



# BEHAVIOR- BASED HUSBANDRY FOR LEMURS

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Jacksonville Zoo and Gardens  
Photo by Lynde Nunn

AN ANIMAL'S BEHAVIOR IS A KEY INDICATOR OF WELFARE AND A CRITICAL TOOL TO INFORM HUSBANDRY DECISIONS. THE GOAL SHOULD BE PROVIDING OPTIMAL CARE, NOT JUST MEETING MINIMUM STANDARDS AND REQUIREMENTS.

Even if an animal has a well-designed exhibit, proper diet, and many opportunities for species-appropriate behavior, it could still not be in the positive range on the animal welfare continuum if, for example, it is constantly experiencing fear, anxiety, or distress. It is imperative to ensure we are meeting all aspects of care—physical, mental, and emotional—to the extent possible so that each animal can thrive.

## Animal Welfare Continuum



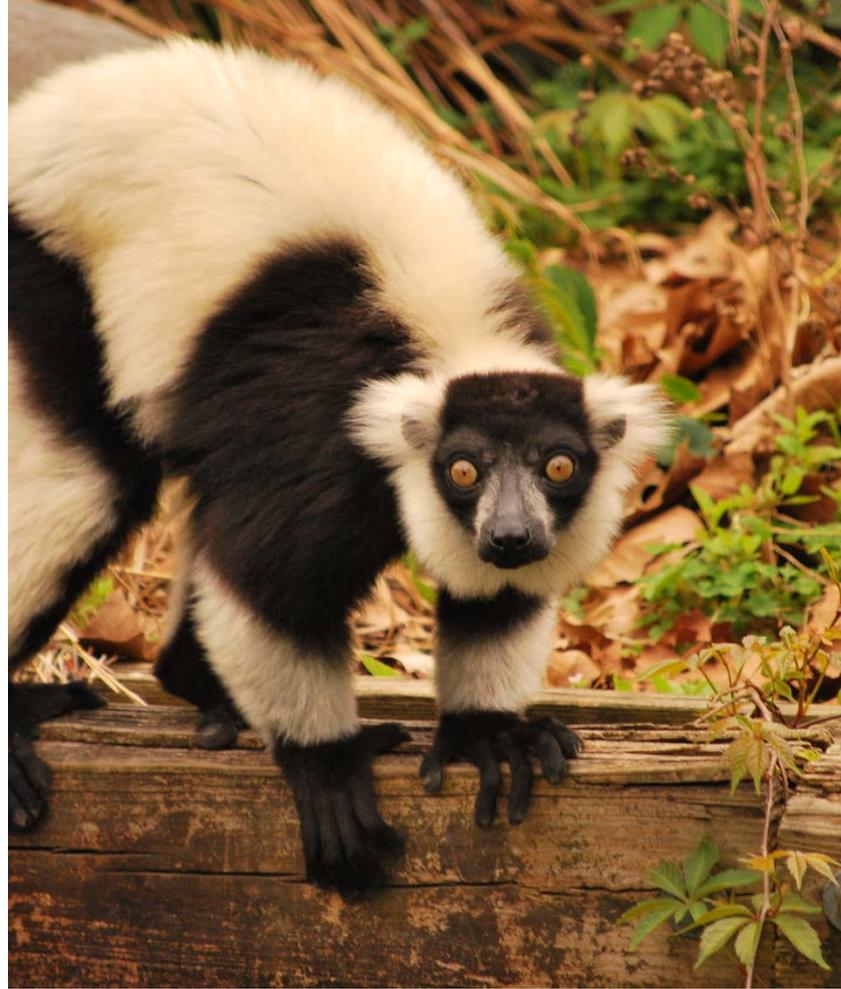
San Diego Zoo Global Academy: <http://www.sdzglobalacademy.org/courses.html>



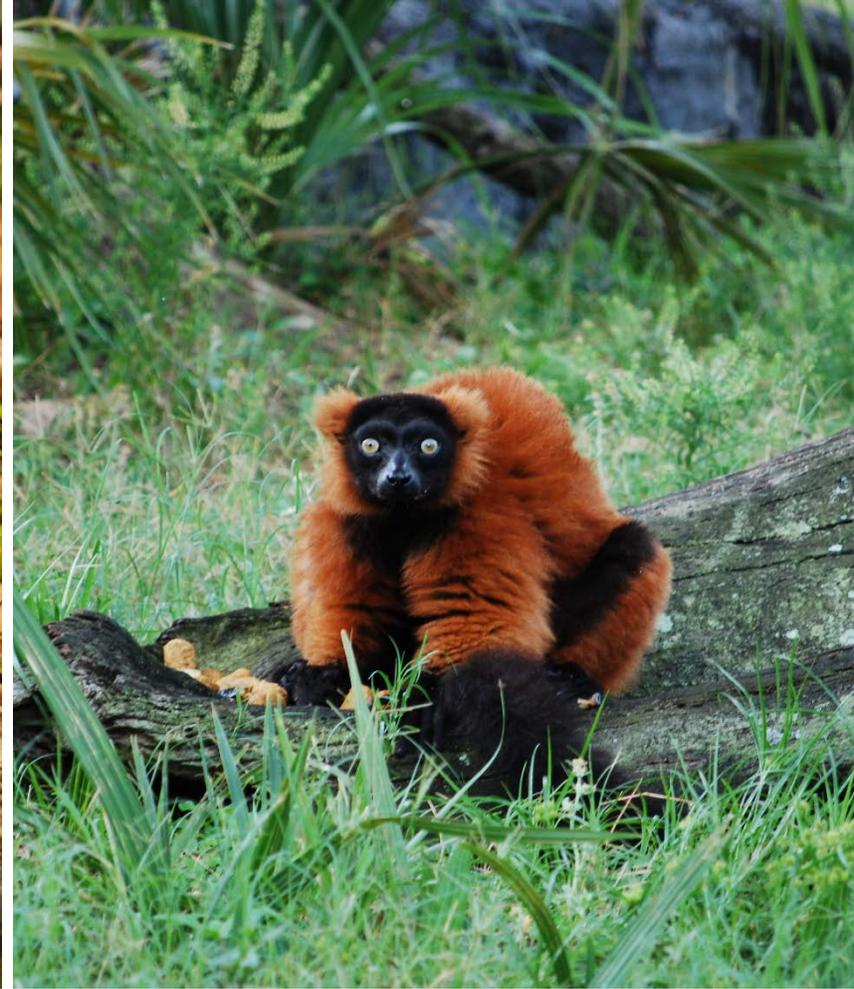
The best husbandry programs are proactive, based on species natural history and individual needs, and responsive to objective evidence of welfare.



