest of the group when the new female black lemur was initially introduced. No fighting was observed when they were all put together. All the animals are very mellow. Reproductive behavior has been observed in the ring-tailed lemur group, including copulations.

## Micke Grove Zoo

Lodi, California

*Current Species*: 3.0 ring-tailed lemur (*L. catta*)
1.1 red ruffed lemur (*V. rubra*)
1.0 black-and-white ruffed lemur (*V. variegata*)

No additional information about introductions, timing, social dynamics, or reproduction in this group.

## Milwaukee County Zoological Gardens

Milwaukee, Wisconsin

*Current Species*: 1.0 lesser bushbaby (*G. moholi*) – adult male
0.2 springhaas (*Pedetes capensis*) – adult females

This group has been together since December 2002. They are mixed together all of the time, with no aggression issues. There were originally 0.3 springhaas in the group. One died in August 2004, and a second one died in April 2008, and another was added to the bushbaby later. None of these events changed the stability of the grouping.

## Minnesota Zoo

Apple Valley, Minnesota

**Group 1**

*Current Species*: 1.4 ring-tailed lemur (*L. catta*) – adults
3.0 red ruffed lemurs (*V. rubra*) – adults

This group has been together since 2003. They are separated in holding at night, so there is no competition for food. There has not been any aggression upon reintroduction in the mornings. When the group was put together they were placed in an exhibit that was new to both species. The exhibit is large enough that each species has its own specific territory. There are few, if any, confrontations between the groups.

The main change to the group occurred in 2005, when 1.0 ring-tailed lemur died. There were no changes in the stability of the group. Both groups are non-reproductive. Later, other changes to occur were that a male ring-tailed lemur was brought into the group and a female red ruffed died.

**Group 2**

*Current Species*: 1.1 slow loris (*N. coucang*) – adult, non-breeding pair, male is castrated
0.1 Prevost's squirrel (*Callosciurus prevostii*) – adult
0.1 pygmy loris (*N. pygmaeus*) – adult

This group has been together since approximately 1998. Each species is able to get their fair share of diet. This group is not routinely separated. Occasionally, a Prevost's squirrel will become aggressive towards the loris, so that individual is removed and replaced with another squirrel for a time.

The Prevost's squirrels reproduced successfully in this group prior to the male being removed. The pygmy loris was added to the group in 2007. There were no changes to the stability of the group.

*Historical group*: 1.1 slow loris (*N. coucang*) – breeding pair
0.1 African crested porcupine (*Hystrix cristata*)

This group was together approximately 5 years. The slow lorises successfully reproduced for many years in this group. The group ended when the porcupine was shipped out.

## Myakka City Lemur Reserve

Myakka City, Florida

**Group 1**

*Current Species*: 3.1 ring-tailed lemur (*L. catta*)
3.1 mongoose lemur (*E. mongoz*)
1.1 Sanford's brown lemur (*E. sanfordi*)
5.0 red ruffed lemur (*V. rubra*)

These animals are held in a free-ranging enclosure that is approximately 8 acres in size.

No additional information about introductions, timing, reproduction, or social dynamics in this group.

**Group 2**

*Current Species*: 1.2 ring-tailed lemur (*L. catta*)
1.2 Sanford's brown lemur (*E. sanfordi*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## Natural Science Center & Animal Discovery of Greensboro

Greensboro, North Carolina
*Current Species*: 1.2 mongoose lemur (*E. mongoz*) – adult, non-breeding group
2.3 ring-tailed lemur (*L. catta*) – adult group
0.1 red ruffed lemur (*V. rubra*) - adult

The exhibit for these species is approximately 44,625 $ft^3$.

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## North Carolina Zoological Park

Asheboro, North Carolina
*Current Species*: 3.2 ring-tailed lemur (*L. catta*)
1.1 red ruffed lemur (*V. rubra*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## Oakland Zoo

Oakland, California
*Current Species*: 2.3 ring-tailed lemur (*L. catta*)
2.0 blue-eyed black lemur (*E. m. flavifrons*)

The original introductions and integration of individuals was difficult, but perserverance by staff led to the success of this group. The female ring-tailed lemurs were very aggressive to the blue-eyed black lemurs in the beginning of the introductions. Introductions took place multiple times, using various combinations of individuals and trial and error. The blue-eyd black lemurs are very comfortable and use the entire exhibit when by themselves or with the ring-tailed lemur males. However, they are limited to one small portion of the exhibit when the female ring-tailed lemurs are added on exhibit. If the blue-eyed blacks venture out into the exhibit, the matriarch ring-tailed lemur chases them back to their spot in the exhibit.

Seasonally, all animals can remain together all day and at night due to mild California weather which allows for indoor/outdoor access at night. In the past, the groups would have to alternate being locked in or out, as the female ring-tailed lemurs would prevent access by the blue-eyed blacks.

Feedings are done cooperatively with 2 people, having one person separate and focus on one species during feeding times.

## Oglebay's Good Zoo

Wheeling, West Virginia

*Current Species*: 4.0 ring-tailed lemur (*L. catta*) – intact adult males
1.1 radiated tortoise (*Astrochelys radiata*) – adult pair

This group has been together since 2003. They are separated seasonally for winter housing, as well as when a new animal is introduced to the exhibit. When new animals are introduced into the ring-tailed lemur group, some non-contact and contact aggression, displacement and vocalizations occur, depending on the how dominant the new animal is compared to the group. This aggression usually lasts only 2-3 days at the most.

The radiated tortoises are the original animals in the exhibit, but the ring-tailed lemurs have changed over time. In 2003, 2.0 ring-tailed lemurs were introduced to the exhibit with 1.1 radiated tortoises. Over time, two additional pairs of 2.0 ring-tailed lemurs have also been introduced. 2.0 ring-tailed lemurs have also passed away. The first introduction of 2.0 ring-tailed lemurs in 2005 went well with some limited aggression, such as stink fighting. The second introduction in 2008 also went well. Everyone got along after a few days, but at first there was aggression, stink fighting, and vocalizations to establish dominance. There has been no reproduction with either species.
*Historical Group*: 1.0 slow loris (*N. coucang*)
1.1 pygmy lorises (*N. pygmaeus*) – breeding pair
0.1 crested wood partridge (*Rollulus rouloul*)
1.1 black-naped fruit doves (*Ptilinopus melanospila*)
1.1 bleeding-heart doves (*Gallicolumba luzonica*)
2.0 Indian star tortoises (*Geochelone elegans*)
1.0 greater Malayan chevrotain (*Tragulus napu*)
2.0 Tokay geckos (*Gekko gecko*)
3.0 Indian flying fox (*Pteropus giganteus*)

There is no more information on this group other than its composition.

## Oklahoma City Zoological Park

Oklahoma City, Oklahoma
*Historical Group*: 3.0 ring-tailed lemurs (*L. catta*) – castrated males
1.1 red-collared brown lemurs (*E. collaris*)

It is unknown how long this group was together. It was broken apart and the collared lemur pair was sent to another institution.

## Omaha's Henry Doorly Zoo

Omaha, Nebraska
**Group 1**
*Current Species*: 1.3 ring-tailed lemur (*L. catta*) – male sterilized
0.1 brown lemur hybrid (*E. fulvus* hybrid) – non-breeding female
0.1 red-collared brown lemur (*E. collaris*) – non-breeding female
1.1 radiated tortoise (*Astrochelys radiata*) – adult pair

There is very little interaction between the lemur species, however the *catta* love to ride on the tortoises. Introductions were very easy – zero interactions positive or negative. There were previously 1.1 *collaris* in the exhibit as well with little interaction. The lemurs are shifted into holding at night and the tortoises stay on exhibit. This group works very well.

**Group 2**

*Current Species*: 3.2 black-and-white ruffed lemur (*V. variegata*) – females contracepted
3.4 red ruffed lemur (*V. rubra*) – females contracepted
0.3 Madagascar teal (*Anas bernieri*)
1.1 Madagascar ibis (*Lophotibis cristata*) – breeding pair
4.0 cattle egret (*Bubulcus ibis*)

No interactions when introduction occurred for this group. No interactions between the lemurs and the birds, except for one *rubra* who bothered the ibis when nesting for one week. Once the behavior stopped it never returned. This is an outdoor exhibit that is quite large, so the lemurs and birds can all find their own spaces to occupy. The lemurs are given access to a night holding. This group works very well.

**Group 3**

*Current Species*: 1.2 black lemur (*E. m. macaco*)
1.0 Madagascar big-headed turtle (*Erymnochelys madagascariensis*)

No interactions when introduction occurred. Lemurs are shifted off exhibit into a night holding. Turtle stays on exhibit. This group works very well.

**Group 4**

*Current Species*: 1.1 mongoose lemur (*E. mongoz*) – adult, breeding
0.4 giant jumping rat (*Hypogeomys antimena*) – siblings

No interactions between the species. Omaha has also had a non-breeding pair of *mongoz*, with no interactions. The lemurs are shifted off exhibit at night. The jumping rats stay on exhibit. The exhibit is diurnal, so generally the rats are sleeping, but visible in their hollowed logs. This group works very well.

**Group 5**

*Current Species*: 1.1 red ruffed lemur (*V. rubra*)
1.0 black-and-white ruffed lemur (*V. variegata*)
3.0 brown lemur (*E. fulvus*)

Introductions took time to get the two ruffed lemur species together. The black-and-white ruffed was very timid and often stayed low or refused to go on exhibit. Over time he became brave and the red ruffed lemurs decided he was not a threat. All lemurs are shifted off exhibit at night. The black-and-white ruffed lemur has since died. This group works very well.

**Group 6**

*Current Species*: 1.1 aye-aye (*D. madagascariensis*) – breeding pair
6.23 straw-colored fruit bat (*Eidolon helvum*)

The female aye-aye was initially intimidated by the bats, but has since grown used to them. The male had no trouble adjusting when introduced to the exhibit. The only challenge in this group is feeding the bats where the aye-aye cannot get to their diet. The aye-aye are shifted off exhibit at night. This group works very well.

**Group 7**

*Current Species:* 3.0 greater bushbaby (*O. garnettii*)
2.1 Brush-tailed porcupine (*Atherurus sp*.) – contracepted female/male and male offspring
1.1 aardvark (*Orycteropus afer*) – breeding pair
2.3 springhaas (Pedetes capensis) – breeding groups

various number of meerkat (*Suricata suricatta*)
4.0 rock hyrax (*Procavia capensis*)

All combinations in this exhibit have worked well, except for the hyraxes. It was never observed, but suspected that they were biting the bushbabies. The hyraxes have since been removed. The meerkat were also removed to another exhibit. Porcupines were a breeding pair until recently – no issues were observed. All animals stay on exhibit except for the aardvarks, which shift into night holding. Many feeding locations exist in the exhibit and the aardvarks are contained to one half of the exhibit.

*Historical Group 1*: 1.4 ring-tailed lemurs (*L. catta*) – adult, non-breeding group, male castrated
1.0 hornbill (Bucerotidae) – unknown age
Additional small free flight avian species

This group was together from approximately 2007-2010. The lemurs lived in a piano wire enclosure within the jungle exhibit. The small birds fly in and out of the enclosure at will. The lemurs and the hornbill were mixed all of the time. The hornbill spent all of his time on the ground, while the lemurs spent the majority of the time up in the trees. They did not compete for food or space.

*Historical Group 2*: 1.1 red ruffed lemur (*V. rubra*)
Small free flight avian species

The red ruffed lemurs lived in a similar piano wire enclosure as the ring-tailed lemur exhibit. Occasionally, the small free flight birds entered their enclosure.

*Historical Group 3*: 1.1 black-and-white ruffed lemur (*V. variegata variegata*)
Various waterfowl

The lemurs lived on an island exhibit during the summer. The lagoon surrounding the island had many swans, geese, and ducks in it. The species composition varied year to year. The waterfowl often walked onto the islands and slept there overnight, or helped themselves to crumbs left by the primates. They seemed to have no problem eating side by side and coexisting in close proximity.

*Historical Group 4*: 1.1 mongoose lemur (*E. mongoz*) – adult, non-breeding pair
2.0 Coquerel's sifaka (*P. coquereli)* – young adult males

No issues with aggression. Mongoose lemurs spent most of the day sleeping away from sifakas. Sifakas have since passed away and mongoose lemurs are currently housed alone.

## Palm Beach Zoo

West Palm Beach, Florida
*Current Species*: 1.1 ring-tailed lemur (*L. catta*) – older, post-reproductive pair
1.1 red-bellied lemur (*E. rubriventer*) – non-breeding pair, female contracepted with MGA implant

This group has been together since April 2004. There is occasional displacement of the red-bellied lemurs by the ring-tailed lemurs. They are separated daily for feeding and night housing. There is no aggression upon reintroduction, though. The group originally included 1.1 black lemurs (*E. m. macaco*), but they were removed in January 2006 due to severe aggression towards 1.0 red-bellied lemur. The three species were housed together as pairs since April 2004. Once the black lemurs were removed, the group became more stable.

## Philadelphia Zoo

Philadelphia, Pennsylvania
**Group 1**
*Current Species*: 2.1 aye-aye (*D. madagascariensis*) – breeding pair with offspring
0.1 Malagasy giant jumping rat (*Hypogeomys antimena*)

This group works very well. The rat's food has been secured in the rat box so the juvenile aye-aye can't drag it out. The rat is on the portion of exhibit floor covered in pine shavings with access to entire aye-aye exhibit, which includes a lot of varied enrichment and arboreal substrates.

**Group 2**
*Current Species*: 1.1 mongoose lemur (*E. mongoz*) – non-breeding pair
1.2 Malagasy giant jumping rats (*Hypogeomys antimena*)

This group coexists nicely in a diurnal exhibit. The mongoose lemurs are no longer able to eat the rat food since the rats were given a new L-shaped box. The group originally contained 2.3 jumping rats, but after some aggression between two of the females (sisters), we pulled 1.1 and put them with our 1.2 saki group, which also works well.

**Group 3**
*Current Species*: 1.0 pygmy loris (*N. pygmaeus*)
1.1 Malagasy giant jumping rats (*Hypogeomys antimena*)

This group is in a nocturnal exhibit and has been together for several years. The loris shares food with the rats, often from the same bowl without any problems.

**Group 4**
*Current Species*: 0.1 pygmy loris (*N. pygmaeus*)
1.1 Malagasy giant jumping rats (*Hypogeomys antimena*)

This group is in a nocturnal exhibit and has been together for several years with no issues.

## Phoenix Zoo

Phoenix, Arizona
*Current Species*: 0.4 ring-tailed lemur (*L. catta*) – adult females, three are sterilized
3.4 radiated tortoises (*Astrochelys radiata*) – adult group, ages unknown

This particular group has been together since approximately 2005, but the two species have been mixed for at least 12 years. The tortoises are pulled inside during the winter. Otherwise, the group is not separated. There is minimal interaction between the lemurs and the tortoises. The only interactions between the two species are that the ring-tailed lemurs eat the tortoise diet, and the tortoises eat the lemur poop. The tortoises do lay eggs which are then pulled.

## Point Defiance Zoo & Aquarium

Tacoma, Washington
*Current Species*: 3.3 ring-tailed lemur (*L. catta*) – adult, non-breeding group
2.0 black lemur (*E. m. macaco*) – adult non-breeding group

This group has been together since May 2008. There was only one brief bout of contact aggression during the initial introduction of the two species. The only other aggression noted is the occasional chasing over a food item. The group is only separated for medication/treatment of individuals. The black lemurs receive dietary supplements, so they are separated for approximately 5 minutes twice daily. The ring-tailed lemurs show no reaction to either the separation or the reintroduction. The exhibit has lost a ring-tailed lemur and a black lemur through attrition over time, but no changes in stability were noted during this time.

## Pueblo Zoo

Pueblo, Colorado
*Historical Group*: 1.1 black-and-white ruffed lemur (*V. variegata*) – older adult breeding group
2.1 red-fronted lemur (*E. rufus*) – older adult non-breeding group, males castrated
2.2 ring-tailed lemur (*L. catta*) – older adult non-breeding group, males castrated

This group was together approximately 5 years. They were housed in an outside exhibit during the summer. In the winter, the group was separated by species indoors. There was some fighting and chasing between the black-and-white ruffed lemurs and the red-fronted lemurs, but separating the species stopped any additional problems. The black-and-white ruffed lemurs were transferred to another institution after five years. The ring-tailed lemurs and red-fronted lemurs were fine together for an additional 12-14 years. The group was split up after the death and transfer of the ring-tailed lemurs.

## Riverbanks Zoo and Garden

Columbia, South Carolina

*Current Species*: 1.3 ring-tailed lemur (*L. catta*) – adult non-breeding group, male castrated
1.1 red ruffed lemur (*V. rubra*) – adult group

This group has been together since 2000. They maintain separate territories while on exhibit. They are separated at night when they shift into their enclosed night house, primarily for the safety of the animals. During shifting, the red ruffed lemurs often chase the ring-tailed lemurs and protect the door. No physical contact occurs.