RING-TAILED LEMUR



BLACK-AND-WHITE RUFFED LEMUR



RED RUFFED LEMUR

# FOCAL SPECIES

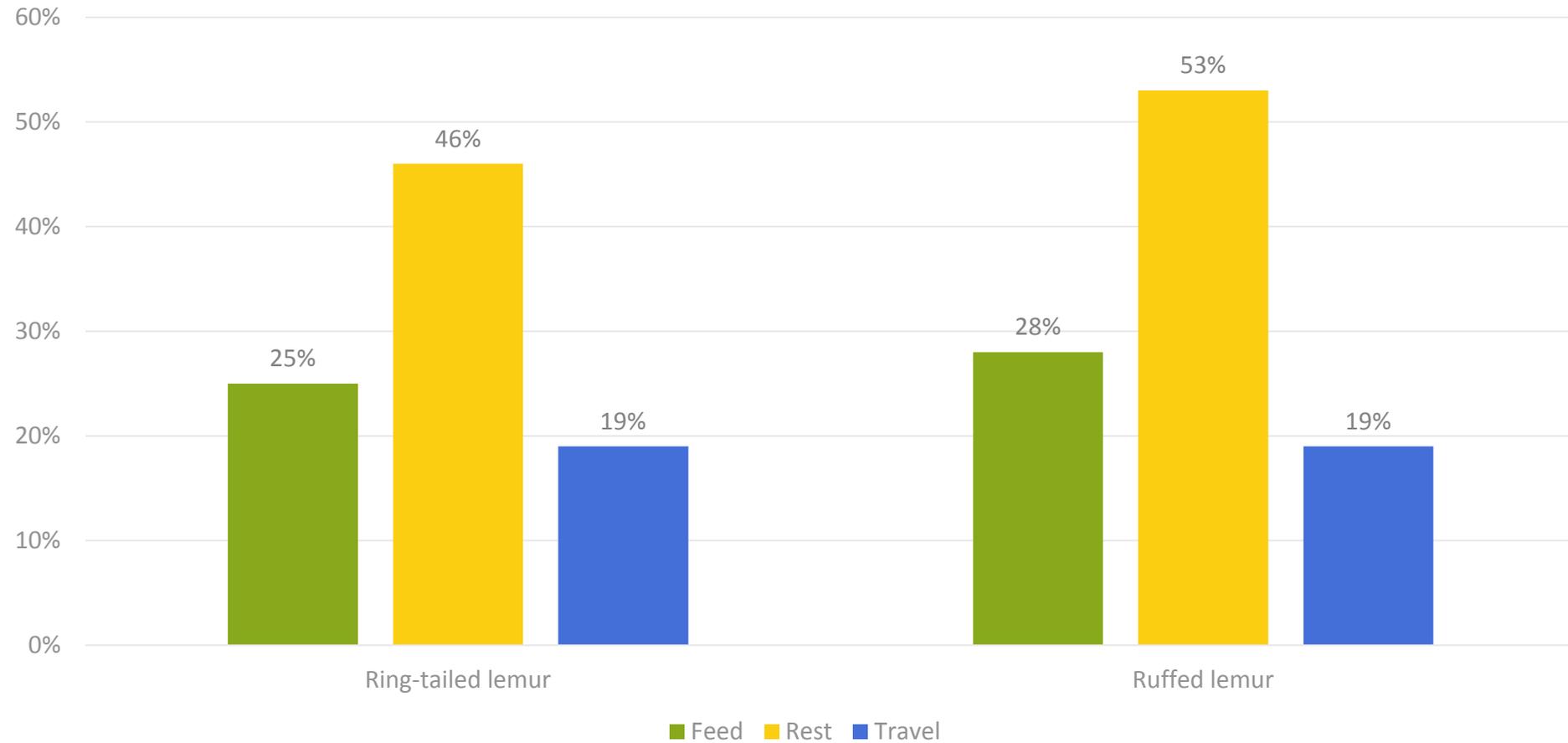
# GENERAL LEMUR NATURAL HISTORY & BEHAVIOR

What do we know about wild-living lemurs?

- High levels of choice and control in environment
- Live in complex and diverse social groups
- Rely heavily on olfactory communication and have diverse vocal communication
- Sun-bathe for thermo-regulation
- Diverse diets and feeding strategies



# ACTIVITY BUDGETS (WILD)



# SPIDER FRAMEWORK





# Feed/ Forage

Little Rock Zoo  
Photo by Karen Caster

## RING-TAILED LEMURS

25% of active time spent feed/  
foraging

**Opportunistic omnivores: ripe  
fruits, leaves, leaf stems, flowers,  
flower stems, exudates, spiders,  
spider webs, caterpillars, cicadas,  
insect cocoons, birds,  
chameleons, cicadas,  
grasshoppers, and even dirt from  
termite mounds**

**Tamarind pods are a major food  
source**

Feed in social groups

Most active in morning & late  
afternoon/ evening

**Most terrestrial of lemurs, but  
feed in all strata of the forest**

Do some “work” for all food  
(locate, harvest, process)

# Feed/ Forage

Goal: ~~Lemurs are eating.~~

The lemurs are approximating the time their wild counterparts spend on foraging and feeding behavior.

The lemurs are utilizing feeding methods/ positions that are the same as or similar to those of their wild counterparts.

The lemurs are, like their wild counterparts, doing some form of “work” for all or most of their food. (This is a strategy known as contra free-loading.)

## RING-TAILED LEMUR



Set goals

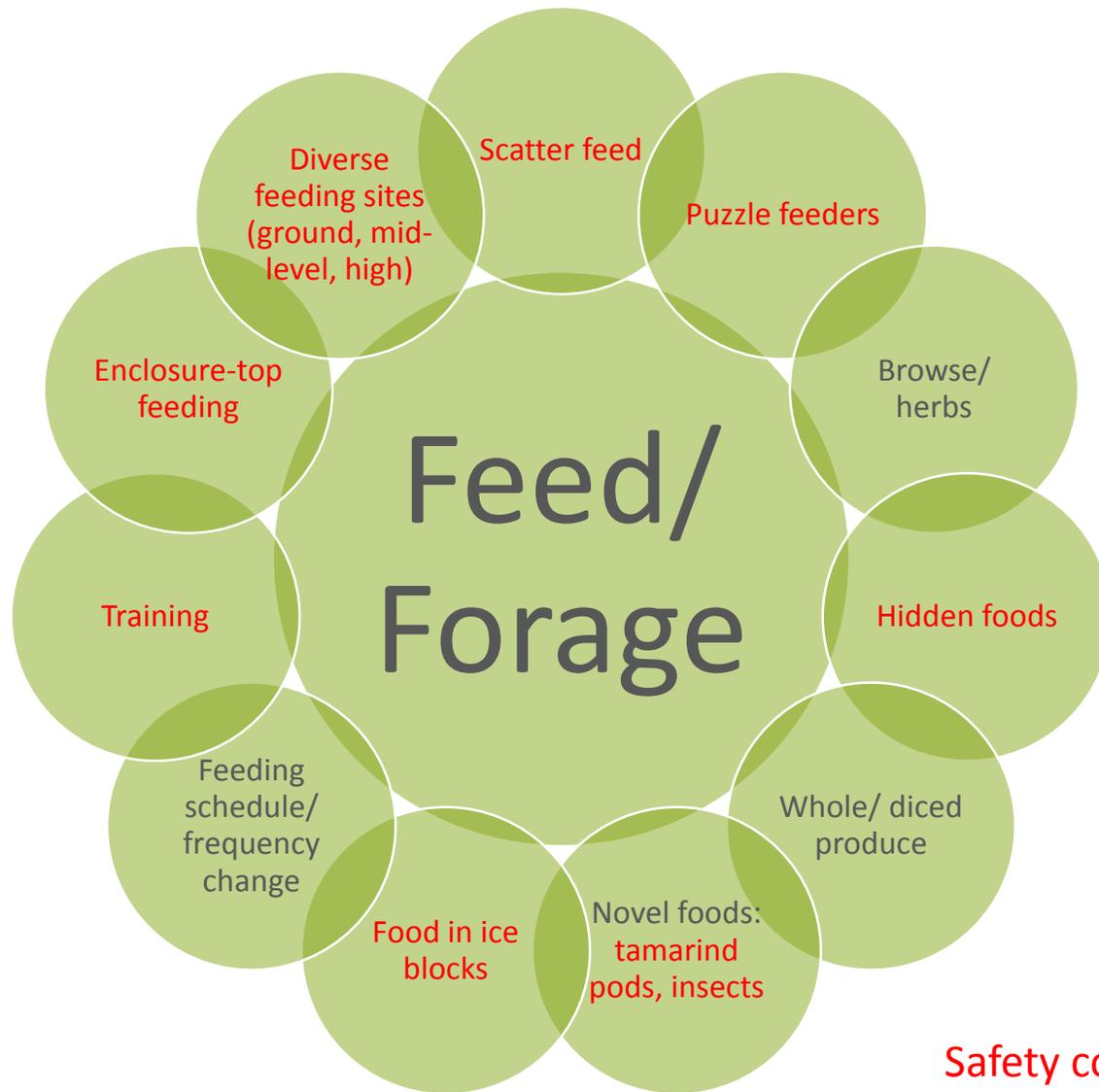
P

I

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R



Safety considerations!