The ring-tailed lemurs have shown reproductive behavior, including giving birth and rearing the offspring in the mixed-species setting. The female and offspring were separated for a time after the birth. Reintroductions were done between each individual in the exhibit first, but no problems arose.

The group has changed some over the years. There have been some deaths and transfers of ring-tailed lemurs. A male was born in 2004. One male died and another was transferred. The younger males were very jumpy. Over time, keeper staff developed a better knowledge of behavioral management which improved their ability to get all individuals acclimated to the exhibits. The three female ring-tailed lemurs have been together a very long time and are very close. They had no problem with raising the baby in 2004; however, they used to sometimes chase males.

## Roger Williams Park Zoo

Providence, Rhode Island

*Historical Group 1*: 1.1 red-bellied lemur (*E. rubriventer*) – adult siblings
2.2.1 mongoose lemur (*E. mongoz*) – adults plus offspring

This group was together from the mid-1990s. They were housed without any problems. At one point during 1998-1999, there were six mongoose lemurs in the group. There is no record of when or why the group was separated. The same pair of red-bellied lemurs was noted to have been introduced with a single female mongoose lemur in 2003. They were together until 0.1 red-bellied lemur died in 2005. The remaining individuals in the group were split up and sent to other institutions.

*Historical Group 2*: 1.0 black lemur (*E. m. macaco*)
0.0.3 red ruffed lemurs (*V. rubra*)

There is no other information on this group, other than the composition. The group was together in 1992.

## Safari West

Santa Rosa, California

*Current Species*: 3.2.2 ring-tailed lemur (*L. catta*) – breeding group with juveniles and infants, non-breeding males castrated
1.1.3 black-necked swans (*Cygnus melanocoryphus*) – breeding pair with cygnets

This group has been together since 2004. The different species are mixed together at all times with no aggression issues. Because they are both breeding groups, there are often changes in the composition of the exhibit. At least one clutch of cygnets is hatched every year. There is also the occasional death and/or removal of older cygnets. The ring-tailed lemurs gave birth and reared the offspring in the exhibit with no problems.

## Saint Louis Zoo

St. Louis, Missouri

**Group 1**

*Current Species*: 2.1 ring-tailed lemur (*L. catta*)
1.1 black lemur (*E. m. macaco*)
1.1 ruffed lemur (*V. spp*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

**Group 2**

*Current Species*: 2.0 black lemur (*E. m. macaco*)
1.0 ruffed lemur (*V. spp*)

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## San Francisco Zoo

San Francisco, California

**Group 1:**

*Historical group*: 6.0 red ruffed lemurs (*V. rubra*) – adult, intact males
4.0 black-and-white ruffed lemurs (*V. variegata*) – adult, intact males
2.2 ring-tailed lemurs (*L. catta*) – adult, non-breeding group, females contracepted with MGA implants and/or Depo-Provera© injections
1.1 black lemur (*E. m. macaco*) – adult, intact male
3.0 3hite-fronted lemur (E. f. albifrons) – adult, intact males

*Current species:* 4.0 red ruffed lemurs (*V. rubra*) – adult, intact males
3.0 black-and-white ruffed lemurs (*V. variegata*) – adult, intact males

3.3 ring-tailed lemurs (*L. catta*) – adult, non-breeding group, females contracepted with MGA implants and/or Depo-Provera© injections
1.0 black lemur (*E. m. macaco*) – adult, intact male
1.0 blue-eyed black lemur (*E.m. flavifrons*)

The exhibit opened in 2002 with the historical group listed above. The current group is listed below that and reflects changes of attrition, rather than incompatibility Most of the aggression is limited to low level contact or non-contact aggression within individual species and generally only occurs during the breeding season. Occasional contact aggression between species appears to be limited to cuffing and poking during breeding season. One male black-and-white ruffed lemur had to be separated during the breeding season every year while he was alive. He had to be separated from his father during breeding season in a previous exhibit. He was mixed with three brothers for the current exhibit and still needed to be separated seasonally. After several years, the red-ruffed lemurs began to target (incessantly chase) the ring-tailed lemurs so they are currently separated at night during the breeding season. They will block doors and not let the ring-tailed lemurs enter the building. The only other reason for separating individuals is due to injury or illness. There is some aggression upon reintroductions, but it is primarily non-contact aggression and vocalizing. Before the female ring-tailed lemurs were implanted, the males would fight and receive bite wounds.

Other instances of aggression occurred due to changes in dominance. When the oldest and very dominant (to all the lemurs in the exhibit) male red ruffed lemur died, there was an increase in aggression within the red ruffed lemur group to establish/re-establish dominance within the red-ruffed group.

There has been successful reproduction within this mixed species group by the current group of ring-tailed lemurs.

**Group 2:**
*Historical group*: 1.1 aye-aye (*D. madagascariensis*) – adult breeding pair
1.0 Coquerel's mouse lemur (*M. coquereli*) – adult male

*Current Species*: 1.2 aye-aye (*D. madagascariensis*) – adult female with 1.1 offspring

The pair of aye-ayes was housed with the mouse lemur prior to the birth of their offspring. The female aye-aye kicked the male aye-aye out of the exhibit room containing her preferred nest box a few days before the first infant was born. The male aye-aye was housed in separate exhibit rooms with the mouse lemur, but with mesh to mesh contact to the other aye-aye. The mouse lemur consumed aye-aye food, including gruel, daily and there were a few displacements off the food by the aye-aye. When the aye-ayes were standing on the scale for weighing, it was difficult to get the mouse lemur off the scale, as he would slip under the aye-aye to get the mealworms, so it was felt the aye-ayes were generally uninterested in the mouse lemur. After the adult female and male infant were reintroduced to the adult male aye-aye , the infant aye-aye harassed the mouse lemur. The mouse lemur was eventually separated from the aye-aye after receiving a broken leg. It was not determined if the mouse lemur was the target of the aggression or was injured in an aye-aye squabble.

## Santa Ana Zoo

Santa Ana, California

*Current Species*: 5.1 ring-tailed lemur (*L. catta*) – older, non-breeding group, female sterile
1.0 black-and-white ruffed lemur (*V. variegata*) – older, intact male
1.1 black lemur (*E. m. macaco*) – older, non-breeding pair, female contracepted with MGA implant
1.0 African porcupine (*Hystrix cristata*)
1.1 trumpeter hornbills (*Ceratogymna bucinator*)
0.0.2 dik dik (*Madoqua spp.*)
0.0.2 rock hyrax (*Procavia capensis*)

The outside exhibit is approximately 60,000 $ft^3$ with an attached holding of 480 $ft^3$.

This current group has been together since 2007. They are mixed at all times, but the black-and-white ruffed lemur can be separated if necessary. There have been no injuries due to lemurs in the group, but the rock hyrax has injured lemurs.

The group composition has changed over the years. Some of the changes have affected the stability of the prosimian members of the group. The group originally consisted of a few more ring-tailed lemurs in addition to the listed non-prosimian species. This group was established in approximately 1996, and remained stable for the next five years. In 2001, 1.0 greater bushbaby was introduced with no problems. In 2006, the male black-and-white ruffed lemur was introduced. Initially, there was aggression between the black-and-white ruffed lemur and the bushbaby, but this behavior soon diminished. In 2007, the black lemurs were introduced to the exhibit. Initially, there was aggression from male black-and-white ruffed to male black lemur, but that settled down over time. However, aggression from both of the males became targeted toward the male bushbaby, so the bushbaby was removed from the group in 2007.

There has been no reproduction in this exhibit. All of the pairs have been non-breeding animals.

## Sedgwick County Zoo

Wichita, Kansas

*Current Species*: 2.0 ring-tailed lemur (*L. catta*)
1.0 black lemur (*E. m. macaco*)
1.0 black-and-white ruffed lemur (*V. variegata*)

The outside exhibit space for this group is approximately 23,166 $ft^3$, with an indoor exhibit of 1,433 $ft^3$ and an indoor holding stall of 1,008 $ft^3$.

No additional information about introductions, timing, reproduction, or social dynamics in this group.

## Smithsonian National Zoological Park

Washington, District of Columbia
*Current Species*: 2.4 ring-tailed lemur (*L. catta*) – adult, non-breeding group, males vasectomized
1.1 red-fronted lemur (*E. rufus*) – adult, non-breeding pair, male vasectomized

This group arrived at National Zoo in 2001 as an established group from the Duke Lemur Center. They are separated daily for feeding, which is especially necessary for the red-fronted lemurs. They are also separated for night housing. No aggression is noted when they are reintroduced. There has been some displacement, and some chasing by the red-fronted lemurs toward the ring-tailed lemurs while they are together on exhibit, as well as some vocalizing. None of this has escalated to contact aggression.

The only group composition changes have been the deaths of four of the ring-tailed lemurs over time. This did not change the stability of the group. The two species keep themselves separate. There is occasional aggression within the ring-tailed lemur group, especially between the females, but the red-fronted lemurs get along well. The three vasectomized males still show normal male behaviors.

There has been no reproduction in this group, but reproductive behaviors are observed.

## Wildlife Safari

Winston, Oregon
*Historical Group*: Ring-tailed lemur (*L. catta*)
Red ruffed lemur (*V. rubra*)

It is unknown exactly how many individuals were in this group, or how long they were together. The group was exhibited on two adjoining island exhibits that were connected by a bridge. Interactions between the two species were good. It was split up due to breeding recommendations.

## Woodland Park Zoo

Seattle, Washington
*Current Species*: 0.0.1 Southern three-banded armadillo (*Tolypeutes matacus*)
0.0.1 African hedgehog (*Atelerix frontalis*)
1.2 Slow loris (*N. coucang or bengalensis*)

The armadillo and hedgehog are education animals. When they are not being used in education programs, they alternate being in the slow loris exhibit. Only one of the armadillo or hedgehog is in the exhibit at a time. They are given the opportunity to have more space, dig in the mulch and have an area to explore for short periods of time. There are no issues with the lorises and either the armadillo or hedgehog. They all ignore each other.

*Historic Group 1*: Ring-tailed lemur (*L. catta*)
Ruffed lemur (*Varecia sp.*)

From the 1980s through about 1994, these animals were housed on a large outdoor naturalistic island. The ring-tailed lemurs were shipped out in 1994. The red ruffed lemurs dominated the ring-tailed lemurs in this exhibit. There was no breeding. An older female ring-tailed lemur did try to "fend off" the red ruffed lemurs. Both species were housed separately at night. One species was in an older holding and the other was housed in a new holding building.

In June 1992, 3.0 red ruffed lemurs were added. In March 1994, 1.0 was removed from the group. There were approximately 5.2 ring-tailed lemurs at the time. Between 1994 and 1996, 2.0 were shipped out, 1.0 died, and 0.2 were euthanized.

From June 1992 through early 1997, there were various attempts to keep both species together on the island and in the Primate House. At one point, 3.0 ring-tailed lemurs were castrated. Throughout this time the red ruffed lemurs dominated the exhibit. In May 1997, the four remaining ring-tailed lemurs were shipped out.

1.1 black-and-white ruffed lemurs arrived in April 1997. The female was implanted. In July and August 1997, attempts were made to introduce this pair to 2.0 red ruffed lemurs in different combinations. The black-and-white ruffed lemurs, especially the female, were aggressive to the red ruffed lemurs. In mid-August, the decision was made to keep the species separate and alternate exhibit and holding space for them. The female black-and-white ruffed lemur was the main challenge to getting this group together.

*Historic Group 2*: Lesser bushbaby (*Galago sp.*)
Fruit bats (*Eidolon sp.*)

The lesser bushbabies used to live in a big African grotto exhibit with the fruit bats. They bred while in that exhibit. They had female offspring, which anecdotely only seems to happen when galagos have a lot of space. Now, they are in a much smaller exhibit by themselves, and they are only having male offspring. They had to be pulled from the exhibit because they became very obese eating the fruit in the fruit bat diet. Everyone got along fine in this exhibit.

Galagos were also housed with 1.2 springhaas at some point, and with an African crested porcupine (*Hystrix sp*.) with no problems.

## Zoo Atlanta

Atlanta, Georgia

*Current Species*: 4.0 ring-tailed lemur (*L. catta*) – young bachelor group
2.4 black-and-white ruffed lemur (*V. variegata*) – adult and juvenile non-breeding group, female contracepted with Depo-Provera® injections

This group has been together since 2005. The only time they have been separated has been due to injuries. Upon reintroduction, varying degrees of aggression have been noted, including chasing, displacement and occasionally contact aggression. There is also some vocalizing.

Group composition changes did affect the stability of this group over the years. The group began with 5.0 ring-tailed lemurs, but one died a few years ago. There were additional female black-and-white lemurs initially, but they were sent to other institutions. The composition of the black-and-white ruffed lemurs has changed every few years.

The black-and-white ruffed lemurs did have successful reproduction while in the mixed-species setting. They exhibited normal reproductive behaviors resulting in offspring that were reared in the exhibit.

*Historical Group*: 3.2 red ruffed lemur (*V. rubra*) – breeding group
2.2 black-and-white ruffed lemur (*V. variegata*) – females contracepted with Depo-Provera® injections

It is unknown how long this group was together.

# UNSUCCESSFUL MIXED-SPECIES GROUPS

This section lists some examples of groups that were unsuccessful when mixed. Potential reasons for the failure of the mixed-species grouping are listed below the group. In general, individual animal personalities, exhibit and holding size, and lack of time and flexibility of care staff are cited as causes of the mixed-species group not working.

## Blank Park Zoo

Des Moines, Iowa

*Species*: 3.0 ring-tailed lemur (*L. catta*) – adult group
0.2 red ruffed lemur (*V. rubra*) – adult group

Additional Information

- Aggression and off exhibit holding size (too small) were factors in the failure of this group.

## Bramble Park Zoo

Watertown, South Dakota

*Species*: 2.2 black lemur (*E. m. macaco*) – older pair with offspring, female contracepted with Depo-Provera® injections
0.2 black-and-white ruffed lemur (*V. variegata*) – older females

Additional Information

- The female black-and-white ruffed lemurs were aggressive towards the black lemurs. They were an established pair before the black lemurs were introduced to the exhibit.

## Brookfield Zoo

Chicago, Illinois

*Species*: 1.1 black lemurs (*E. m. macaco*)
2.0 mongoose lemur (*E. mongoz*)
0.5 ring-tailed lemur (*L. catta*)

Additional information:

- Introductions were attempted between the group of ring-tailed lemurs and a group consisting of the black and mongoose lemurs. They were deemed unsuccessful due to aggression from 0.1 ring-tailed lemur to 0.1 black lemur.
- The two aggressive animals both eventually died due to cancer related illnesses. The group was then re-introduced successfully (see prior section).

## Busch Gardens

Tampa, Florida

*Species*: 1.2 black-and-white ruffed lemur (*V. variegata*) – adults, male castrated
0.1 red ruffed lemur (*V. rubra*) – adult

Additional information:

- The female red ruffed lemur was very aggressive towards the other lemurs. They have not been able to house her with any other animals.

## Caldwell Zoo

Tyler, Texas

*Species:* 0.2 red-collared brown lemur (*E. collaris*) – adult group, contracepted with MGA implants
1.2 ring-tailed lemur (*L. catta*) – adult group, 0.1 contracepted with MGA implant, breeding recommendation for additional female
1.1 red ruffed lemur (*V. rubra*) – adult group, female contracepted with MGA implant

Additional information:

- This group was attempted after exhibit modifications were made to allow for breeding of the ring-tailed lemurs.
- The red-collared lemurs were the first to become aggressive to the other species and were then removed from group.
- After the red-collared lemurs were removed, the female red ruffed lemur became aggressive toward the ring-tailed lemurs.
- The ring-tailed lemurs were never seen to be aggressive to the other species. They remained neutral and were generally the recipients of the aggression.

## Capron Park Zoo

Attleboro, Massachussetts

*Species:* 2.1 red ruffed lemur (*V. rubra*) – adult group, female oldest in group and contracepted with MGA implant
1.2 ring-tailed lemur (*L. catta*) – adult female, juvenile male and female; one female contracepted with Depo-Provera® injections, the other with an MGA implant

Additional information:

- In July 2008, both species were first given visual and olfactory access to each other, and then they were given access to each other and a run around space.
- The red ruffed lemurs chased the ring-tailed lemurs, and the female red ruffed bit the male ring-tailed. She did the majority of the chasing, but the male ring-tailed lemur did attempt to fight back a few times.
- The female ring-tailed lemurs were both more laid back.
- Not enough space was one factor in the failure of this group. The personalities of the ring-tailed lemurs also appeared to be a factor. The younger animals were very edgy and nervous.