# RING-TAILED LEMUR



S  
Plan  
I  
D  
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R

# Feed/ Forage

Safety  
Observation



Omaha's Henry Doorly Zoo  
Photo by Lauren Darnold

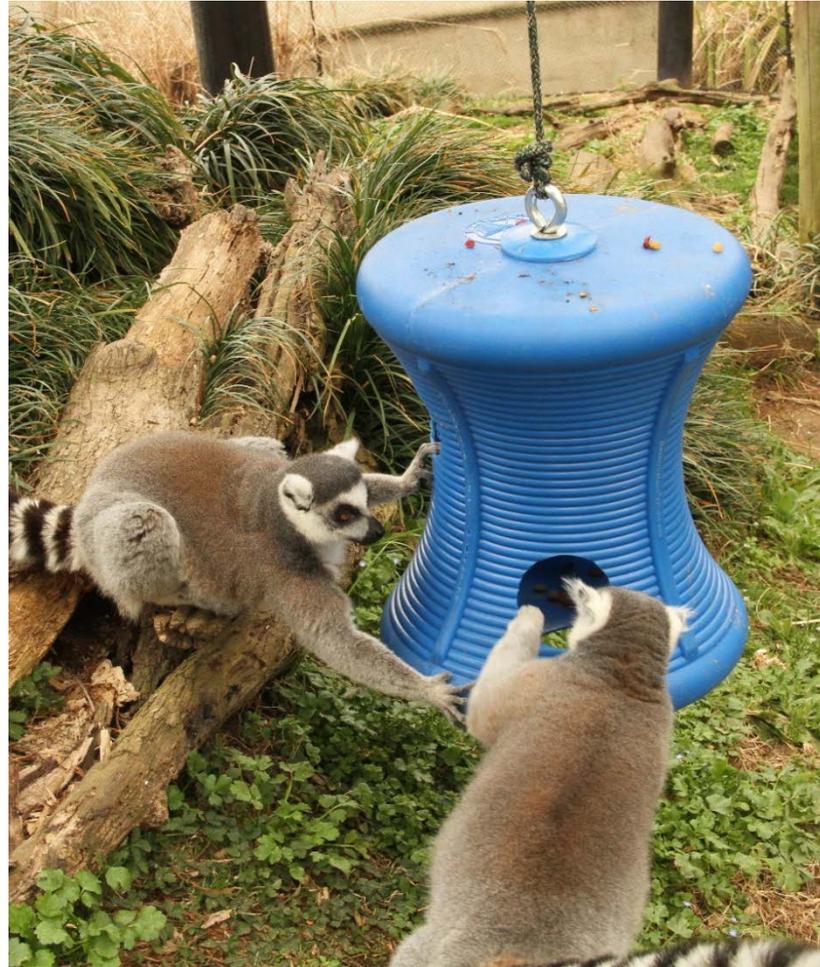
RING-TAILED  
LEMUR



S  
P  
Implement  
D  
E  
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# Feed/ Forage

- Ad-lib notes
- Enrichment log/  
database
- Cameras/ videos
- Formal data collection/  
research (see [www.zoomonitor.org](http://www.zoomonitor.org)  
for useful tools)



Little Rock Zoo  
Photo by Karen Caster

RING-TAILED  
LEMUR



S  
P  
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Document  
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# Feed/ Forage



Analyze records –

- Were the behavior goals met?
- How well?
- Which initiatives were most successful?
- Safety concerns?

RING-TAILED  
LEMUR



S  
P  
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D  
Evaluate  
R

# Feed/ Forage



San Francisco Zoo

- Modification of devices
- Change in frequency item is offered
- Elimination of ineffective enrichment

RING-TAILED  
LEMUR



S  
P  
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Re-adjust



# Feed/ Forage

Little Rock Zoo  
Photo by Karen Caster

## RUFFED LEMURS



~28% of active time spent feed/  
foraging

**Most frugivorous lemurs**

Feed in social groups

Most active in morning and late  
afternoon/ evening

**Rarely go to ground, feed mostly in  
upper strata of forest (30-80')**

**Suspensory feeding postures**

Do some “work” for all food  
(locate, harvest, process)



Little Rock Zoo  
Photo by Karen Caster



Tulsa Zoo  
Photo by Rick Kotarsky



Little Rock Zoo  
Photo by Karen Caster

# SUSPENSORY POSTURE

RUFFED LEMUR

# Feed/ Forage

Goal: ~~Lemurs are eating.~~

The lemurs are approximating the time their wild counterparts spend on foraging and feeding behavior.

The lemurs are utilizing feeding methods/ positions that are the same as or similar to those of their wild counterparts (i.e. suspensory postures).

The lemurs are, like their wild counterparts, doing some form of “work” for all or most of their food. (This is a strategy known as contra free-loading.)

## RUFFED LEMURS



Set goals

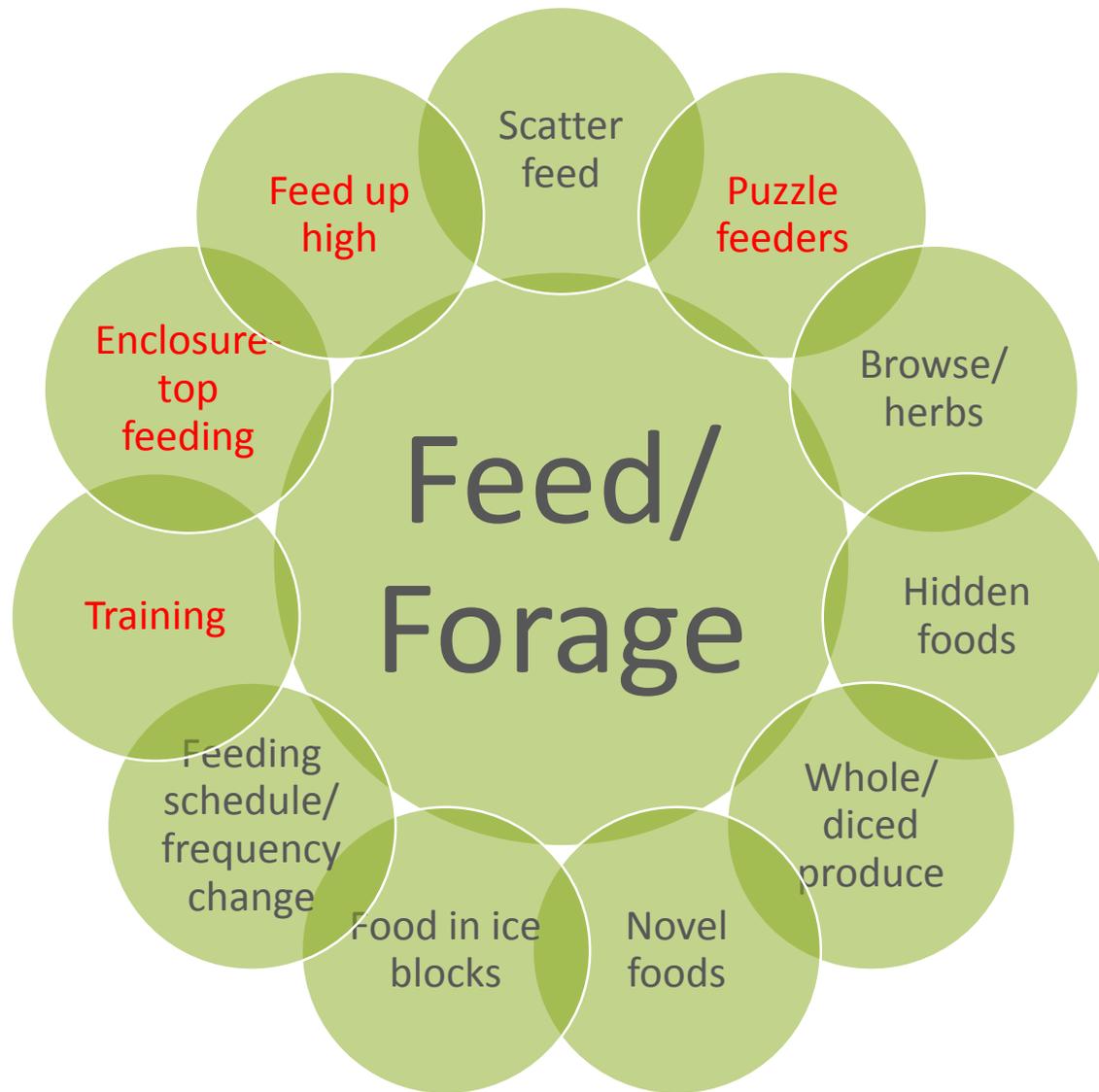
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## RUFFED LEMUR