## Great Plains Zoo

Sioux Falls, South Dakota

*Species:* 5.0 ring-tailed lemur (*L. catta*) – young adult bachelor group

2.0 red ruffed lemur (*V. rubra*) – adult bachelor group

Additional information:

- The group was initially together from July – October 2008 and split due to aggression from red ruffed lemurs to ring-tailed lemurs.
- In November 2008, 1.0 red ruffed lemur died. They then attempted to put single red ruffed lemur with ring-tailed lemurs.
- Introductions were done by putting 1.0 ring-tailed lemur with 1.0 red ruffed lemur, then adding in additional ring-tailed lemurs. This was attempted twice with different ring-tail lemurs.
- In the original group, 2.0 red ruffed lemur were aggressive to 5.0 ring-tailed lemurs. However, after the death of 1.0 red ruffed lemur, ring-tailed lemurs were aggressive to the individual red ruffed lemur.
- Species were housed separately due to indoor holding space not being large enough to attempt introductions and animals must be kept indoors during winter conditions.

## Henson Robinson Zoo

Springfield, Illinois

*Species:* 3.0 ring-tailed lemur (*L. catta*) – young males
3.2 black lemur (*E. m. macaco*) – adult non-breeding group

Additional information:

- See current exhibit section for history of changes of stability in this group.

## Honolulu Zoo

Honolulu, Hawaii

*Species:* 1.4 black-and-white ruffed lemur (*V. variegata*) – adult group, male castrated
4.2 ring-tailed lemur (*L. catta*) – adult group, males castrated

Additional information:

- Each species originally inhabited two islands. The islands were linked together to attempt to mix species. Islands were only linked for two months before being separated again.
- One of the female black-and-white ruffed lemurs became very territorial of the island on which she was born. She would go immediately and chase the ring-tailed lemurs on their island.
- There was also the ability to transfer between the two islands through the holding building; however, animals were only held in holding when islands were being cleaned.
- Without the aggressive female, the two species got along better. They were unable to relocate the individual female so the mixed-species attempt was abandoned.

## Houston Zoo

Houston, Texas

*Species:* 0.1 black-and-white ruffed lemur (*V. variegata*) – 20 years old

1.2 ring-tailed lemur (*L. catta*) – geriatrics
1.1 brown lemur (*E. fulvus*) – 20 and 8 years old

Additional information:

- The female black-and-white ruffed lemur was aggressive towards all the other animals in the group.
- There was not enough space in the night house to accommodate an aggressive animal in the group.
- They speculate that they may not have had enough individuals of the other two species to counteract the aggressive tendencies of the black-and-white ruffed lemur.

## Kansas City Zoo

Kansas City, Missouri
*Species:* 2.0 red ruffed lemur (*V. rubra*) – adult, intact males
3.0 ring-tailed lemur (*L. catta*) – adult, neutered males

Additional information:

- The exhibit was outside, with a 15-foot-high mesh fence and viewing windows. It was an open-topped exhibit. Ring-tailed lemurs dominated both exhibit and the red ruffed lemurs. Red ruffed were highly intimidated by ring-tailed lemurs. The group was not together very long. Aggression started immediately, and the open top exhibit led to escapes.

## Los Angeles Zoo

Los Angeles, California
*Species:* 1.0 Black-and-white ruffed lemur (*V. variegata*)
1.1 Ring-tailed lemur (*Lemur catta*)

Additional information:

- Ring-tailed lemurs harassed lone black-and-white ruffed lemur, even though there was lots of space.

## Milwaukee County Zoological Gardens

Milwaukee, Wisconsin
*Species:* 1.1 lesser bushbaby (*G. moholi*) – adult pair
0.1 springhaas (*Pedetes capensis*) – adult female

Additional information:

- The pair of galagos was aggressive to the springhaas. The group only lasted 1 month.

## Nashville Zoo

Nashville, Tennessee
*Species:* 1.2 red ruffed lemur (*V. rubra*) – male permanently contracepted, geriatric group
3.0 ring-tailed lemur (*L. catta*) – adult and juvenile intact group

Additional information:

- Group was only together for a few weeks in 2004 before breaking apart.

## Oglebay's Good Zoo

Wheeling, West Virgina

*Species:* 1.1 pygmy loris (*N. pygmaeus*)
1.0 Palawan peacock pheasant (*Polyplectron napoleonis*)
1.0 Prevost's squirrel (*Callosciurus prevostii*)

Additional information:

- Prevost's squirrel did not get along with smaller bird species.
- Slow loris killed and ate smaller bird species.

## Palm Beach Zoo

West Palm Beach, Florida

*Species:* 1.1 ring-tailed lemur (*L. catta*) – adult, non-breeding pair, female post-reproductive
1.1 red-bellied lemur (*E. rubriventer*) – adult, non-breeding pair, female contracepted with MGA implant
1.1 black lemur (*E. m. macaco*) – adult, non-breeding pair

Additional information:

- Black lemur was aggressive toward the male red-bellied lemur.
- See current exhibit section for history of changes of stability in this group.

## Potawatomi Zoo

South Bend, Indiana

*Species:* 1.1 black-and-white ruffed lemur (*V. variegata*) – adult pair, male vasectomized
2.1 ring-tailed lemur (*L. catta*) – adult female, juvenile males, female contracepted with either MGA implant or Depo-Provera® injections

Additional information:

- Attempt at introduction was short-lived, only 17 days.

## Santa Ana Zoo

Santa Ana, California

*Species:* 5.1 + ring-tailed lemur (*L. catta*) – older, non-breeding group, female sterile
1.0 greater bushbaby (*Otolemur sp.*) – intact male
1.0 black-and-white ruffed lemur (*V. variegata*) – older, intact male
1.1 black lemur (*E. m. macaco*) – older, non-breeding pair, female contracepted with MGA implant
African porcupine (*Hystrix cristata*)
0.0.2 trumpeter hornbills (*Ceratogymna bucinator*)

0.0.2 dik dik (*Madoqua spp*)
0.0.2 rock hyrax (*Procavia capensis*)

Additional information:

- Black lemurs were introduced in 2007; the group only lasted a few months.
- Male black lemur was first chased by male black-and-white ruffed lemur, but that aggression settled. Then aggression increased toward bushbaby by both males.
- Bushbaby was moved out after this aggression, but other species remained.

## Utah's Hogle Zoo

Salt Lake City, Utah

*Species:* 1.1 black-and-white ruffed lemur (*V. variegata*) – geriatric pair, post-reproductive
1.0 white-fronted lemur (*E. albifrons*) – castrated geriatric male

Additional information:

- Attempted to introduce white-fronted lemur to older pair of black-and-white ruffed lemurs. The black-and-white ruffeds dominated him, especially the female.
- The dynamic did not improve and the situation was stressful to the white-fronted lemur, so the introductions were discontinued.

*Species:* 1.2 ring-tailed lemur (*L. catta*) – geriatric group, male vasectomized
1.0 white-fronted lemur (*E. albifrons*) – castrated geriatric male

Additional information:

- Same white-fronted lemur as above, older troop of ring-tailed lemurs
- Introduction lasted about two weeks; white-fronted lemur did fine with individual ring-tailed lemurs, but as more individuals were added the ring-tails dominated him and the dynamic never became calm.

# WHAT DEFINES A SUCCESSFUL GROUP?

We asked managers how they would define a successful mixed species prosimian group and what characteristics of their groups led them to say the group was successful. A total of 122 individual answers were given for this question, but many gave multiple responses to this question. Answers were therefore broken down for a total of 264 responses. The six reasons mentioned most often are listed below, as well as the percent of time these responses were given:

1) **25% - Little to no aggression in the group** – Managers suggested that for a successful group, animals should not be overly aggressive to one another. Seasonal periods of heightened aggression or fighting may be present and occasional low level aggressive interactions, including cuffing, vocalizations, displacement, and chasing, may be present, but regular aggressive interactions escalating to contact or injury should not occur.
2) **12%** - **Little to no feeding competition** – For a group to be successful, all animals should have equal access to adequate amounts of food and water and have normal diet consumption.
3) **11%** - **No concerns, exhibit works well** – Many respondents had a very general response to this question, suggesting that a group was successful when no concerns were brought up about the exhibit at all and that most prosimian groups seem to mix well with no significant issues between species. In general, all animals should get along and be compatible.
4) **10% - Positive or affiliative interactions** – Some suggest that members of a successful group should interact with eachother positively and perform affiliative behaviors such as sitting in close proximity, grooming, sleeping or huddling together.
5) **8%** - **Maintain specific space or territy, no interactions –** Conversely, some respondents define their groups as successful if species maintain their distance and own territories. Each species should utilize a different part of the exhibit and leave eachother alone with no interactions.
6) **7% - No injuries** – Many feel that their exhibit is successful if there are no injuries or wounds requiring separation or veterinary care. Most managers will tolerate low levels of aggression in their mixed species groups. However, when contact aggression leading to injury, wounding, and veterinary intervention occurs, there are concerns about the ability of the group to stay together.

Additional factors mentioned in defining group success included maintaining health and weight, having reproduction occur within the mixed-species exhibit, lacking stereotypies and visible stress in individuals, the ability to share space with other species and keeping the group together over long periods of time without constant separation and re-introductions.

# FACTORS INFLUENCING SUCCESS IN MIXED-SPECIES GROUPS

We asked what three factors could contribute to the success of a mixed-species prosimian group. A total of 190 answers were given for this question. The six reasons mentioned most often are listed below, as well as the percent of times these answers were given:

1) **31% - Personality, demeanor, age of individuals or species** – Group composition and the disposition of the individuals that comprised the group were very important to the success of

the mixed-species exhibit. Calm and mature animals were good to mix together. Ring-tailed lemurs are often cited as being a species that is compatible with many other prosimians. Also, having non-breeding groups and no individuals with very dominant personalities was important to success.

2) **27%** - **Size, design, and complexity of exhibit and holding** – Abundant space on exhibit and in holding areas contributes to the success of mixed-species exhibits. Some of the qualities of a good exhibit include a lot of varied levels of perching, multiple sleeping or resting areas, complexity, visual barriers, and multiple feeding areas. In addition, large off-exhibit holding is very important.
3) **9%** - **Species that self-segregate** – The separation and maintenance of species-specific groups is important in successful mixed-species exhibits. For example, ring-tailed lemurs stay separate in specific areas of their exhibit, or some species are more arboreal and others are more terrestrial.
4) **8%** - **Ability to separate individuals** – Seperating individuals or groups by species for various reasons is an important component to successful mixed-species groupings. For example, separating individuals by species at night, or for feeding, is beneficial for less dominant species or individuals. Different sleeping and night holding stalls or feeding stations on exhibit or in holding can be used for separation. Many institutions have stated that they separate species overnight as part of regular management. Also, separating during breeding season, times of increased aggression, or 'time-outs'. However, there is always a balance of time separated in order to keep groups integrated. Also, whenever separation does occur, keeping visual, auditory, and olfactory contact is important.
5) **7%** - **Staff experience and patience with introductions** – Having animal keeper staff that are both knowledgeable about and patient with introductions can be very important in creating new mixed-species groups. Managers and keepers need to be enthusiastic and persistant about getting the group together and working through the process. They should be detail-oriented and have time to make regular observations of group dynamics and notice any slight changes in the species' behaviors.

Other factors that influence group success include sex composition of group, reproductive condition (castrated, non-breeding, etc.), introduction timing, amount of resources available to animals, the general natural history of the species, behavioral management and training, and length of time group has been together.

# FACTORS THAT CONTRIBUTE TO BREAKDOWN OF GROUP STRUCTURE

We asked what three factors could contribute to the breaking apart or failure of a mixed-species prosimian group. A total of 121 answers were given for this question. The six reasons mentioned most often are listed below, as well as the percent of times these answers were given:

1) **17% - Exhibit and holding size** – In general, lack of space was cited as contributing the breakdown of mixed species group. This can be both on-exhibit or in holding, where animals

cannot retreat if they are being targeted. There should be differentiation in space, and height and complexity to exhibits so individuals and species have different resting and feeding areas, separate off-exhibit stalls, and the ability to separate for feeding, husbandry, and medical needs. If multiple exhibits are present, visual and olfactory barriers can be helpful.

2) **16% - Breeding season** – Prosimians are seasonal breeders, and aggression becomes heightened during this period when hormones are fluctuating. Groups can be affected by breeding pairs, reproductive behaviors, presence of cycling females, males pursuing females, and other changes related to breeding season.
3) **13% - Dominance of one species** – Some species exhibit more dominant tendencies over others. In particular, both species of ruffed lemur can be aggressive to ring-tailed lemurs and *Eulemur*. Also, blue-eyed black lemurs and collared lemurs are reported as being dominant over other species in some cases.
4) **11% - Aggression** – General aggression was cited as a contributing factor to groups breaking down. This can be aggression during breeding season, from one species or one individual targeting another species or individual. It can be low-level continual aggression or can escalate during certain times. A change in aggression in the group may signify future problems in group stability.
5) **10% - Individual personalities** – Certain individuals or species are more compatible with other individuals or species. The "right" combination of individuals and species can make or break a mixed-species exhibit.
6) **7% - Food competition** – Not being able to manage nutrition properly among species is a concern. There are distinct differences in species' diet requirements and there should be the ability to separate species to prevent sharing of diet.

Other factors mentioned were changes in group composition, age of individuals in group, lack of staff experience in husbandry and introductions, sex differences in groups (all males vs. all females), and the dominance of females over males. Of course, many of these factors are not independent of one another. Often a problem in one aspect can lead to increased concerns in another. Care should be taken to observe these factors and monitor areas like aggression, food presentation, and breeding season when creating a mixed-species group.

# MIXED-SPECIES GROUPS IN CAPTIVITY FOUND IN THE LITERATURE

| Group Composition | Institution | Citation |
|---|---|---|
| Group 1<br>• 11 Black and white ruffed lemurs (*V. variegata)*<br>• 9 Brown lemurs (*E. fulvus*)<br>• 26 Ring-tailed lemurs (*L. catta*)<br>Group 2<br>• 3 Crowned lemurs (*E. coronatus*)<br>• 6 Black lemurs (*E. m. macaco*) | Duke Lemur Center | Alford-Madden 1986 |
| • 5.2 Ringtail lemur (*L catta*)<br>• 5.2 Ruffed lemur (*V. variegata*) | Burnet Park Zoo | Bollen 1996 |
| • Common brown lemurs (*E. fulvus*)<br>• Ring-tailed lemurs (*L. catta*)<br>• Black and white ruffed lemurs (*V. variegata)* | Madrid Zoo | Bueno 2007 |
| • Brown lemurs (*L. f. fluvus*)<br>• Red-fronted lemurs (*L. f. rufus*) | Field Station for Animal Behavior at Duke University | Buettner-Janusch 1967 |
| • Grey mouse lemur (*M. murinus*)<br>• Fat-tailed dwarf lemur (*C. medius*) | Duke Lemur Center | Cherry et al. 1987 |
| Group 1<br>• 1.0 Diademed sifaka (*P. d. diadema)*<br>• 1.0 Golden-crowned sifaka (*P. tattersalli*)<br>• 0.1 Coquerel's sifaka (*P. v. coquereli)*<br>Group 2<br>• 2.0 Mongoose lemur (*E. mongoz*)<br>• 2.2 Grey gentle lemur (*H. g. griseus)*<br>Group 3<br>• Mongoose lemurs (*E. mongoz*)<br>• Grey gentle lemurs (*H. g. griseus)*<br>Group 4<br>• 2.0 Ring-tailed lemur (*L. catta)*<br>• 2.0 Red-bellied lemur (*E. rubriventer*)<br>Group 5<br>• 3.1 White-fronted lemur (*E. f. albifrons*)<br>• 3.0 Black and white ruffed lemur (*V. v. variegata*)<br>Group 6<br>• 1.0 Ring-tailed lemur (*L. catta)*<br>• 1.0 Hybrid brown lemur (*E. fulvus (hyb))*<br>Group 7<br>• Crowned lemurs (*E. coronatus*)<br>• Sanford's lemurs (*E. f. sanfordi*)<br>Group 8 | Duke University Primate Center | Coffman 1996 |

| Group Composition | Institution | Citation |
|---|---|---|
| • 1.1 Collared lemur (*E. f. collaris*)<br>• 1.1 Mongoose lemur (*E. mongoz*)<br>Group 9<br>• Collared lemurs (*E. f. collaris*)<br>• Red ruffed lemurs (*V.v. rubra*)<br>Groups 10 and 11<br>• Ring-tailed lemurs (*L. catta)*<br>• Red-fronted lemurs (*E. f. rufus)*<br>• Red ruffed lemurs (*V. v. rubra*)<br>Group 12<br>• 1.1 Golden-crowned sifaka (*P. tattersalli*)<br>• 1.0 Red-bellied lemur (*E. rubriventer*)<br>Group 13<br>• 1.1 Verreaux's sifaka (*P. v. verreauxi)*<br>• 1.2 Grey gentle lemur (*H. g. griseus)*<br>Group 14<br>• 1.1 Verreaux's sifaka (*P. v. verreauxi)*<br>• 1.1 Grey gentle lemur (*H. g. griseus)*<br>Group 15<br>• 1.1 Verreaux's sifaka (*P. v. verreauxi)*<br>• 1.0 Coquerel's sifaka (*P. v. coquereli)*<br>• 2.0 Grey gentle lemur (*H. g. griseus)*<br>Group 16<br>• 1.1 Red-bellied lemur (*E. rubriventer*)<br>• 1.1 Grey gentle lemur (*H. g. griseus)*<br>Group 17<br>• 1.2 Ring-tailed lemur (*L. catta)*<br>• 3.1 Red-fronted lemur (*E. f. rufus)*<br>Group 18<br>• 3.0 Ring-tailed lemur (*L. catta)*<br>• 2.1 Red-fronted lemur (*E. f. rufus)*<br>Group 19<br>• 1.0 Collared lemur (*E. f. collaris*)<br>• 1.0 White-fronted lemur (*E.f. albifrons*)<br>• 1.0 Black lemur (*E. m. macaco*)<br>Group 20<br>• 3.1 Mongoose lemur (*E. mongoz*)<br>• 2.0 Hybrid gentle lemur (*H. griseus (hyb))*<br>Group 21<br>• 3.1 White-fronted lemur (*E.f. albifrons*)<br>• 1.1 Black and white ruffed lemur (*V. v. variegata*)<br>Group 22<br>• 0.2 Mongoose lemur (*E. mongoz*)<br>• 0.1 Coquerel's sifaka (*P. v. coquereli)* | | |