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Plan  
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# FEEDING & NUTRITION TIPS

- Provide at least as many feeding sites as there are group members to reduce food competition/ aggression.
- Between lemur species, there are significant variations in digestive system morphology and thus dietary needs. Research dietary needs.
- Provide fruit in moderation. Wild fruits are more nutritionally similar to human-cultivated vegetables.
- Historical reports of hemosiderosis (iron storage disease) being a significant concern for lemurs have been debunked. Dietary recommendations in those old publications could be problematic.



*This feeding strategy (single feeding site) is not likely to be successful in most situations/ groups.*

# FEEDING & NUTRITION TIPS

- Lemurs are prone to obesity and resulting medical issues (diabetes, etc.) in human care! Later in life, excess weight can be very hard to reduce.
- Even if an animal is over-conditioned, it does not mean their diet is nutritionally complete.
- Ideal weight ranges (Duke Lemur Center):  
Ring-tailed lemur: 2.2-2.7 kg (4.85-5.95 lbs)  
Ruffed lemur: 3.2-3.9 kg (7.05-8.6 lbs)
- Ring-tailed lemur nutrition information:  
<http://www.zutrition.com/ring-tailed-lemur-nutrition-guide/>.



Jacksonville Zoo and Gardens  
Photo by John Reed  
How Embarrassing!!! ☺



Little Rock Zoo  
Photo by Karen Caster



Little Rock Zoo  