| Group Composition | Institution | Citation |
|---|---|---|
| Group 23<br>• 2.0 Mongoose lemur (*E. mongoz*)<br>• 2.2 Grey gentle lemur (*H. g. griseus)*<br>Group 24<br>• Crowned lemurs (*E. coronatus*)<br>• Sanford's lemurs (*E. f. sanfordi*)<br>• Coquerel's sifakas (*P. v. coquereli)*<br>Group 25<br>• Blue-eyed lemurs (*E. m. flavifrons*)<br>• Mongoose lemurs (*E. mongoz*)<br>Group 26<br>• 4.2 Black lemur (*E. m. macaco*)<br>• 2.2 Crowned lemur (*E. coronatus*)<br>Group 27<br>• Hybrid brown lemurs (*E. fulvus (hyb))*<br>• 1.2 Crowned lemur (*E. coronatus*)<br>Group 28<br>• Collared lemurs (*E. f. collaris*)<br>• Blue-eyed lemurs (*E. m. flavifrons*)<br>• Red-bellied lemurs (*E. rubriventer*)<br>• Mongoose lemurs (*E. mongoz*)<br>Group 29<br>• Black lemurs (*E. m. macaco*)<br>• Mongoose lemurs (*E. mongoz*)<br>Group 30<br>• 1.2 Coquerel's sifaka (*P. v. coquereli)*<br>• 2.0 Grey gentle lemur (*H. g. griseus)*<br>Group 31<br>• 1.1 Coquerel's sifaka (*P. v. coquereli)*<br>• 1.1 Red-bellied lemur (*E. rubriventer*) | | |
| • 2.1 Red-fronted lemur (*E. rufus)*<br>• 7.2 Ring-tailed lemur *(L. catta*) | Los Angeles Zoo | Dee and Emerson 1973 |
| • 4.0 Red ruffed lemur (*V. v. ruber*)<br>• 2.0 Black and white ruffed lemur (*V. v. variegata*)<br>• 2.0 Black lemur (*L. macaco*)<br>• 2.0 Ring-tailed lemur (*L. catta*) | Hattiesburg Zoo | Gecewicz 2001 |
| • 3 Brown lemurs (*E. fulvus*)<br>• 4 Brown lemur hybrids (*E. fulvus* x *E.f. rufus*)<br>• 17 Ring-tailed lemurs (*L. catta*) | Duke University Primate Center | Glander et al. 1985 |
| Group 1<br>• 1.0 Grey gentle lemur/Eastern lesser bamboo lemur (*H. g. griseus*)<br>• 0.1 Grey gentle lemur/Alaotran gentle | 1) Duke University Primate Center | Haring and Davis 1998 |

| Group Composition | Institution | Citation |
|---|---|---|
| lemur (*H. g. alaotrensis)*<br>Group 2<br>• 4 Lesser bamboo lemurs (*H. g. griseus*)<br>• 2.0 Mongoose lemur (*E. mongoz*)<br>Group 3<br>• 0.2 Lesser bamboo lemur ( *H. g. griseus*)<br>• 2.1 Mongoose lemur (*E. mongoz*)<br>Group 4<br>• Lesser bamboo lemurs (*H. g. griseus*)<br>• 1.1 Mongoose lemur (*E. mongoz*)<br>Group 5<br>• 1.1 Lesser bamboo lemur (*H. g. griseus*)<br>• Sifakas (*Propithecus sp.*)<br>Group 6<br>• 3.2 Crown lemur (*E. coronatus*)<br>• 2.2 Sanford's lemur (*E. f. sanfordi*)<br>• 2.1 Lesser bamboo lemur(*H. g. griseus* x *H. g alaotrensis* hybrid female and 2.0 juveniles )<br>Group 7<br>• 2.1 Lesser bamboo lemur (*H. g. griseus*)<br>• 2.2 Crowned lemur (*E. coronatus*) | 2) Duke University Primate Center<br><br>3) Duke University Primate Center<br><br>4) Philadelphia Zoo<br><br>5) Duke University Primate Center<br><br>6) Duke University Primate Center<br><br>7) Duke University Primate Center | |
| Group 1<br>• 11.8 Ring-tailed lemur (*L. catta*)<br>• 7.4 Red-fronted lemur (*E. rufus*)<br>- With juveniles<br>Group 2<br>• 4.5 Ring-tailed lemur (*L. catta*)<br>• 3.2 Red-fronted lemur (*E. rufus*)<br>- With juveniles | Duke University Primate Center | Kappeler 1993 |
| Groups 1 and 2<br>• Red-fronted lemurs (*E. f. rufus*)<br>- With juveniles<br>• Ring-tailed lemurs (*L. catta*)<br>• Black and white ruffed lemurs (*V. variegata*)<br>Group 3<br>• Collared lemurs (*E. collaris*)<br>- With juveniles<br>• Verreaux sifakas (*P. verreauxi*) | Duke University Primate Center | Kaufman 1996 |
| • 1.1 Black lemur (*E. macaco*)<br>• 3.0 Ring-tailed lemur (*L. catta*) | Henson Robinson Zoo | Maloney et al. 2006 |
| • 2.3 Ring-tailed lemur (*L. catta*)<br>• 1.1 Black and white ruffed lemur (*V. variegata*) | Parco Zoo Punta Verde, Italy | Manna et al. 2007 |

| Group Composition | Institution | Citation |
|---|---|---|
| • 3.2 Black lemur (*E. m. macaco*)<br>• 4.4 Ring-tailed lemur (*L. catta*)<br>- With juveniles | Jacksonville Zoo | Meyer 1982 |
| • 2.4 Black and white ruffed lemur (*V. v. variegata*)<br>• 4.2 Ring-tailed lemur (*L. catta*) | Honolulu Zoo | Pappas and McLennan 2003 |
| • 2.4 Ring-tailed lemur (*L. catta*)<br>• 4.1 Red ruffed lemur (*V. rubra*) | Bristol Zoo | Partridge 2006 |
| Group 1<br>• White-fronted lemurs (*E. f. albifrons*)<br>• Tonkean macaques (*Macaca tonkeana*)<br>• Uganda red-tailed monkeys (*Cercopithecus ascanius schmidti*)<br>Group 2<br>• Red ruffed lemur (*V. v. rubra*)<br>• Black and white ruffed lemur (*V. v. variegata*)<br>• Capuchins (*Cebus apella*) | Zoo Quinta S. Inácio<br><br>Europaradise | Paterok and Livet 2007 |
| Group 1<br>• Pygmy slow loris (*N. pygmaeus*)<br>• Asian horned beetle (*Xylotrupes Gideon sumatraensis*)<br>Group 2<br>• Pygmy slow loris (*N. pygmaeus*)<br>• Tokay geckos (*Gekko gecko*) | Pozan Zoo | Ratajszczak and Trtzesowska 2000 |
| • 1.0 White-belted black-and-white ruffed lemur (*V. v. subcincta*)<br>• 5.0 Black and white ruffed lemur (*V. v. variegata*)<br>• 6.0 Red ruffed lemur (*V. v. rubra*)<br>• 17.0 Ring-tailed lemur (*L. catta*)<br>• White-fronted lemurs (*E. f. albifrons*) | La Vallée des Singes | Romano and Vermeer 2003 |
| • 1.0 Brown lemur (*L. fulvus*)<br>• 0.1 Red-bellied lemur (*L. rubriventer*)<br>• 4 Ring-tailed lemurs (*L. catta*) | Asson Zoo (Jardin Exotique Zoo d'Asson) | Saint-pie 1970 |
| • Pygmy loris (*N. pygmaeus*)<br>• *Loris sp.*<br>• *Tarsius sp.* | Duke University Primate Center | Schulze 1998 |
| • Black-and-white lemur (*V. variegata*)<br>• Red lemur (*E. rufus*)<br>• Red-bellied lemur (*E. rubriventer*) | Unknown | Snipp 2004 |
| • 2.1 White-fronted lemur (*E. f. albifrons*)<br>• 1 Alaotran gentle lemur (*H. g alaotrensis*) | Zurich Zoo | Sommerfeld et al. 2006 |

| Group Composition | Institution | Citation |
|---|---|---|
| • Aviary consisting of "lemurs, squirrel monkeys and birds" | Senda El Retiro Parque Botánico-Ornitologico | Strehlow 2007 |
| • Ring-tailed lemurs (*L. catta*)<br>• Flamingos<br>• White-naped cranes<br>• Red squirrels | Banham Zoo | Tuson 2002 |
| • Black and white ruffed lemurs (*V. v. variegata*)<br>• Red ruffed lemurs (*V. v. rubra*)<br>- 12 total males of these subspecies<br>• 16 Ring-tailed lemur (*L. catta*)<br>• White-fronted lemurs (*E. f. albifrons*) | La Vallée des Singes | Vermeer 2000 |
| • 2.12 Ring-tailed lemur (*L. catta*)<br>• 1.2 Collared lemur (*L. f. collaris*) | Indianapolis Zoo | Villers and Lent 1993 |
| • 7.0 Ring-tailed lemur (*L. catta*)<br>• 2.3 Black lemur (*E. m. macaco*)<br>• 1.1 Red ruffed lemur (*V. v. rubra*) | Blackpool Zoo | Webster 2000 |
| • 2.0 Black lemur (*E. m. macaco*)<br>• 2.0 Red ruffed lemur (*V. rubra*)<br>• 1.0 Black-and-white lemur (*V. variegata*)<br>• 2.0 Ring-tailed lemur (*L. catta*)<br>• 3.0 Crowned lemur (*E. coronatus*) | Hattiesburg Zoo | Wright and Hamilton 2004 |

# SYMPATRIC SPECIES OF PROSIMIANS IN THE WILD

Bolded sources include all listed species while secondary sources (not boldface) include a subset of those species listed. Any interaction (ecological, behavioral, or otherwise) that was observed between species is noted.

| Species | Citation(s) | Notes |
|---|---|---|
| • Allen's galago (*G. alleni*)<br>• Northern needle-clawed galago (*E. pallidus*)<br>• Demidoff's galago (*G. demidoff*)<br>• Thomas's galago (*G. thomasi*) | **Ambrose and Perkins 1999-2000** | |
| • Indri (*I. indri*)<br>• Black-and-white ruffed lemur (*V. v. variegata*)<br>• White-fronted brown lemur (*E. f. albifrons*)<br>• Eastern woolly lemur (*A. langier*)<br>• Aye-aye (*D. madagascariensis*)<br>• Brown mouse lemur (*M. rufus*)<br>• Eastern fork-marked lemur (*P. furcifer*) | **Britt et al. 1999**<br>**Britt 2002** | |
| • Kenya coast galago (*G. cocos*)<br>• Udzungwa galago (*G. z. udzungwensis*)<br>• Grant's lesser galago (*G. granti*) | **Butynski et al. 2006** | These species are parapatric or, perhaps, narrowly sympatric. |
| • Greater bushbaby (*O. crassicaudatus*)<br>• Lesser bushbaby (*G. senegalensis*)<br>• Udzungwa galago (*G. udzungwensis*)<br>• Mountain dwarf galago (*G. orinus*) | **Butynski et al. 1998** | |
| • Hairy-eared dwarf lemur (*A. trichotis*)<br>• Aye-aye (*D. madagascariensis*)<br>• Black-and-white ruffed lemur (*V. variegata*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Brown mouse lemur (*M. rufus*)<br>• Brown lemur (*E. fulvus*)<br>• Greater dwarf lemur (*C. major*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Eastern woolly lemur (*A. laniger*)<br>• Diademed sifaka (*P. diadema*)<br>• Indri (*I. indri*)<br>• Weasel sportive lemur (*L. mustelinus*) | **Ganzhorn 1998**<br><br>Evans et al. 1995<br>Ganzhorn 1987<br>Ganzhorn 1988<br>Ganzhorn 1989<br>Goodman and Schütz 1999<br>Goodman and Schütz 2000<br>Lehman 2006<br>Lehman 2007a<br>Stephenson et al. 1994<br>Tattersall and Sussman 1998 | Species observed (all except *A. trichotis*) differ in categories of food consumed, food species composition, habitat utilization, and activity rhythms. Food consumption differed with respect to protein concentrations, condensed tannins, and alkaloids.<br>- Ganzhorn 1988<br>*I. indri* tends to join in on alarm calls initiated by sympatric species.<br>*P. d. diadema* is noted to be dominant species in all inter-specific interactions.<br>*V. v. variegata* exhibits possible feeding dominance over *E. rubriventer*.<br>Presence of *V. v. variegata* causes possible avoidance behavior in *H. g. griseus*.<br>- Evans et al. 1995 |

| Species | Citation(s) | Notes |
|---|---|---|
| | | The dietary and habitat niches of *C. major* overlap with those of *A. laniger, H. griseus, I. indri, E. f. fulvus,* and *L. mustelinus*.<br>There is also overlap seen between *I. indri* and *E. f. fulvus*; *L. mustelinus* and *H. griseus*; and *E. f. fulvus*, *A. laniger*, and *L. mustelinus.*<br>- Ganzhorn 1989<br>*E. rubriventer* is separated by elevation from *I. indri* and *D. madagascariensis*<br>- Goodman and Schütz 2000<br>*H. g. griseus* avoids cut transects in the forest more than other sympatric species.<br>- Lehman 2006 |
| • Brown mouse lemur (*M. rufus*)<br>• Brown lemur (*E. fulvus*)<br>• Greater dwarf lemur (*C. major*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Aye-aye (*D. madagascariensis*)<br>• Eastern woolly lemur (*A. laniger*)<br>• Diademed sifaka (*P. diadema*)<br>• Black-and-white ruffed lemur (*V. variegata*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Hairy-eared dwarf lemur (*A. trichotis*)<br>• Greater bamboo lemur (*H. simus*)<br>• Golden bamboo lemur (*H. aureus*) | **Ganzhorn 1998**<br><br>Arrigo-Nelson and Wright 2004<br>Lehman 2007a<br>Stephenson et al. 1994<br>Tattersall and Sussman 1998 | |
| • Gray mouse lemur (*M. murinus*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Brown lemur (*E. fulvus*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Verreaux's sifaka (*P. verreauxi*)<br>• Ring-tailed lemur (*L. catta*) | **Ganzhorn 1998**<br><br>Cuozzo et al. 2008<br>Oda 1998<br>Simmen et al. 2003<br>Ward and Sussman 1979<br>Yamashita 2002<br>Yamashita 2008 | Both species consume tamarind fruit. *L. catta* tend to eat hard ripe fruit, which dominates their diet, while *P. verreauxi* tend to eat soft unripe fruit, but their diet is dominated by leaves.<br>*L. catta* is primarily terrestrial while *P. verreauxi* is primarily arboreal.<br>- Cuozzo et al. 2008<br>*P. verreauxi* are shown to perceive and react to the anti-carnivore alarm calls of *L. catta*.<br>- Oda 1998<br>*L. catta* and *E. fulvus* showed greater dietary overlap than either did with *P. verreauxi*.<br>- Simmen et al. 2003<br>*L. catta* is typically in the lowest levels of |