Photo by Karen Caster



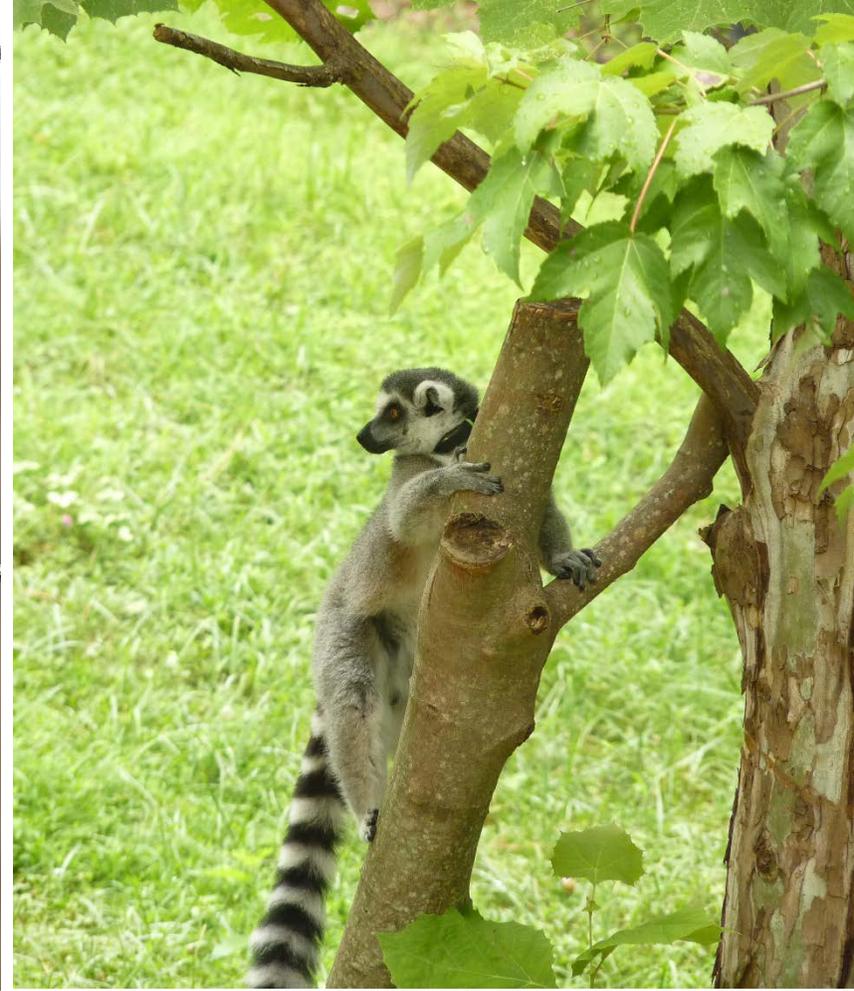
Little Rock Zoo  
Photo by Karen Caster

# LOCOMOTION

RUFFED LEMUR



Museum of Life and Science



Museum of Life and Science

# LOCOMOTION

RING-TAILED LEMUR



# LOCOMOTION

## Ring-tailed lemurs

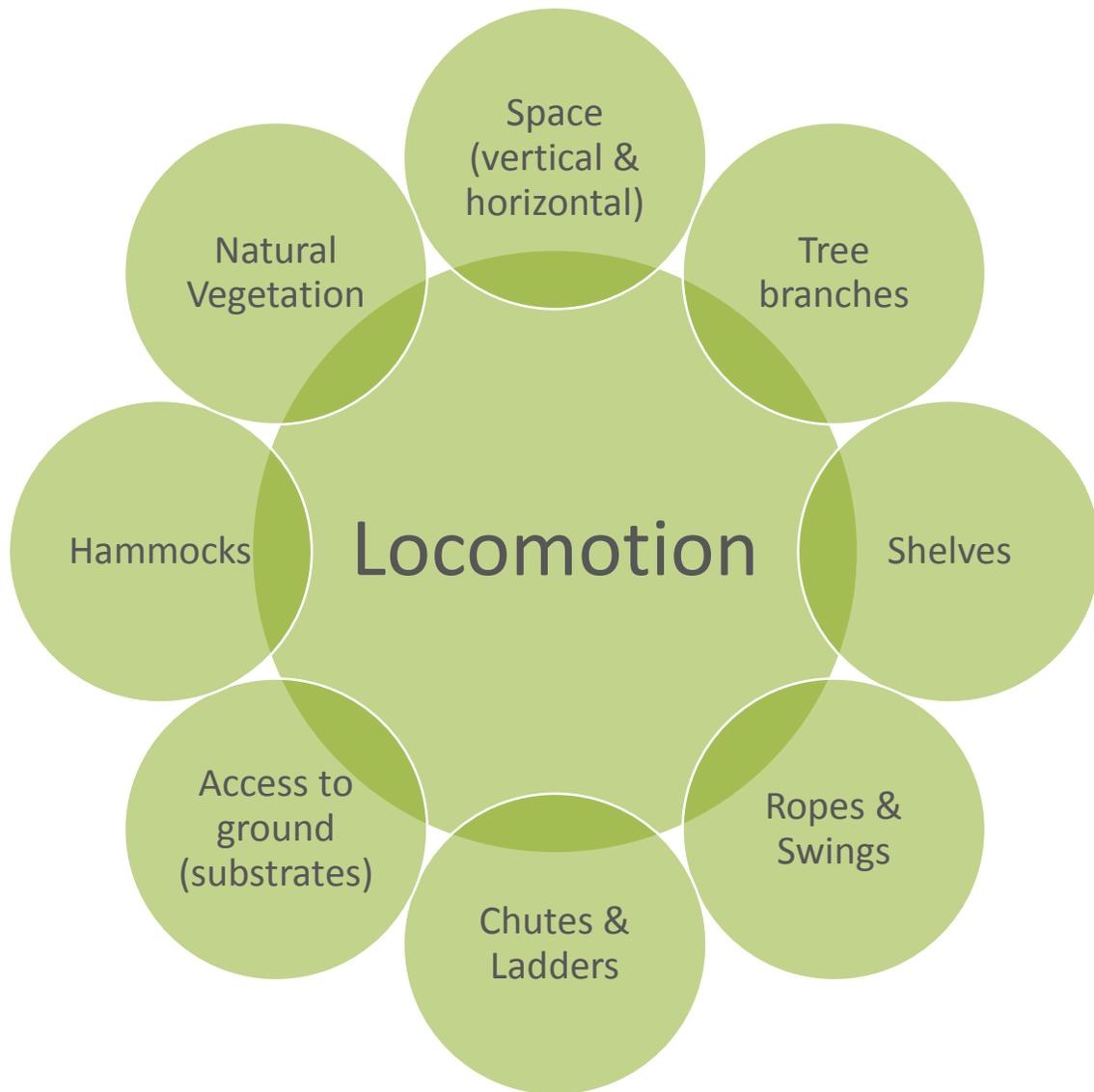
- Quadrupedal
- Travel in social groups
- Most active in morning & late afternoon/ evening
- ~70% of travel is terrestrial
- ~33% of day spent on ground, 23-25% in mid to upper canopy, ~13% in small bushes, ~6% in emergent layer

## Ruffed lemurs

- Quadrupedal
- Travel in social groups
- Most active in morning and late afternoon/ evening
- Rarely go to ground
- Suspensory postures

SET GOALS

P  
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S  
PLAN  
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Fresno Chaffee Zoo  
Photo by Victoria Karabanova



Jacksonville Zoo and Gardens  
Photo by Jeannie Gordon



# ENCLOSURE TYPES

MOATED EXHIBITS/ ISLANDS

**Warning: Drowning hazard!**



Jacksonville Zoo and Gardens  
Photo by Tracy Fenn



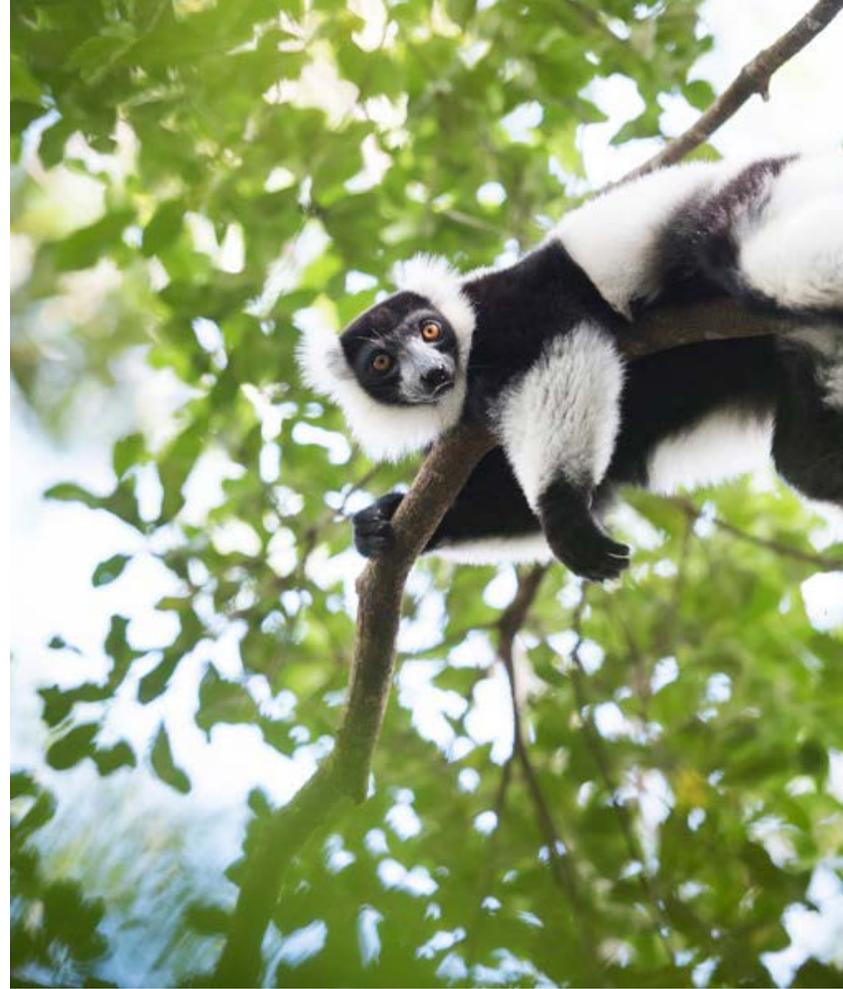
Endangered Primate Foundation's Prosimian Sanctuary  
Photo by Tracy Fenn



Endangered Primate Foundation's Prosimian Sanctuary  
Photo by Tracy Fenn

# ENCLOSURE TYPES

MESH ENCLOSED



Lemur Conservation Foundation

# ENCLOSURE TYPES

SEMI-FREE RANGE FORESTS

Warning: Not appropriate or safe for managing hyper-aggressive animals (i.e. former pets)!