| Species | Citation(s) | Notes |
|---|---|---|
| | | the forest and uses the ground for travel. *E. fulvus* uses the upper levels of the canopy and is very rarely on the ground.<br>- Ward and Sussman 1979 |
| • Gray mouse lemur (*M. murinus*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Verreaux's sifaka (*P. verreauxi*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Brown lemur (*E. fulvus*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Mouse lemur (*Microcebus sp.*) | **Ganzhorn 1998** | |
| • Gray mouse lemur (*M. murinus*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Verreaux's sifaka (*P. verreauxi*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Brown lemur (*E. fulvus*)<br>• Mongoose lemur (*E. mongoz*) | **Ganzhorn 1998**<br><br>Tattersall and Sussman 1998 | *E. fulvus* and E. *mongoz* demonstrate contrasting activity patterns, which vary by season.<br>- Tattersall and Sussman 1998 |
| • Pygmy mouse lemur (*M. myoxinus*)<br>• Gray mouse lemur (*M. murinus*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Red-tailed sportive lemur (*L. ruficaudatus*)<br>• Red lemur (*E. f. rufus*)<br>• Verreaux's sifaka (*P. v. verreauxi*) | **Ganzhorn and Kappeler 1996**<br><br>Razafimanantsoa 1999<br>Schwab and Ganzhorn 2004<br>Sussman 1974 | *M. myoxinus*, *M. murinus*, *C. medius*, and perhaps *L. ruficaudatus* tend to live solitarily while *P. furcifer*, *E. f. rufus*, and *P. v. verreauxi* live in pairs or groups. Species forage at different heights and are active at different times.<br>Negative correlation between populations of *Microcebus sp.* and *C. medius* is potentially due to interspecific competition.<br>Researchers observed aggressive behaviors between *C. medius* and *M. coquereli*, during which *C. medius* was the victor.<br>- Ganzhorn and Kappeler 1996<br>*P. verreauxi* tend to use vertical supports during locomotion while *E. fulvus* are more quadrupedal, using horizontal supports.<br>- Razafimanantsoa 1999 |
| • Mouse lemur (*Microcebus sp.*)<br>• Greater dwarf lemur (*C. major*)<br>• Gray-backed sportive lemur (*L. dorsalis*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Aye-aye (*D. madagascariensis*) | **Goodman and Schütz 2000**<br><br>Birkinshaw et al. 2000<br>Mittermeier et al. 2008 | *E. rubriventer* is separated by elevation from *C. major*, *L. dorsalis*, and *D. madagascariensis*. |

| Species | Citation(s) | Notes |
|---|---|---|
| • Brown lemur (*E. fulvus*)<br>• Black lemur (*E. macaco*) | Tattersall and Sussman 1998 | |
| • Brown mouse lemur (*M. rufus*)<br>• Greater dwarf lemur (*C. major*)<br>• Eastern woolly lemur (*A. laniger*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Brown lemur (*E. fulvus*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Diademed sifaka (*P. diadema*)<br>• Aye-aye (*D. madagascariensis*) | **Goodman and Schütz 2000**<br><br>Goodman and Schütz 1999<br>Lehman 2006<br>Lehman 2007a<br>Stephenson et al. 1994<br>Tattersall and Sussman 1998 | *H. g. griseus* avoids cut transects in the forest more than other sympatric species.<br>- Lehman 2006 |
| • Zanzibar bushbaby (*G. zanzibaricus*)<br>• Greater bushbaby (*O. garnettii*) | **Harcourt and Nash 1986** | *O. garnettii* ate more fruit and different species of invertebrate prey than *G. zanzibaricus*.<br>*O. garnettii* used higher branches, and branches with larger diameter than *G. zanzibaricus* |
| • Gray mouse lemur (*M. murinus*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Decken's sifaka (*P. v. deckenii*)<br>• Red lemur (*E. f. rufus*) | **Hawkins et al. 1998**<br><br>Sussman 1977 | |
| • Collared brown lemur (*E. f. collaris*)<br>• Lesser bamboo lemur (*H. griseus sp.*)<br>• Aye-aye (*D. madagascariensis*)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Brown mouse lemur (*M. rufus*) | **Irwin et al. 2001** | |
| • Red lemur (*E. f. rufus*)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Mouse lemur (*Microcebus sp.*)<br>• Verreaux's sifaka (*P. verreauxi*)<br>• Ring-tailed lemur (*L. catta*) | **Jolly et al. 2000**<br><br>Cuozzo et al. 2008<br>Oda 1998<br>Razafimanantsoa 1999<br>Sussman 1977<br>Tattersall and Sussman 1998<br>Vasey 2000<br>Yamashita 2002<br>Yamashita 2008 | *E. f. rufus* have been observed preying on *L. catta* infants.<br>- Jolly et al. 2000<br>Both species consume tamarind fruit. *L. catta* tend to eat hard ripe fruit, which dominates their diet, while *P. verreauxi* tend to eat soft unripe fruit, but their diet is dominated by leaves.<br>*L. catta* is primarily terrestrial while *P. verreauxi* is primarily arboreal.<br>- Cuozzo et al. 2008<br>*P. verreauxi* are shown to perceive and react to the anti-carnivore alarm calls of *L. catta*.<br>- Oda 1998<br>*P. verreauxi* tend to use vertical supports during locomotion while *E.* |

| Species | Citation(s) | Notes |
|---|---|---|
| | | *fulvus* are more quadrupedal, using horizontal supports.<br>- Razafimanantsoa 1999 |
| • Brown mouse lemur (*M. rufus*)<br>• Greater dwarf lemur (*C. major*)<br>• Eastern woolly lemur (*A. laniger*)<br>• Red lemur (*E. f. rufus*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Black-and-white ruffed lemur (*V. variegata*)<br>• Aye-aye (*D. madagascariensis*)<br>• Small-toothed sportive lemur (*L. microdon*)<br>• Milne-Edwards' sifaka (*P. edwardsi*)<br>• Greater bamboo lemur (*P. simus*)<br>• Golden bamboo lemur (*H. aureus*)<br>• Eastern lesser bamboo lemur (*H. griseus*) | **Karpanty 2006**<br><br>Arrigo-Nelson and Wright 2004<br>Ballhorn et al. 2009<br>Lehman 2006<br>Lehman et al. 2006<br>Meier and Rumpler 1987<br>Mittermeier et al. 2008<br>Overdorff 1992<br>Overdorff 1993<br>Overdorff 1996<br>Overdorff and Erhart 2005<br>Overdorff and Strait 1998<br>Tattersall and Sussman 1998<br>Wright 1989 | Study investigates the impact of raptor predation on lemur population dynamics, which may affect how lemur species coexist.<br>- Karpanty 2006<br>Diet for all three consists mainly of giant bamboo (*C. madagascariensis*). *H. aureus* and *H. griseus* eat primarily new growth while *P. simus* will consume leaves of different ages, shoots, and mature culms.<br>- Ballhorn et al. 2009<br>*H. g. griseus* avoids cut transects in the forest more than other sympatric species.<br>- Lehman 2006<br>*E. rubriventer* licked nectar from flowers while *E. f. rufus* ate all flower parts.<br>- Overdorff 1992<br>*E. f. rufus* initiated more feeding bouts and bouts of shorter duration than *E. rubriventer*. *E. f. rufus* exploited more unripe fruit and mature leaves than *E. rubriventer*.<br>- Overdorff 1993<br>*E. f. rufus* lived in larger groups and travelled more than *E. rubriventer*.<br>- Overdorff 1996<br>Species exhibit different food preferences and abilities to digest certain bamboo parts.<br>- Wright 1989 |
| • Eastern woolly lemur (*A. laniger*)<br>• Collared brown lemur (*E. collaris*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Greater dwarf lemur (*C. major*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Gray mouse lemur (*M. murinus*) | **Lahann 2007a**<br><br>Lahann 2007b<br>Lahann 2008 | *C. medius*, *M. murinus*, and *C. major* were found sleeping in different tree holes in the same trees.<br>- Lahann 2007a<br>*C. medius*, *M. murinus*, and *C. major* fed on same plant species, but at different heights.<br>- Lahann 2007b |
| • Greater dwarf lemur (*C. major*)<br>• Brown lemur (*E. f. fulvus*)<br>• Hybrid brown lemur (*E.* hybrid) | **Lehman and Wright 2000**<br><br>Meier and Rumpler | |

| Species | Citation(s) | Notes |
|---|---|---|
| • Red-bellied lemur (*E. rubriventer*)<br>• Brown mouse lemur (*M. rufus*)<br>• Aye-aye (*D. madagascariensis*)<br>• Golden bamboo lemur (*H. aureus*)<br>• Eastern lesser bamboo lemur (*H. g. griseus*) | 1987<br>Mittermeier et al. 2008<br>Tattersall and Sussman 1998 | |
| • Perrier's sifaka (*P. d. perrieri*)<br>• Northern sportive lemur (*L. septentrionalis*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Aye-aye (*D. madagascariensis*)<br>• Brown mouse lemur (*M. rufus*)<br>• Sanford's brown lemur (*E. f. sanfordi*)<br>• Crowned lemur (*E. coronatus*) | **Meyers and Ratsirarson 1989**<br><br>Freed 1995<br>Mittermeier et al. 2008<br>Tattersall and Sussman 1998 | *E. coronatus* were seen foraging more than *E. f. sanfordi*.<br>- Freed 1995<br>*E. coronatus* fed and stayed mostly in the understory, while *E. f. sanfordi* preferred the middle canopy.<br>- Tattersall and Sussman 1998 |
| • Mittermeier's mouse lemur (*M. mittermeieri*)<br>• MacArthur's mouse lemur (*M. macarthurii*) | **Mittermeier et al. 2008** | |
| • Small-toothed sportive lemur (*L. microdon*)<br>• Weasel sportive lemur (*L. mustelinus*) | **Mittermeier et al. 2008** | |
| • Fat-tailed dwarf lemur (*C. medius*)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Gray mouse lemur (*M. murinus*)<br>• Crowned sifaka (*P. v. coronatus*)<br>• Red lemur (*E. f. rufus*)<br>• Mongoose lemur (*E. mongoz*) | **Müller et al. 2000**<br><br>Sussman 1977<br>Tattersall and Sussman 1998<br>Zaramody and Pastorini 2001 | *E. mongoz* demonstrated contrasting activity patterns with both *E. f. rufus* and *E. fulvus*, which varied by season.<br>- Tattersall and Sussman 1998<br>Evidence exists for hybridization between *E. f. rufus* and *E. mongoz*.<br>- Zaramody and Pastorini 2001 |
| • Collared brown lemur (*E. collaris*)<br>• Eastern woolly lemur (*A. laniger*)<br>• Dwarf lemur (*Cheirogaleus sp.*)<br>• Brown mouse lemur (*M. rufus*) | **Norscia et al. 2006** | |
| • Bengal slow loris (*N. bengalensis*)<br>• Pygmy loris (*N. pygmaeus*) | **Pan et al. 2007** | |
| • Silky sifaka (*P. candidus*)<br>• Red ruffed lemur (*V. rubra*) | **Patel and Andrianandrasana 2008** | Sympatry assumed based on vocalizations of *V. rubra* heard within one km of the study site in the *P. candidus* habitat. |
| • Collared brown lemur (*E. collaris*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Eastern woolly lemur (*A. laniger*)<br>• Dwarf lemur (*Cheirogaleus sp.* 1)<br>• Dwarf lemur (*Cheirogaleus sp.* 2)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Mouse lemur (*Microcebus sp.*) | **Rabeson et al. 2006** | |

| Species | Citation(s) | Notes |
|---|---|---|
| • Aye-aye (*D. madagascariensis*) | | |
| • Red lemur (*E. f. rufus*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Eastern woolly lemur (*A. laniger*)<br>• Seal's sportive lemur (*L. seali*)<br>• Brown mouse lemur (*M. rufus*)<br>• Aye-aye (*D. madagascariensis*) | **Rabeson et al. 2006** | |
| • Fat-tailed dwarf lemur (*C. medius*)<br>• Brown lemur (*E. f. fulvus*)<br>• Mongoose lemur (*E. mongoz*)<br>• Coquerel's sifaka (*P. v. coquereli*)<br>• Golden-brown mouse lemur (*M. ravelobensis*)<br>• Gray mouse lemur (*M. murinus*)<br>• Milne-Edwards' sportive lemur (*L. edwardsi*)<br>• Western woolly lemur (*A. occidentalis*) | **Radespiel and Raveloson 2001**<br><br>Ganzhorn 1988<br>Ganzhorn 2003<br>Radespiel et al. 2003<br>Radespiel et al. 2006<br>Rambinintsoa et al. 2006<br>Schmelting et al. 2000<br>Schwab and Tattersall and Sussman 1998<br>Thalmann 2001<br>Sussman 1977<br>Warren 1997<br>Zimmermann et al. 1998 | Species observed (all except *M. ravelobensis*) differ in categories of food consumed, food species composition, habitat utilization, and activity rhythms. Food consumption differed with respect to protein concentrations, condensed tannins, and alkaloids.<br>- Ganzhorn 1988<br>*M. murinus* used tree holes as sleeping sites more frequently than *M. ravelobensis*, which used a variety of less protected sites. This could be due to interspecies competition for protected sleeping sites or niche differentiation.<br>- Radespiel et al. 2003<br>Reproductive activity occurs earlier in *M. ravelobensis* than in *M. murinus*.<br>- Schmelting et al. 2000<br>*E. fulvus* and E. *mongoz* demonstrate contrasting activity patterns, which vary by season.<br>- Tattersall and Sussman 1998<br>*A. occidentalis* and *L. edwardsi* avoid niche overlap by using resources of different sizes and having different seasonal eating patterns.<br>- Thalmann 2001<br>*A. occidentalis* spent more time in the canopy. *L. edwardsi* preferred lower forest levels.<br>- Warren 1997 |
| • Red-bellied lemur (*E. rubriventer*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Greater dwarf lemur (*C. major*)<br>• Brown mouse lemur (*M. rufus*)<br>• Hairy-eared dwarf lemur (*A. trichotis*)<br>• Aye-aye (*D. madagascariensis*)<br>• Eastern woolly lemur (*A. laniger*) | **Ralison 2006a**<br><br>Britt et al. 1999<br>Britt 2002<br>Lehman 2006<br>Lehman 2007a<br>Simons and Lindsay | *H. g. griseus* avoids cut transects in the forest more than other sympatric species.<br>- Lehman 2006 |

| Species | Citation(s) | Notes |
|---|---|---|
| • Eastern lesser bamboo lemur (*H. g. griseus*)<br>• White-fronted brown lemur (*E. f. albifrons*)<br>• Indri (*I. indri*)<br>• Diademed sifaka (*P. d. diadema*)<br>• Black-and-white ruffed lemur (*V. v. variegata*) | 1987<br>Tattersall and Sussman 1998 | |
| • Gray mouse lemur (*M. murinus*)<br>• Reddish-gray mouse lemur (*M. griseorufus*)<br>• White-footed sportive lemur (*L. leucopus*)<br>• Ring-tailed lemur (*L. catta*)<br>• Verreaux's sifaka (*P. v. verreauxi*) | **Ralison 2006b**<br>**Ravoahangy et al. 2008**<br><br>Cuozzo et al. 2008<br>Oda 1998<br>Richard et al. 1993<br>Schwab and Ganzhorn 2004<br>Yamashita 2002<br>Yamashita 2008<br>Yoder et al. 2002 | Both species consume tamarind fruit. *L. catta* tend to eat hard ripe fruit, which dominates their diet, while *P. verreauxi* tend to eat soft unripe fruit, but their diet is dominated by leaves.<br>*L. catta* is primarily terrestrial while *P. verreauxi* is primarily arboreal.<br>- Cuozzo et al. 2008<br>*P. verreauxi* are shown to perceive and react to the anti-carnivore alarm calls of *L. catta*.<br>- Oda 1998 |
| • Aye-aye (*D. madagascariensis*)<br>• Perrier's sifaka (*P. perrieri*)<br>• Sanford's brown lemur (*E. sanfordi*)<br>• Crowned lemur (*E. coronatus*)<br>• Ankarana sportive lemur (*L. ankaranensis*) | **Ranaivoarisoa et al. 2006**<br><br>Freed 1995<br>Mittermeier et al. 2008<br>Tattersall and Sussman 1998<br>Wilson et al. 1995 | *E. coronatus* were seen foraging more than *E. f. sanfordi*.<br>- Freed 1995<br>*E. coronatus* fed and stayed mostly in the understory, while *E. f. sanfordi* preferred the middle canopy.<br>- Tattersall and Sussman 1998 |
| • Eastern woolly lemur (*A. laniger*)<br>• Dwarf lemur (*Cheirogaleus sp.*)<br>• Aye-aye (*D. madagascariensis*)<br>• White-collared brown lemur (*E. albocollaris*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Brown mouse lemur (*M. rufus*) | **Ravoahangy et al. 2008** | |
| • Dwarf lemur (*Cheirogaleus sp.*)<br>• Aye-aye (*D. madagascariensis*)<br>• Decken's sifaka (*P. deckenii*)<br>• Red lemur (*E. rufus*)<br>• Western lesser bamboo lemur (*H. occidentalis*)<br>• Gray mouse lemur (*M. murinus*) | **Ravoahangy et al. 2008**<br><br>Hawkins et al. 1998<br>Sterling 1998<br>Sussman 1977 | |
| • Dwarf lemur (*Cheirogaleus sp.*)<br>• Sanford's brown lemur (*E. sanfordi*)<br>• Aye-aye (*D. madagascariensis*) | **Ravoahangy et al. 2008** | |

| Species | Citation(s) | Notes |
|---|---|---|
| • Eastern lesser bamboo lemur (*H. griseus*)<br>• Brown mouse lemur (*M. rufus*) | | |
| • Dwarf lemur (*Cheirogaleus sp.*)<br>• Aye-aye (*D. madagascariensis*)<br>• Brown lemur (*E. fulvus*)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Gray mouse lemur (*M. murinus*)<br>• Coquerel's sifaka (*P. coquereli*) | **Ravoahangy et al. 2008** | |
| • Eastern woolly lemur (*A. laniger*)<br>• Aye-aye (*D. madagascariensis*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Greater dwarf lemur (*C. major*)<br>• Furry-eared dwarf lemur (*C. crossleyi*)<br>• Brown mouse lemur (*M. rufus*)<br>• Crowned lemur (*E. coronatus*)<br>• Sanford's brown lemur (*E. sanfordi*) | **Ravoahangy et al. 2008**<br><br>Freed 1995<br>Mittermeier et al. 2008<br>Tattersall and Sussman 1998 | *E. coronatus* were seen foraging more than *E. f. sanfordi*.<br>- Freed 1995<br>*E. coronatus* fed and stayed mostly in the understory, while *E. f. sanfordi* preferred the middle canopy.<br>- Tattersall and Sussman 1998 |
| • Aye-aye (*D. madagascariensis*)<br>• Northern sportive lemur (*L. septentrionalis*)<br>• Gray mouse lemur (*M. murinus*)<br>• Crowned lemur (*E. coronatus*)<br>• Sanford's brown lemur (*E. sanfordi*) | **Ravoahangy et al. 2008**<br><br>Freed 1995<br>Mittermeier et al. 2008<br>Tattersall and Sussman 1998 | *E. coronatus* were seen foraging more than *E. f. sanfordi*.<br>- Freed 1995<br>*E. coronatus* fed and stayed mostly in the understory, while *E. f. sanfordi* preferred the middle canopy.<br>- Tattersall and Sussman 1998 |
| • Fat-tailed dwarf lemur (*C. medius*)<br>• Red lemur (*E. rufus*)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Gray mouse lemur (*M. murinus*)<br>• Ring-tailed lemur (*L. catta*)<br>• Verreaux's sifaka (*P. verreauxi*) | **Ravoahangy et al. 2008**<br><br>Cuozzo et al. 2008<br>Oda 1998<br>Razafimanantsoa 1999<br>Sussman 1977<br>Tattersall and Sussman 1998<br>Vasey 2000<br>Yamashita 2002<br>Yamashita 2008 | Both species consume tamarind fruit. *L. catta* tend to eat hard ripe fruit, which dominates their diet, while *P. verreauxi* tend to eat soft unripe fruit, but their diet is dominated by leaves.<br>*L. catta* is primarily terrestrial while *P. verreauxi* is primarily arboreal.<br>- Cuozzo et al. 2008<br>*P. verreauxi* are shown to perceive and react to the anti-carnivore alarm calls of *L. catta*.<br>- Oda 1998<br>*P. verreauxi* tend to use vertical supports during locomotion while *E. fulvus* are more quadripedal, using horizontal supports.<br>- Razafimanantsoa 1999 |
| • Fat-tailed dwarf lemur (*C. medius*)<br>• Aye-aye (*D. madagascariensis*)<br>• Brown lemur (*E. fulvus*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Eastern lesser bamboo lemur (*H. griseus*) | **Ravoahangy et al. 2008**<br><br>Tattersall and Sussman 1998 | |

| Species | Citation(s) | Notes |
|---|---|---|
| • Brown mouse lemur (*M. rufus*) | | |
| • Gray mouse lemur (*M. murinus*)<br>• Brown mouse lemur (*M. rufus*) | **Schmid and Kappeler 1994** | |
| • Madame Berthe's mouse lemur (*M. berthae*)<br>• Gray mouse lemur (*M. murinus*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Red-tailed sportive lemur (*L. ruficaudatus*)<br>• Red lemur (*E. f. rufus*)<br>• Verreaux's sifaka (*P. verreauxi*) | **Schwab and Ganzhorn 2004**<br>**Hilgartner et al. 2008**<br><br>Razafimanantsoa 1999<br>Sussman 1974 | *M. berthae* and *M. murinus* may avoid direct competition by spatial separation.<br>*M. berthae* and *C. medius* differ in food composition and habitat requirements.<br>- Schwab and Ganzhorn 2004<br>*P. verreauxi* tend to use vertical supports during locomotion while *E. fulvus* are more quadripedal, using horizontal supports.<br>- Razafimanantsoa 1999 |
| • Red ruffed lemur (*V. v. rubra*)<br>• White-fronted brown lemur (*E. f. albifrons*)<br>• Eastern lesser bamboo lemur (*H. g. griseus*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Eastern woolly lemur (*A. l. laniger*)<br>• Greater dwarf lemur (*C. major*)<br>• Brown mouse lemur (*M. rufus*)<br>• Aye-aye (*D. madagascariensis*)<br>• Hairy-eared dwarf lemur (*A. trichotis*)<br>• Eastern fork-marked lemur (*P. furcifer*) | **Sterling and Rakotoarison 1998**<br><br>Simons and Lindsay 1987<br>Vasey 2000<br>Vasey 2004 | The ecological role of *V. rubra* is relatively consistent regardless of sympatric species. *E. f. albifrons* demonstrates more flexibility in its ecological role, depending on sympatric species.<br>- Vasey 2000<br>*V. rubra* stays in upper canopy and feeds in larger trees, while *E. f. albifrons* shows more varied use of forest sites and has a more varied diet.<br>- Vasey 2000, 2004 |
| • Red lemur (*E. f. rufus*)<br>• Ring-tailed lemur (*L. catta*)<br>• Red-tailed sportive lemur (*L. ruficaudatus*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Gray mouse lemur (*M. murinus*) | **Sussman 1974**<br><br>Tattersall and Sussman 1998 | |
| • Brown lemur (*E. f. fulvus*)<br>• Sanford's brown lemur (*E. f. sanfordi*) | **Sussman 1977** | |
| • Red lemur (*E. f. rufus*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Weasel sportive lemur (*L. mustelinus*)<br>• Greater dwarf lemur (*C. major*)<br>• Gray mouse lemur (*M. murinus*)<br>• Ring-tailed lemur (*L. catta*)<br>• Verreaux's sifaka (*P. verreauxi*) | **Sussman et al. 2003**<br><br>Cuozzo et al. 2008<br>Lehman 2007b<br>Oda 1998<br>Razafimanantsoa 1999<br>Sussman 1977<br>Tattersall and Sussman 1998<br>Vasey 2000 | Both species consume tamarind fruit. *L. catta* tend to eat hard ripe fruit, which dominates their diet, while *P. verreauxi* tend to eat soft unripe fruit, but their diet is dominated by leaves.<br>*L. catta* is primarily terrestrial while *P. verreauxi* is primarily arboreal.<br>- Cuozzo et al. 2008<br>*P. verreauxi* are shown to perceive and react to the anti-carnivore alarm calls of |

| Species | Citation(s) | Notes |
|---|---|---|
| | Yamashita 2002<br>Yamashita 2008 | *L. catta*.<br>- Oda 1998<br>*P. verreauxi* tend to use vertical supports during locomotion while *E. fulvus* are more quadripedal, using horizontal supports.<br>- Razafimanantsoa 1999 |
| • Weasel sportive lemur (*L. mustelinus*)<br>• Gray mouse lemur (*M. murinus*)<br>• Reddish-gray mouse lemur (*M. griseorufus*)<br>• Ring-tailed lemur (*L. catta*)<br>• Verreaux's sifaka (*P. verreauxi*) | **Sussman et al. 2003**<br><br>Cuozzo et al. 2008<br>Oda 1998<br>Schwab and Ganzhorn 2004<br>Yamashita 2002<br>Yamashita 2008<br>Yoder et al. 2002 | Both species consume tamarind fruit. *L. catta* tend to eat hard ripe fruit, which dominates their diet, while *P. verreauxi* tend to eat soft unripe fruit, but their diet is dominated by leaves.<br>*L. catta* is primarily terrestrial while *P. verreauxi* is primarily arboreal.<br>- Cuozzo et al. 2008<br>*P. verreauxi* are shown to perceive and react to the anti-carnivore alarm calls of *L. catta*.<br>- Oda 1998 |
| • White-footed sportive lemur (*L. m. leucopus*)<br>• Gray mouse lemur (*M. murinus*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Ring-tailed lemur (*L. catta*)<br>• Verreaux's sifaka (*P. verreauxi*) | **Sussman and Richard 1986**<br><br>Cuozzo et al. 2008<br>Oda 1998<br>Richard et al. 1993<br>Yamashita 2002<br>Yamashita 2008<br>Sussman 1974 | Both species consume tamarind fruit. *L. catta* tend to eat hard ripe fruit, which dominates their diet, while *P. verreauxi* tend to eat soft unripe fruit, but their diet is dominated by leaves.<br>*L. catta* is primarily terrestrial while *P. verreauxi* is primarily arboreal.<br>- Cuozzo et al. 2008<br>*P. verreauxi* are shown to perceive and react to the anti-carnivore alarm calls of *L. catta*.<br>- Oda 1998 |
| • Brown mouse lemur (*M. rufus*)<br>• Greater dwarf lemur (*C. major*)<br>• Sportive lemur (*Lepilemur sp.*)<br>• Eastern woolly lemur (*A. l. laniger*)<br>• Aye-aye (*D. madagascariensis*)<br>• Red lemur (*E. f. rufus*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Milne-Edwards' sifaka (*P. d. edwardsi*)<br>• Greater bamboo lemur (*P. simus*)<br>• Golden bamboo lemur (*H. aureus*)<br>• Eastern lesser bamboo lemur (*H. g. griseus*) | **Tan 1999**<br><br>Arrigo-Nelson and Wright 2004<br>Ballhorn et al. 2009<br>Lehman 2006<br>Lehman et al. 2006<br>Meier and Rumpler 1987<br>Mittermeier et al. 2008<br>Overdorff 1992<br>Overdorff 1993<br>Overdorff 1996<br>Overdorff and Strait 1998 | Hapalemur species' diets differ in the proportions and parts of bamboo eaten.<br>- Tan 1999<br>Diet for all three consists mainly of giant bamboo (*C. madagascariensis*). *H. aureus* and *H. griseus* eat primarily new growth while *P. simus* will consume leaves of different ages, shoots, and mature culms.<br>- Ballhorn et al. 2009<br>*H. g. griseus* avoids cut transects in the forest more than other sympatric species.<br>- Lehman 2006<br>*E. rubriventer* licked nectar from flowers while *E. f. rufus* ate all flower parts. |

| Species | Citation(s) | Notes |
|---|---|---|
| | Tattersall and Sussman 1998<br>Wright 1989 | - Overdorff 1992<br>*E. f. rufus* initiated more feeding bouts and bouts of shorter duration than *E. rubriventer*. *E. f. rufus* exploited more unripe fruit and mature leaves than *E. rubriventer*.<br>- Overdorff 1993<br>*E. f. rufus* lived in larger groups and travelled more than *E. rubriventer*.<br>- Overdorff 1996<br>Species exhibit different food preferences and abilities to digest certain bamboo parts.<br>- Wright 1989 |
| • Collared brown lemur (*E. f. collaris*)<br>• Red lemur (*E. f. rufus*)<br>• Ring-tailed lemur (*L. catta*)<br>• Hybrid brown lemur (*E.* hybrid) | **Tanaka 2007**<br><br>Jolly et al. 2002<br>Pitts 1996<br>Tattersall and Sussman 1998 | *Eulemur* are hybrids of *E. f. rufus* and *E. collaris*, which were introduced to the region artificially.<br>- Tanaka 2007<br>*Eulemur* were introduced to Berenty, Madagascar as escaped pets. *Eulemur* compete directly with *L. catta.* Lemur populations in study area are partially sustained by food provided by tourism.<br>- Jolly et al. 2002<br>An instance of female *E. f. rufus* harassing female *L. catta* and killing and consuming a *L. catta* infant was observed.<br>- Pitts 1996 |
| • Red-bellied lemur (*E. rubriventer*)<br>• White-collared brown lemur (*E. f. albocollaris*) | **Tattersall and Sussman 1998** | |
| • Sclater's black lemur (*E. m. flavifrons*)<br>• Brown lemur (*E. f. fulvus*) | **Tattersall and Sussman 1998** | |
| • Aye-aye (*D. madagascariensis*)<br>• Milne-Edwards' sportive lemur (*L. edwardsi*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Crowned sifaka (*P. v. coronatus*)<br>• Greater dwarf lemur (*C. major*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Gray mouse lemur (*M. murinus*)<br>• Red lemur (*E. f. rufus*) | **Thalmann and Rakotoarison 1994**<br><br>Hawkins et al. 1998<br>Lahann 2007b<br>Lahann 2008 | *C. medius*, *M. murinus*, and *C. major* fed on same plant species, but at different heights.<br>- Lahann 2007b |

| Species | Citation(s) | Notes |
|---|---|---|
| • Western lesser bamboo lemur (*H. g. occidentalis*) | | |
| • Aye-aye (*D. madagascariensis*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Western lesser bamboo lemur (*H. g. occidentalis*)<br>• Red lemur (*E. f. rufus*)<br>• Decken's sifaka (*P. v. deckenii*)<br>• Gray mouse lemur (*M. murinus*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Greater dwarf lemur (*C. major*)<br>• Western woolly lemur (*A. occidentalis*)<br>• Milne-Edwards' sportive lemur (*L. edwardsi*) | **Thalmann and Rakotoarison 1994**<br><br>Hawkins et al. 1998<br>Lahann 2007b<br>Lahann 2008<br>Rakotoarison et al. 1993<br>Sterling 1998<br>Sussman 1977<br>Thalmann 2001<br>Warren 1997 | *C. medius*, *M. murinus*, and *C. major* fed on same plant species, but at different heights.<br>- Lahann 2007b<br>*A. occidentalis* and *L. edwardsi* avoid niche overlap by using resources of different sizes and having different seasonal eating patterns.<br>- Thalmann 2001<br>*A. occidentalis* spent more time in the canopy. *L. edwardsi* preferred lower forest levels.<br>- Warren 1997 |
| • Milne-Edwards' sportive lemur (*L. edwardsi*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Crowned sifaka (*P. v. coronatus*)<br>• Fat-tailed dwarf lemur (*C. medius*)<br>• Gray mouse lemur (*M. murinus*)<br>• Decken's sifaka (*P. v. deckenii*)<br>• Red lemur (*E. f. rufus*)<br>• Mongoose lemur (*E. mongoz*) | **Thalmann and Rakotoarison 1994**<br><br>Hawkins et al. 1998<br>Sussman 1977<br>Sussman 1998<br>Tattersall and Sussman 1998<br>Zaramody and Pastorini 2001 | *E. f. rufus* and *E. mongoz* demonstrate contrasting activity patterns, which vary by season.<br>- Tattersall and Sussman 1998<br>Evidence exists for hybridization between *E. f. rufus* and *E. mongoz*.<br>- Zaramody and Pastorini 2001 |
| • Fat-tailed dwarf lemur (*C. medius*)<br>• Milne-Edwards' sportive lemur (*L. edwardsi*)<br>• Coquerel's giant mouse lemur (*M. coquereli*)<br>• Eastern fork-marked lemur (*P. furcifer*)<br>• Crowned sifaka (*P. v. coronatus*)<br>• Western lesser bamboo lemur (*H. g. occidentalis*)<br>• Gray mouse lemur (*M. murinus*)<br>• Red lemur (*E. f. rufus*)<br>• Mongoose lemur (*E. mongoz*) | **Thalmann and Rakotoarison 1994**<br><br>Hawkins et al. 1998<br>Sussman 1977<br>Tattersall and Sussman 1998<br>Zaramody and Pastorini 2001 | *E. f. rufus* and *E. mongoz* demonstrate contrasting activity patterns, which vary by season.<br>- Tattersall and Sussman 1998<br>Evidence exists for hybridization between *E. f. rufus* and *E. mongoz*.<br>- Zaramody and Pastorini 2001 |
| • Greater dwarf lemur (*C. major*)<br>• Western lesser bamboo lemur (*H. g. occidentalis*)<br>• Crowned sifaka (*P. v. coronatus*)<br>• Decken's sifaka (*P. v. deckenii*) | **Thalmann and Rakotoarison 1994** | |
| • Black-and-white ruffed lemur (*V. v.* | **Vasey 2000** | *E. rubriventer* licked nectar from flowers |

| Species | Citation(s) | Notes |
|---|---|---|
| *variegata*)<br>• Red lemur (*E. f. rufus*)<br>• Red-bellied lemur (*E. rubriventer*)<br>• Diademed sifaka (*P. diadema*)<br>• Eastern lesser bamboo lemur (*H. griseus*) | Overdorff 1992<br>Overdorff 1993<br>Overdorff 1996<br>Tattersall and Sussman 1998 | while *E. f. rufus* ate all flower parts.<br>- Overdorff 1992<br>*E. f. rufus* initiated more feeding bouts and bouts of shorter duration than *E. rubriventer*. *E. f. rufus* exploited more unripe fruit and mature leaves than *E. rubriventer*.<br>- Overdorff 1993<br>*E. f. rufus* lived in larger groups and travelled more than *E. rubriventer*.<br>- Overdorff 1996 |
| • Diademed sifaka (*P. diadema*)<br>• Eastern lesser bamboo lemur (*H. griseus*)<br>• Crowned lemur (*E. coronatus*)<br>• Sanford's brown lemur (*E. f. sanfordi*) | **Vasey 2000**<br><br>Freed 1995<br>Mittermeier et al. 2008<br>Tattersall and Sussman 1998 | *E. coronatus* were seen foraging more than *E. f. sanfordi*.<br>- Freed 1995<br>*E. coronatus* fed and stayed mostly in the understory, while *E. f. sanfordi* preferred the middle canopy.<br>- Tattersall and Sussman 1998 |
| • Allen's galago (*G. alleni*)<br>• Demidoff's galago (*G. demidoff*)<br>• Thomas' galago (*G. thomasi*)<br>• Southern needle-clawed galago (*E. elegantulus*)<br>• Potto (*P. potto*)<br>• Angwantibo (*Arctocebus sp.*) | **Wickings et al. 1998** | |
| • Red lemur (*E. f. rufus*)<br>• White-collared brown lemur (*E. albocollaris*) | **Wyner et al. 2002** | Lemurs cross into one another's territory and hybridize. |

# DISCUSSION:
# POINTS TO CONSIDER WHEN CREATING A MIXED-SPECIES EXHIBIT

## BEST SPECIES FOR 'MIXING'

The results of this survey suggest that, in general, there is no one 'best' species for creating a successful mixed-species exhibit with prosimians. Some species are more prevalent in mixed-species groups, including ring-tailed lemurs and black-and-white ruffed lemurs. This may be more a function of their population numbers, rather than something about the species' disposition that makes them better exhibit mates. Individual personalities of animals seem to play a big role in the success of the group, and the manual finds that trying different combinations of individuals and species can work in most cases.