Fresno Chaffee Zoo  
Photo by Victoria Karabanova

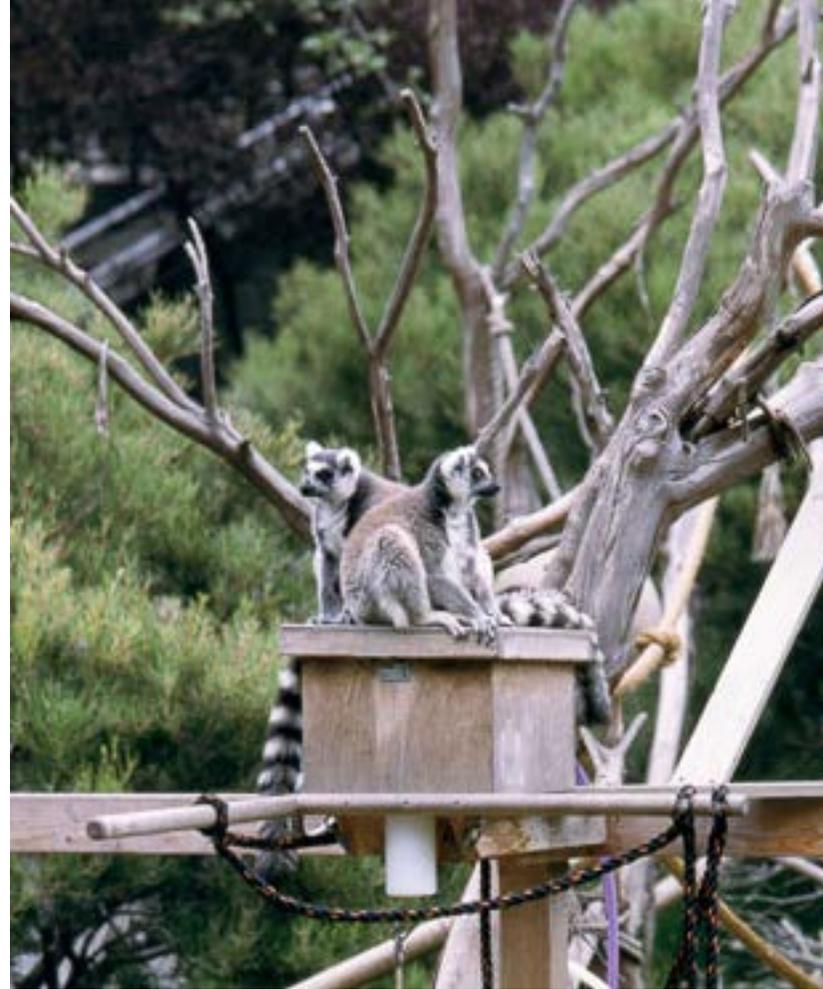


Photoshop-Dragon.com Copyright Curt Schimmel

# ENCLOSURE FURNITURE



ENCLOSURE FURNITURE



ENCLOSURE FURNITURE



Jacksonville Zoo and Gardens  
Photo by Lynde Nunn

Museum of Life and Science

# ENCLOSURE FURNITURE



## ENCLOSURE FURNITURE

Sway poles – Lincoln Park Zoo  
Photo by Maureen Leahy

# ENCLOSURE TIPS

- State and federal regulations enclosure size and complexity are often viewed as insufficient by most primatologists. The goal should be to exceed the minimum requirements as much as feasibly possible.
- Safety must be the top priority.
- Vertical space and outdoor access (weather permitting) is important to lemurs.