## EXHIBIT CONSIDERATIONS

Care should be taken to provide numerous areas for varying behaviors in mixed-species and large groups. In a mixed-species exhibit of *E. collaris* and *L. catta*, the two species occupied and made use of separate cave, feeding, and sleeping areas (Villers & Lent 1993). In general, inter-individual distance is important to consider when managing mixed-species exhibits. Each species will need to find areas that they are comfortable inhabiting. The decision to exhibit mixed-species will influence the size of exhibit needed. Besides size of exhibit, creating areas of the exhibit for each species to occupy and feel comfortable in is important. As mentioned above, additional perching and sleeping areas as well as visual barriers in the exhibit are important. As with the formation of any large social group, care should be taken to provide all species with sufficient space and refuge within the exhibit. Inter-specific inter-animal distances will vary widely and will be influenced by both the species and the individuals. Ideally, species with different spatial preferences can be chosen so as to partition the space in the exhibit and prevent aggression related to desired sleeping or feeding sites (i.e., Villers & Lent 1993). When planning a mixed-species exhibit, limiting exposure to species that have the potential to transmit diseases is important.

## INTRODUCTIONS BETWEEN SPECIES

Introductions between mixed species can be very difficult. However, the level of success of all introductions can depend on the individual animals and space. Most introductions between new individuals begin using a visual introduction (e.g., howdy cage, separate stalls with no tactile contact). Release into the group should be based on behavior of the existing group to the new individual, including minimal amounts of interest and no aggression. Introductions between males and females are typically less eventful than introductions between males or mixed-species groupings. It has been noted that introductions between two females or adding a new female to an existing pair is more difficult. Time of year is also important to consider when planning introductions. Introducing two males during the breeding season could be potentially difficult; however male/female introductions during this time should be relatively successful. Also, some species of *Eulemur* may be easier to introduce into a mixed-species setting. There have been more successful introductions to other species with *E. coronatus* and *E. collaris* than with *E. m. macaco* and *E. m. flavifrons.*

For example, introducing a group of black lemurs to a group of ring-tailed lemurs was successful at one zoological institution after several attempts (Meyer 1982). Ring-tailed lemurs were kept on an island exhibit with two dens present. One pair of black lemurs was kept in a holding cage inside one of the dens on the island, giving both lemur species the opportunity to familiarize themselves with one another. When the black lemurs were released, there was immediate aggression toward them by an adult male ring-tailed lemur. The two black lemurs made no attempt at defense and, therefore, were placed back in the holding cage. After two weeks, the male ring-tailed lemur was placed in a holding cage and the black lemur pair was released without further problems from the other ring-tailed lemurs. Later, additional black lemurs were released on the island with little agonistic incidence. After a short time they were residing peacefully together. Ten weeks after the ring-tailed male had been transferred to the holding cage, he was released back to the island without further aggression.

Another example is from a research institute which houses lemurs in two mixed-species enclosures. Introductions were made by housing new animals in smaller enclosures within the area before release into the group (Alford-Madden 1986). The Lemur Conservation Foundation and the Indianapolis Zoo reported experiences of introductions between *Eulemur collaris* and *Lemur catta*, *Eulemur coronatus* and *Lemur catta*, and *Eulemur m. flavifrons* and *Varecia rubra* (Mogilewsky and Lent, pers. comm. 2008). Introductions begin with animals placed in adjoining cages, side by side generally for a few days. This time period proved to be long enough for the animals to have exposure to each other, but short enough so that agonistic interactions did not become repetitive or rehearsed. In situations where these behaviors were seen, a pen was placed between cages to reduce aggression. This process was started with the dominant animals from the established group. Animals were then added or subtracted based on aggression levels. Aggressive animals were removed and less aggressive animals added. This process was continued until the entire troop was united. Once the decision was made to leave the group together overnight, every attempt was made to not separate individuals from that point forward. The introduction period may take as little as a day or as long as months.

## REPRODUCTION IN MIXED-SPECIES GROUPS

It should be noted that while successful reproduction and rearing of offspring has occurred in mixed-species groupings with prosimians, it is often unsuccessful. Where reproduction has occurred in mixed-species groups, the presence of offspring may change the dynamics of the group, resulting in sudden increased aggression and death of the infants. Black lemurs, mongoose lemurs, brown lemurs, and red-bellied lemurs have all been suspected of infanticide toward other lemurs (Coffman 1996). Duke Lemur Center has also witnessed a mongoose lemur infant killed by a group of black lemurs (Campbell, pers. comm. 2008). Adult female ruffed lemurs do not easily tolerate other females during estrous periods or in the presence of young infants (Tattersall 1982). In general, rearing of offspring in single species groups is encouraged whenever possible or at the minimum, institutions should be prepared to separate reproductive individuals in case of concern (AZA Prosimian TAG, in review). There are several cautions that should be taken when housing mixed species groups with *Eulemur*. If the grouping contains multiple species of *Eulemur*, the females must be placed on contraception to prevent breeding. The different species and sub-species can inter-breed resulting in hybrids that cannot be part of any of the managed breeding programs.

## RE-INTEGRATION OF INDIVIDUALS INTO A GROUP AFTER SEPARATION

There are many situations in which one or a few individuals need to be separated from the group, including medical treatment, breeding season, or after a change in dominance or social structure. Many managers have found that slow reintroduction to the group with monitoring is the best way to ensure an individual is successfully reintegrated. Sometimes it can takes weeks or months to re-create a social structure in an exhibit that has had some turnover. Time, patience, persistence in reworking group structure, and creativity will often lead to successful reintroduction of individuals into a group. If all else fails, many institutions find that rotating social groups or pairs and finding multiple combinations is the best method of managing difficult individuals.

## SOCIAL INTERACTIONS BETWEEN SPECIES

Some *Eulemur* pairs can be quite assertive (e.g. *E. m. flavifrons*) and displace other larger species such as ruffed lemurs while some are very timid and will be easily displaced and/or injured by larger species (e.g. *E. mongoz*). While it is nice to see affiliative behaviors or positive interactions between the species in the mixed exhibits, this quality is not necessary to deem a mixed-species exhibit successful unless two individuals are meant to be social companions for one another. Many managers will even tolerate low levels of aggressive interactions provided no regular contact or injury occurs. Having multiple species coexist in one exhibit peacefully is success for many institutions.

# ACKNOWLEDGEMENTS

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# REFERENCES

The first section of this reference list includes information that has been published regarding mixed-species groups of prosimians in captivity. The second section of the list refers to studies focused on sympatric species of prosimians in the wild. The third includes additional references that were cited in this manual.

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# APPENDIX I.
# PROSIMIAN MIXED-SPECIES EXHIBIT OBSERVATION PROTOCOL

## Objectives

1) To determine rates of social interaction both within and between species in a large mixed species exhibit of prosimians
2) To determine exhibit usage patterns in a mixed species exhibit

## Protocol

Behavior and habitat usage data will be collected in 30 minute observation periods, two times a day, a minimum of 3 days a week.

## Behavior Data

All-occurrences of social behavior will be recorded. See the ethogram below for a complete list of the behaviors. For each social behavior the individual that initiated the behavior and the individual that received the behavior will be recorded. In the event that individual animals cannot be identified, the species that initiated the behavior and the species that received the behavior should be recorded. All behavioral data should be recorded using the datasheet provided.

## Habitat Usage Data

In order to collect habitat usage data, a map of the exhibit will need to be created. This can be a hand drawn map that includes only the most obvious features. The map should be divided into approximately equal areas. Any number of areas between three and ten can be used. The number of areas should be based on landmarks and dividing areas that will give information about types of areas in the exhibit that each species uses. The landmarks used for dividing the areas should be included on the map. The map with the divided areas should be used for training all observers.

Habitat usage data will be recorded at five minute intervals throughout the 30 minute observation period. On the interval, the area that each individual is occupying should be recorded. As with the behavior data, if individual identities cannot be determined, species should be recorded. In addition to recording the area occupied, the canopy level should also be recorded. Categories for recording canopy level are:

*Ground level*: individual is on the ground, rock, stumps, or the trunk of a tree
*Lower canopy*: individual is in the branches in the lower half of a tree, or below a designated height
*Upper canopy*: individual is in the branches in the upper half of a tree, or above a designated height

## Ethogram

To be used for behavior observations

***Aggressive***

Lunge/pounce – thrusting the upper or whole body toward or upon another individual

Chatter – rapid staccato sound associated with social yielding, submission, or subordinate status
Cuff – striking gesture with the hand, which may or may not include contact
Bite – oral seizure of the pelage or body of another individual
Chase – rapid pursuit of a retreating or fleeing individual
Displace/supplant – advancing toward a stationary individual whom withdraws from its position a distance greater than one body length. The approacher may or may not assume the original position of the displaced individual.
Stink fight – individuals rub their tails over their wrists and then hold their tails above their heads at another individual
Threat – any sort of aggressive posturing, including jump-fighting and standing tall, or vocalizing directed toward another individual

***Affiliative***

Approach – slow locomotion directed toward a stationary or moving individual with approacher coming to within at least one body length of the individual that is being approached
Greet – sniffing momentarily to the face, mouth, armpit, shoulder, or back areas; rubbing of the rhinaria (the area of naked skin around the nostrils)
Groom – licking of hair; forward scraping of hair using the toothcomb, beginning at the base of the hair follicle and pushing through to the end
Ano-genital sniff/lick – sniffing or licking the ano-genital region of another individual
Mount/copulate – male approach of an individual from behind with contact of the pelvic region against another's hind section. Often includes the wrapping of arms around the individual's abdomen and may include thrusting and actual copulation.
Social play – non-agonistic grappling/wrestling, which can include lunge, pounce, grab, mock bite, chase, and flee; must occur in the absence of vocalizations
Huddling – one or more individuals resting in contact with another animal for more than 5 seconds. The animal that joins the individual or the group is the initiator and all other animals that were already present/huddling are the recipients.

***Other***

Scent marking – rubbing the ano-genital region, the chest, or the wrists across a surface (there is no recipient for this behavior)

Ethogram definitions taken largely from:

Kuhar C, Schoffner T, Winkler D, Bettinger T. 2001. I may never leave home! Management of a large group of red ruffed lemurs at Cleveland Metroparks Zoo. Proceedings of the American Association of Zoos and Aquariums. St. Louis, MO.

# MIXED SPECIES LEMUR EXHIBIT BEHAVIOR DATASHEET

**Observer**:_____

**Date**:_____

**Time**: _____

**Temp**: _____

**Weather**: _____

**Exhibit / Holding**

Ar = Exhibit Area (numbered 1 through #)
Cn = Canopy Type (G = Ground, L = Lower, U = Upper)

| | **Species 1** | | | | **Species 2** | | | |
|---|---|---|---|---|---|---|---|---|
| Animal | Indiv. 1 | | Indiv. 2 | | Indiv. 3 | | Indiv. 4 | |
| | Ar | Cn | Ar | Cn | Ar | Cn | Ar | Cn |
| 5:00 | | | | | | | | |
| 10:00 | | | | | | | | |
| 15:00 | | | | | | | | |
| 20:00 | | | | | | | | |
| 25:00 | | | | | | | | |
| 30:00 | | | | | | | | |

| **Aggressive** | | | | | | | | | | | | | | | | **Affiliative** | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **lunge** | | **chatter** | | **cuff** | | **bite** | | **chase** | | **displace** | | **stink** | | **threat** | | **approach** | | **greet** | | **groom** | | **sniff** | | **mount** | | **play** | | **huddle** | | **mark** |
| in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | in | rc | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

# APPENDIX II.
# RESULTS FROM PROSIMIAN MIXED-SPECIES EXHIBIT STUDIES

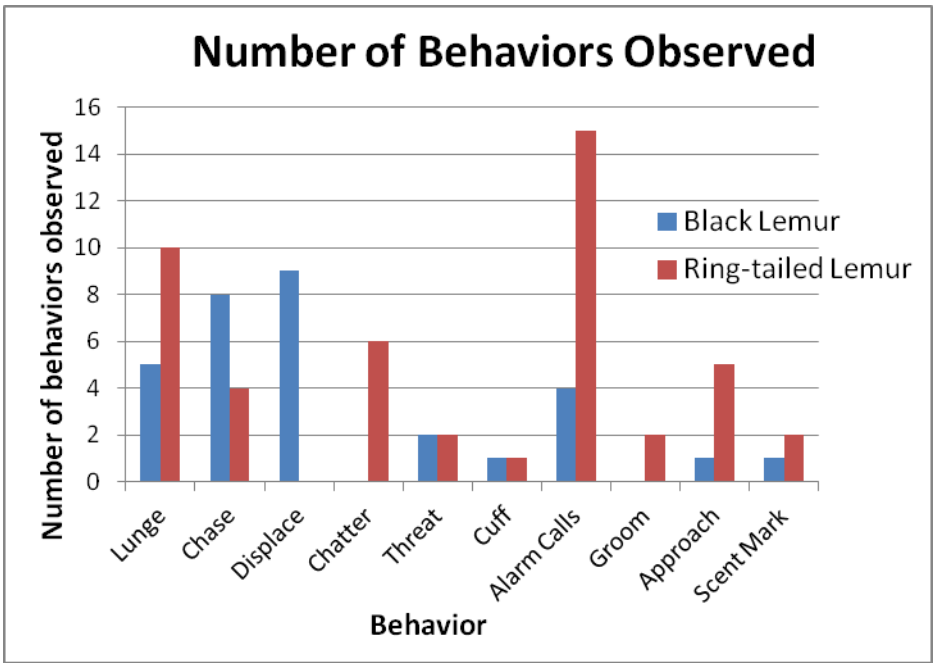
## Pt. Defiance Zoo

In May 2008, animal keepers at the Pt. Defiance Zoo and Aquarium in Tacoma, WA conducted a short-term study of a new mixed-species lemur exhibit using the described methods. Three black lemurs (*Eulemur m. macaco*) and seven ring-tailed lemurs (*L. catta*) were introduced in this new exhibit. Data were collected at various times throughout the day and night during the initial introduction. In addition to the behaviors listed on the ethogram, alarm calls were also recorded. Most observed behaviors took place during the first three days of data collection (98.7% of recorded behaviors). Aggressive behaviors, which accounted for 61.5% of all recorded behaviors, included lunge, chase, displace, chatter, threat, and cuff, listed here in decreasing order of frequency. Most aggressive behaviors were between the black lemurs and ring-tailed lemurs, with the exception of one instance of a black lemur threatening a conspecific. All displacements and most chases (66.7%) were initiated by black lemurs with a ring-tailed recipient, while most lunges (66.7%) were initiated by ring-tailed lemurs with a black lemur recipient. Both species were observed initiating threats and cuffs with similar frequencies (two instances of threat and one instance of cuff per species). With the exception of chattering, which was only initiated by ring-tailed lemurs at either other ring-tailed lemurs in the group or at black lemurs, a slight majority of the aggression was initiated by black lemurs and directed towards ring-tailed lemurs (59.9%), indicating dominance of the black lemurs. A majority of the aggression initiated by the ring-tailed lemurs was directed at one individual black lemur, a 19 year old male, "Houston." In addition, the ring-tailed lemurs were observed vocalizing (alarm calls and chattering) more often than the black lemurs. As stated above, all chattering was initiated by ring-tailed lemurs with an unknown recipient, and ring-tailed lemurs made 78.9% of all recorded alarm calls. No aggression or vocalizations were recorded after the first three days of data collection. Very few affiliative behaviors were recorded (10.3% of behaviors recorded). A black lemur was observed approaching a ring-tailed lemur once, and ring-tailed lemurs were observed approaching black lemurs more often (four instances). Grooming was observed only twice and was between individual ring-tailed lemurs.

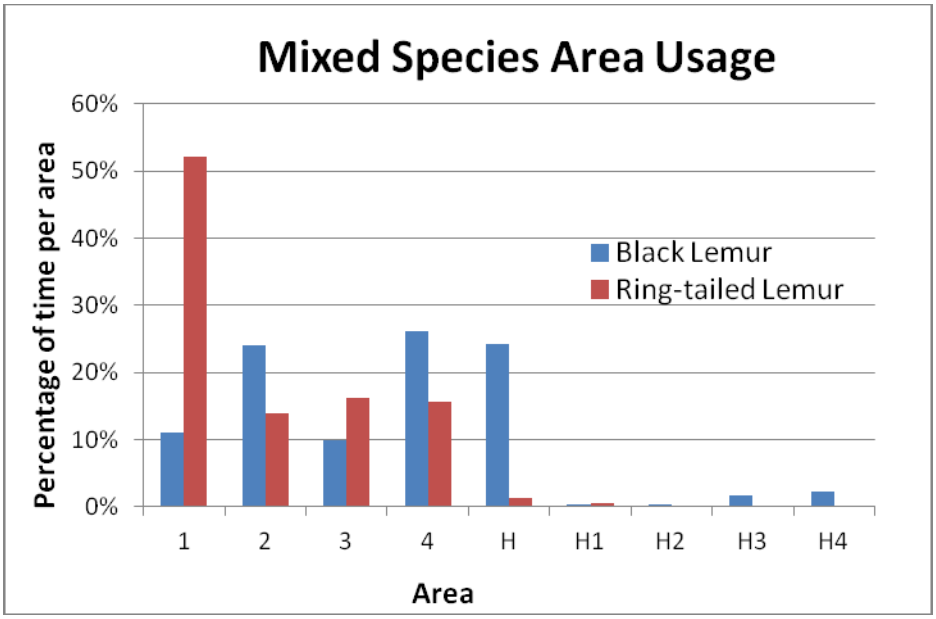
Habitat usage data of the new exhibit was collected in May and June of 2008 at various times throughout the day (at approximately the following times: 12am, 4am, 8am, 12pm, 4pm, 8pm). See map of exhibit and delineated areas. For most observations, conspecifics remained segregated by area, although there were some instances recorded in which black lemurs and ring-tailed lemurs occupied the same area. Black lemurs spent a majority of time in area 2 (24.8%), near the door to the holding area; area 4 (26.1%), which includes a cave; and in holding (28.9%) when access was given to both exhibit and holding. Ring-tailed lemurs spent a majority of time in area 1 (52.2%), which includes a playground structure. Interestingly, both lemur species spent a majority of time in the upper canopy level during the first three days of data collection (84.7% for black lemurs and 85.5% for ring-tailed lemurs). During subsequent observations, both species occupied the ground and lower canopy levels more frequently (96.1% for black lemurs and 94.6% for ring-tailed lemurs).

Overall, data show that both species acclimated to their new exhibit with few problems. Although aggression was frequent for the first three days of data collection, very little aggression was

observed after this point. Once acclimated, each species seemed to form their own territories in the exhibit, keeping themselves separated from each other and avoiding aggressive interactions.




Aggression accounted for 61.5% of all recorded behaviors.




Black lemurs spent a majoirty of time in areas 2 and 4 and in holding. Ring-tailed lemurs spent a majority of time in area 1. See area delineations on map below. A designation of "H" refers to an unknown area in holding.


Exhibit and holding were divided into four areas each.

## Disney's Animal Kingdom

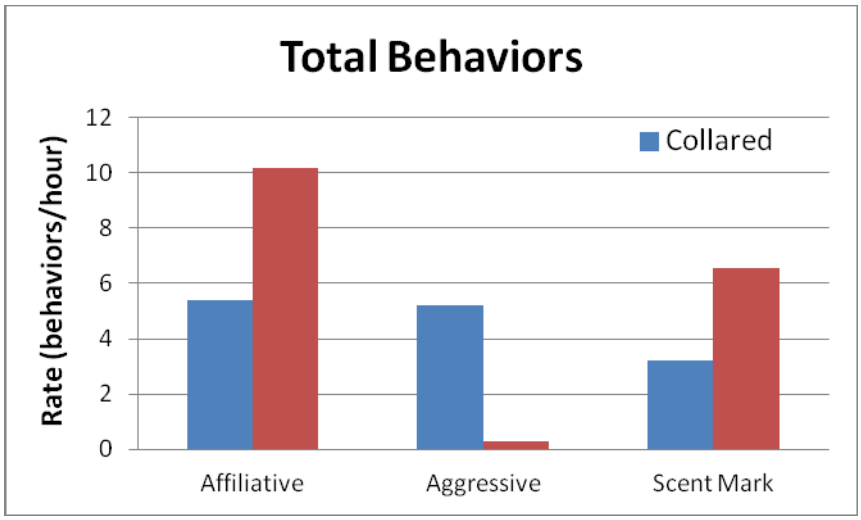
From February through May 2011, animal keepers and researchers at Disney's Animal Kingdom in Orlando, FL conducted a brief study to observe the introductions and interactions of a mixed-species lemur exhibit using the described methods. Two intact adult male ring-tailed lemurs (*Lemur catta*) were introduced to an exhibit that already housed two castrated adult male collared lemurs (*Eulemur collaris*). Data were collected in the morning and afternoon, between 8-10am and 4-5pm, respectively. Affiliative behaviors accounted for 50.5% of all recorded behaviors. Most affiliative behaviors (94.2%) were initiated and received by the same species (either collared lemur to collared lemur or ring-tailed lemur to ring-tailed lemur). Ring-tailed lemurs were more affiliative (10.2 behaviors/hr) than collared lemurs (5.4 behaviors/hr). Approach was the most commonly seen affiliative behavior in ring-tailed lemurs (30.2% of all recorded ring-tailed behaviors), followed by groom (11.8%), huddle (10.1%), and greet (6.4%). Approach was also the most commonly seen affiliative behavior in collared lemurs (19.9% of all recorded collared behaviors), followed by huddle (11.6%) and groom (6.8%). For the collared lemurs, "Thierry," the father of the other collared lemur, initiated more (61.4%) within-species affiliative behavior than "Pepe" (38.6%), while the ring-tailed lemurs initiated within-species affiliative behavior equally (51.0% by "Chip", 49.0% by "Dale"). Scent marking accounted for 31.7% of all recorded behaviors. Ring-tailed lemurs scent marked more often (6.6 behaviors/hr) than collared lemurs (3.2 behaviors/hr). Aggressive behaviors accounted for 17.8% of all recorded behaviors, 88.6% of which were initiated by the collared lemurs and directed towards the ring-tailed lemurs. Collared lemurs were aggressive at a rate of 5.2 behaviors/hr while ring-tailed lemurs were aggressive at a rate of 0.3 behaviors/hr. One individual collared lemur, "Thierry," initiated 72.2% of collared lemur-initiated aggression towards ring-tailed lemurs. "Thierry" also initiated all collared lemur to collared lemur aggression. Displace was the most commonly recorded aggressive behavior (35.5% of all recorded collared behaviors), followed by chase (1.6%). Displace and threat were the most commonly recorded ring-tailed lemur-initiated aggressive behaviors (0.7% each). Very little contact aggression was observed, accounting for less than one half percent of recorded behaviors.

There was one notable aggressive incident that resulted in separation of the two species for a period of five days. On April 30 (not during an observation session), the ring-tailed lemurs were observed fighting on exhibit and in holding. Species were then separated and reintroduced on May 6. Upon reintroduction, collared lemur-initiated aggression and ring-tailed lemur scent marking increased dramatically. Collared lemur-initiated aggression increased from a rate of 6.9 behaviors/hr the week before the incident to a rate of 23 behaviors/hr after reintroduction, while ring-tailed lemur scent marking increased from a rate of 4.9 scent marks/hr to a rate of 43 scent marks/hr. The following week, the rates of collared lemur aggression and ring-tailed lemur scent marking began to drop (7.3 behaviors/hr and 19.8 scent marks/hr, respectively).

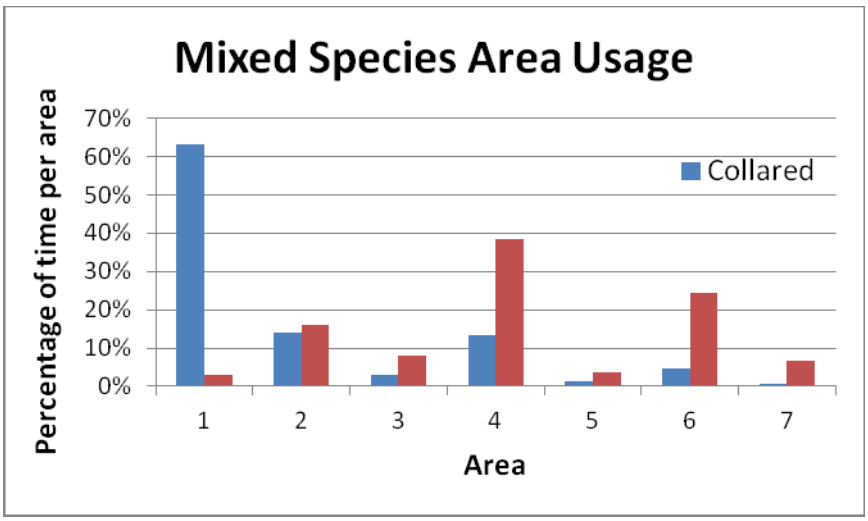
Habitat usage data also was collected during these observations. See map of the exhibit for delineated areas. For most observations, the two species remained segregated by area, although there were some instances recorded in which collared lemurs and ring-tailed lemurs occupied the same area. Collared lemurs spent a majority of time in area 1 (63.1%), which contains a yew tree. Ring-tailed lemurs spent a majority of time in area 4 (38.3%), which contains a log and the door to holding; and area 6 (24.4%), which contains a magnolia tree. As expected, collared lemurs, which tend to be mostly arboreal in the wild, spent a majority of their time in the upper canopy level (70.7%). Ring-tailed lemurs were expected to spend a majority of time on the ground level; however, they did not seem to have a strong preference (approximately ⅓ of time was spent on each level). Interestingly, they

preferred the upper canopy during morning observations and preferred the ground level during afternoon observations. This could be attributed to keeper presence in the exhibit during some afternoon observation sessions.

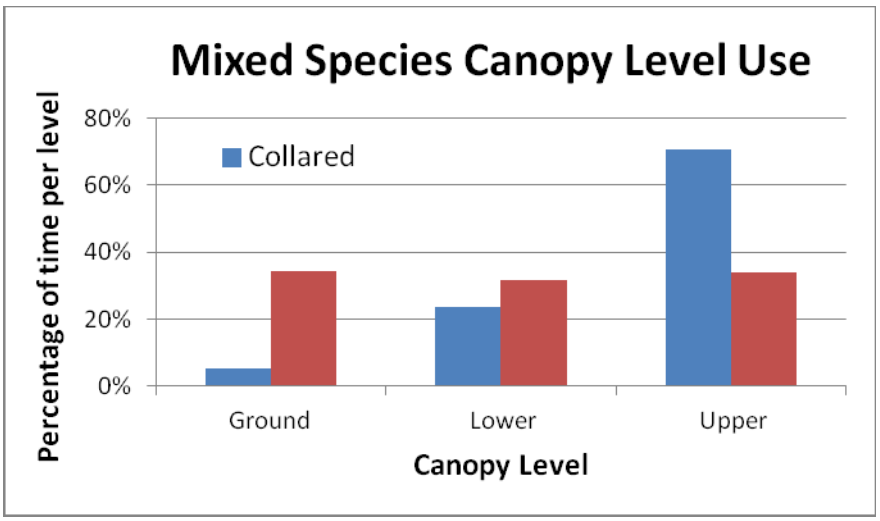
Although aggression between species has not decreased over time, rates of aggression are not alarming and contact aggression is rarely seen. Therefore, it seems as though the ring-tailed lemurs have acclimated well to their new exhibit, and the collared lemurs have acclimated well to their new exhibit mates. Using the data collected, researchers were able to recommend that keepers work with horticulture to maintain preferred exhibit areas, avoid species separation whenever possible, and monitor any future reintroductions.



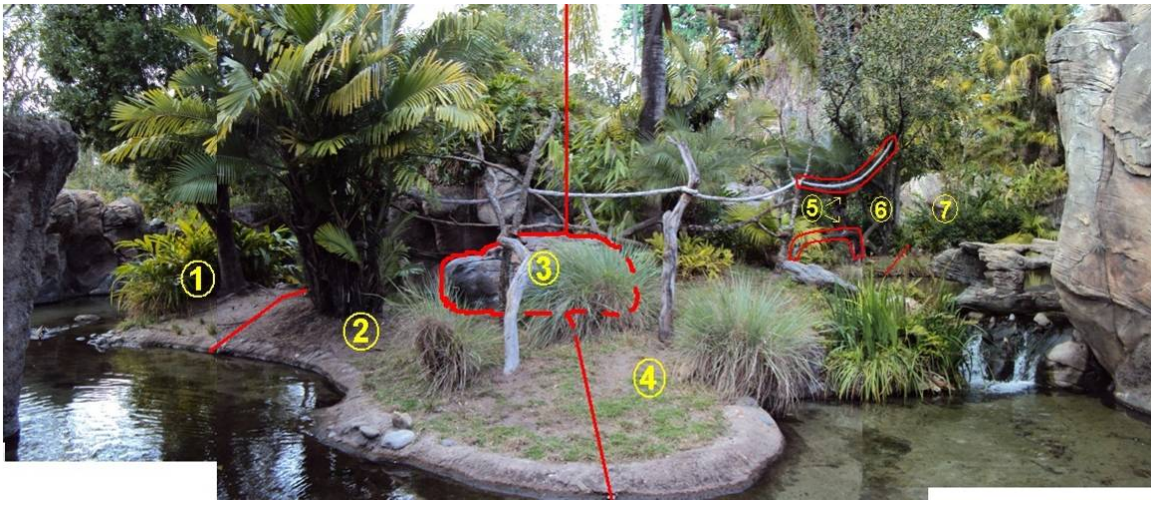

Ring-tailed lemurs were more affiliative than collared lemurs. Collared lemurs were more aggressive.

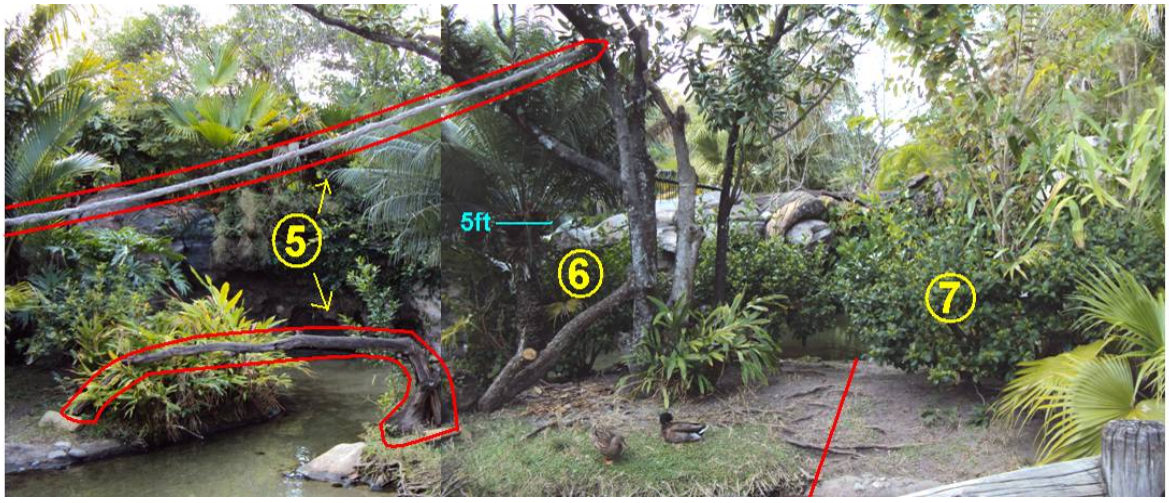



Collared lemurs preferred area 1 while ring-tailed lemurs preferred areas 4 and 6.




Collared lemurs preferred the upper canopy level while ring-tailed lemurs utilized all canopy levels.



The exhibit, which contains two islands, was divided into 7 areas. Two different views of the exhibit are provided here. The bottom picture provides a clearer view of the second island, seen in the background of the top picture.