Tulsa Zoo  
Photo by Pat Murphy

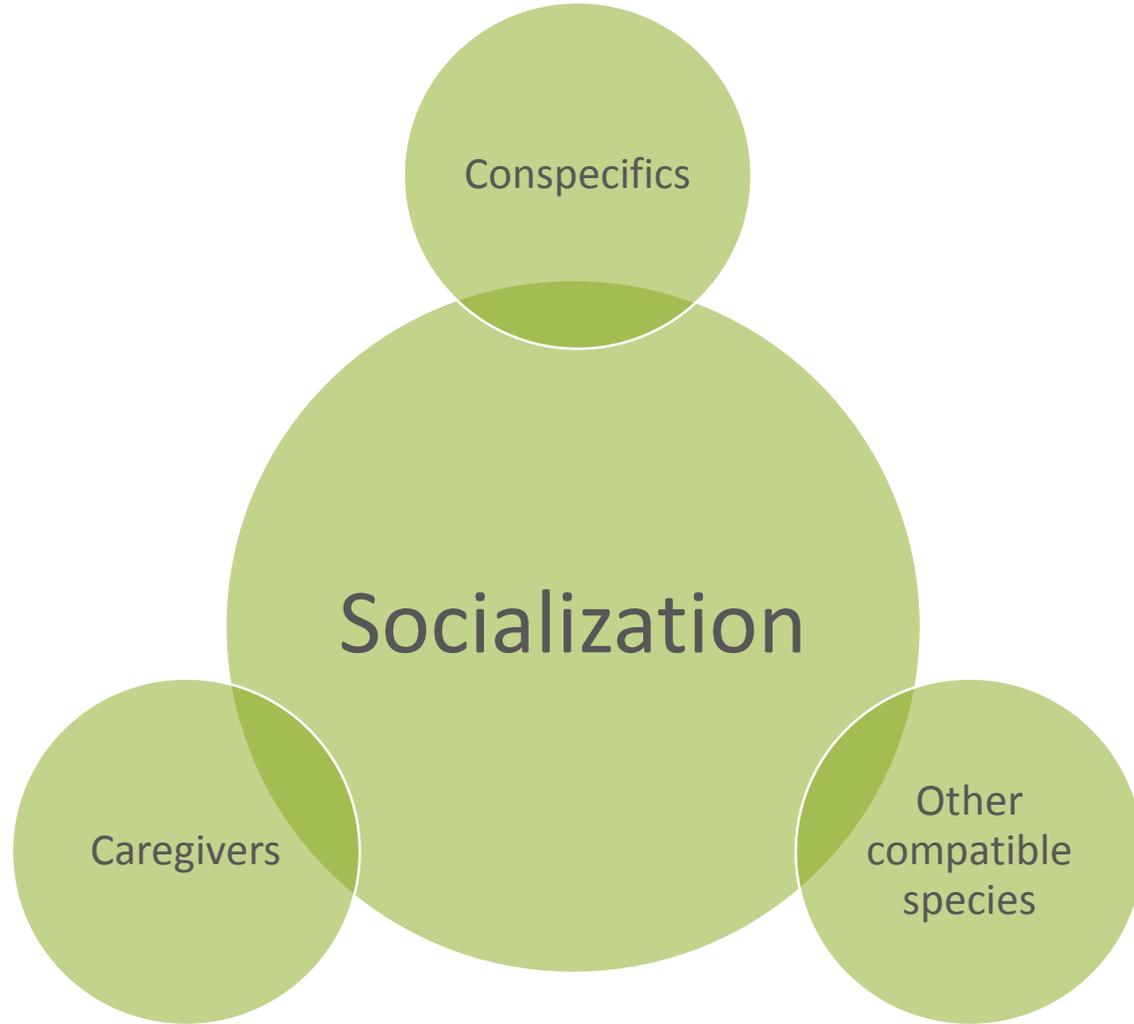


Fresno Chaffee Zoo  
Photo by Victoria Karabanova



Jacksonville Zoo and Gardens  
Photo by Jeannie Gordon

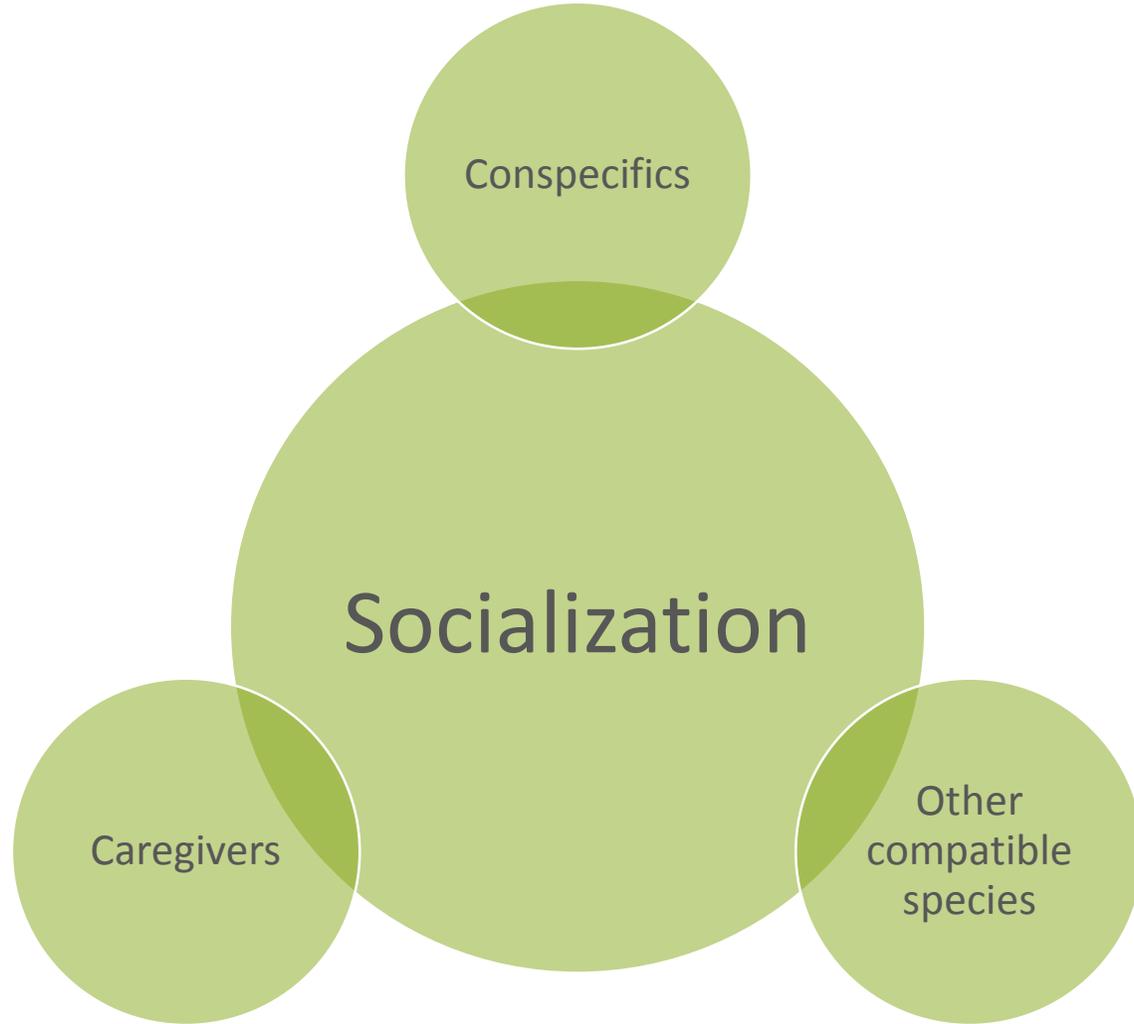
# SOCIALIZATION



## RING-TAILED LEMURS



Ring-tailed lemurs live in multi-male, multi-female groups ranging in size from 4-31 pending location. Females are dominant and remain in natal group; males emigrate. They are sympatric with at least nine other prosimian species in the wild. In human care, they have been successfully housed with at least 12 other lemur species (including Ruffed lemurs and *Eulemur* sp.) and over 30 different non-prosimian mammals and birds.



## RUFFED LEMURS



Ruffed lemurs live in diverse social structures best described as multi-male/ multi-female fission-fusion communities. Core groups of 2-9 animals (but up to 31) within communities often include two females, multiple males, and offspring. In human care, females are dominant but this is not clear in the wild. They are sympatric with at least nine other prosimian species in the wild. In human care, they have been successfully housed with at least 12 other lemur species (including Ruffed lemurs and Eulemur sp.) and over 30 different non-prosimian mammals and birds.



Jacksonville Zoo and Gardens  
Photo by Tracy Fenn



Endangered Primate Foundation's Prosimian Sanctuary  
Photo by Tracy Fenn

# MIXED-SPECIES GROUPS



## MIXED-SPECIES GROUPS

Unconventional mixed-species group at Jacksonville Zoo and Gardens: Angolan colobus, Ring-tailed lemurs, Black-and-white ruffed lemur.

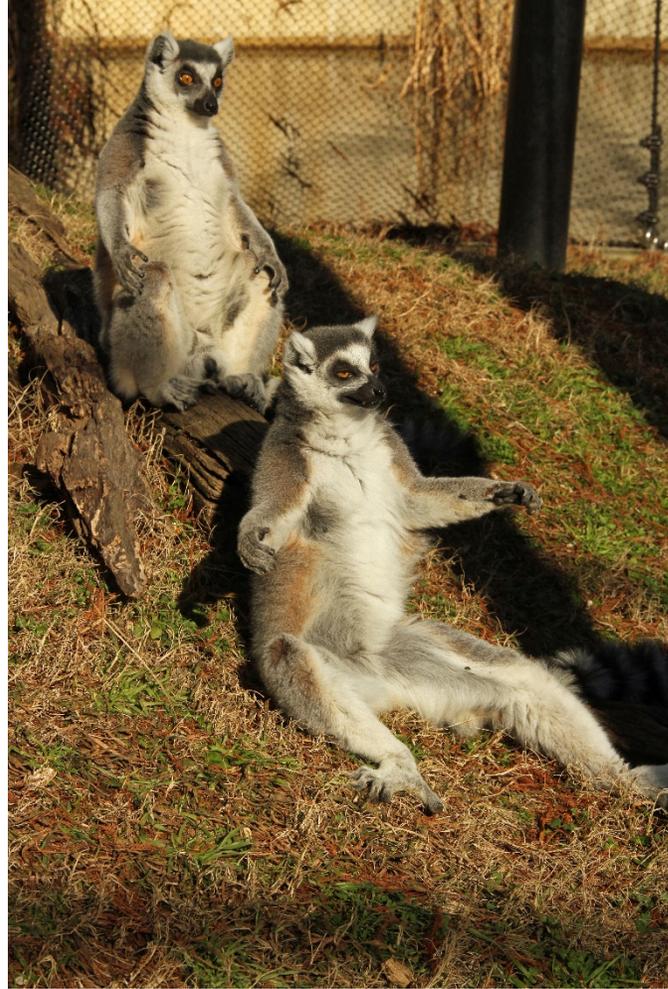
Photo by Tracy Fenn

# MIXED-SPECIES CONSIDERATIONS

- Success depends on group structure and individual characteristics
- Avoid mixing species that occupy the same ecological niche
- Plan for staff time to appropriately conduct introductions and continuously monitor
- Periodic group dynamic changes (often seasonal)
- For disease control, never mix species native to different continents! Lemur immune systems are very naïve.



Little Rock Zoo  
Photo by Karen Caster



Little Rock Zoo  
Photo by Karen Caster



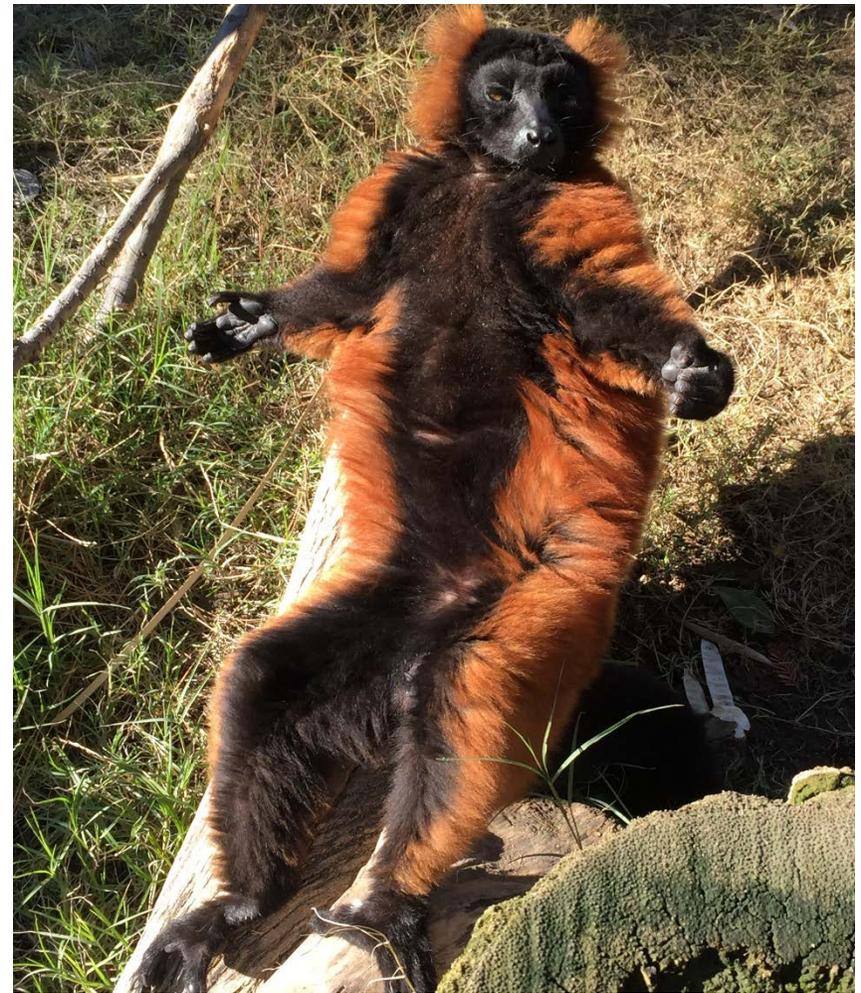
Little Rock Zoo  
Photo by Karen Caster

# SUN-BATHING

RING-TAILED LEMUR



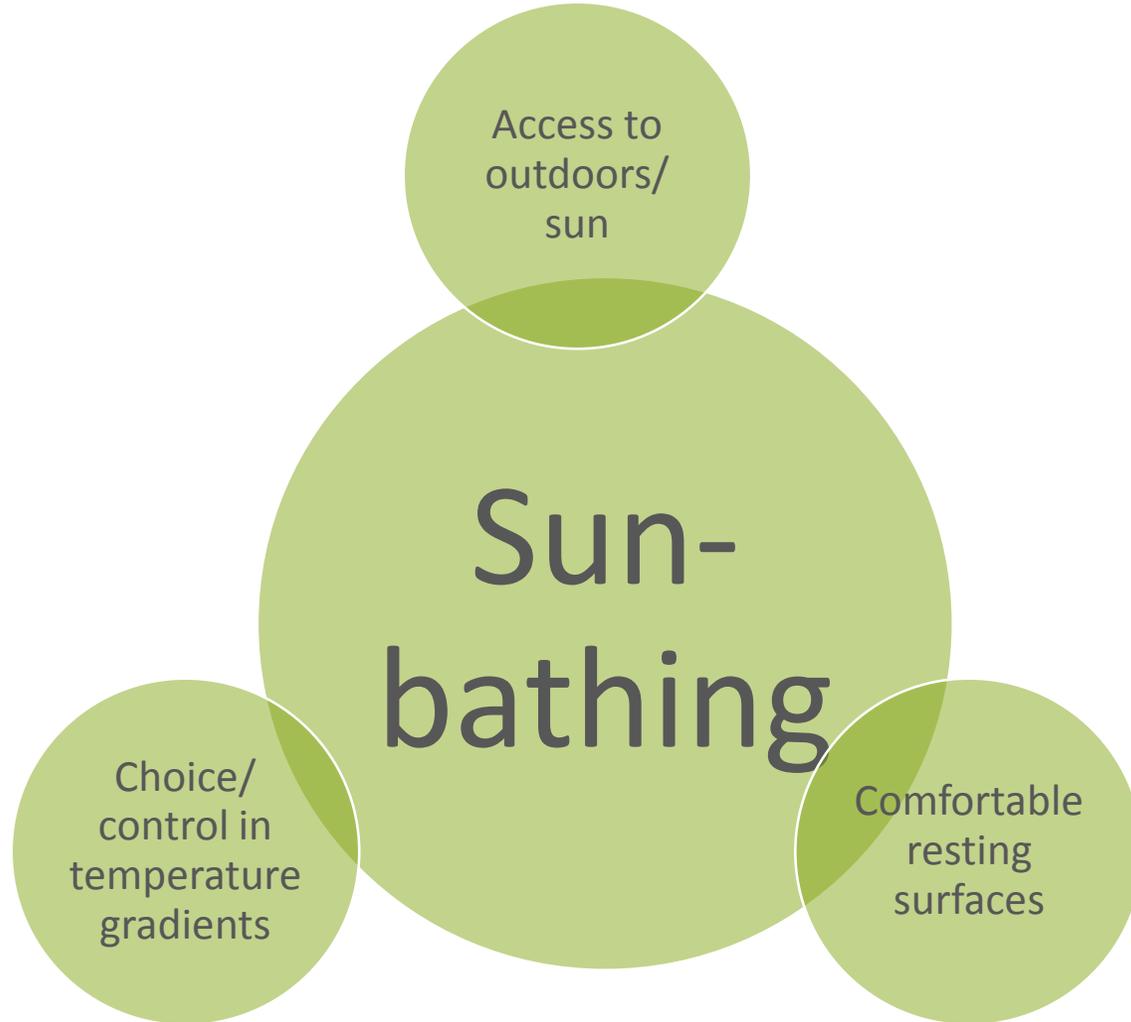
Tulsa Zoo



Fresno Chaffee Zoo  
Photo by Victoria Karabanova

# SUN-BATHING

RUFFED LEMUR



## SUN-BATHING



Thermoregulation function

Lemurs sit upright on their haunches, spread-eagle, and rest their forearms on their knees, exposing their undersides to direct sunlight.



## RING-TAILED LEMURS

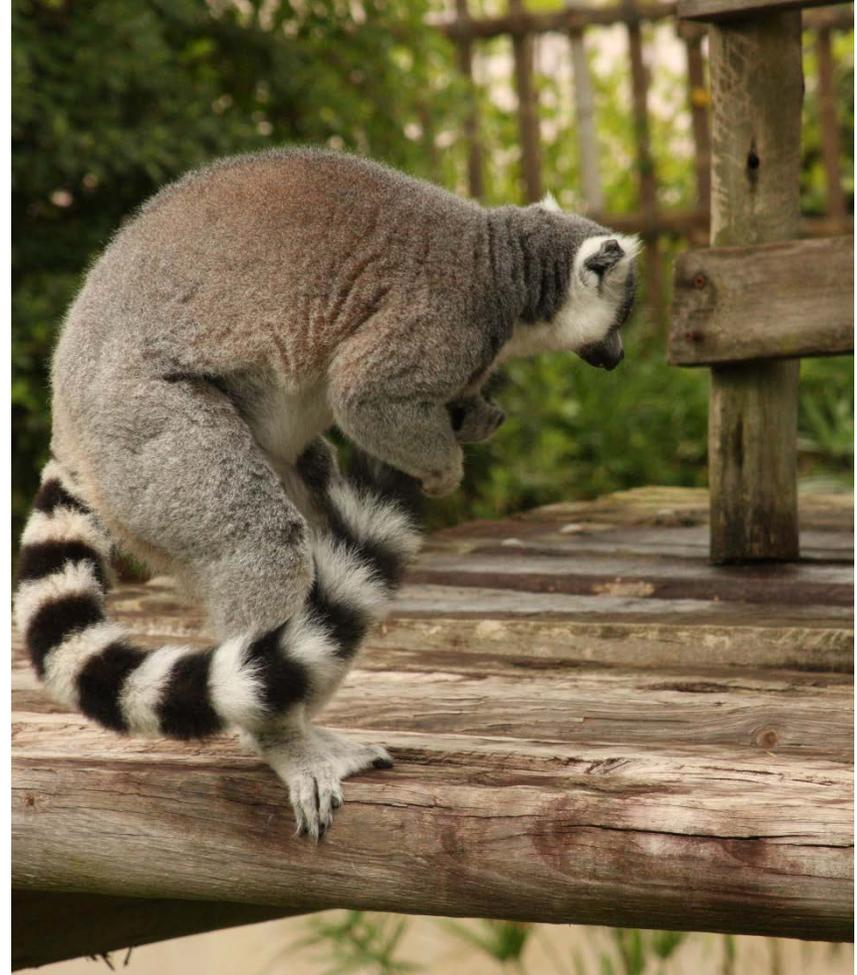


Communicates information on sex, location, and identity.

Females use ano-genital glands to mark surfaces and males use scent glands on the wrist which include a “spur” that allows them to gouge scent into a surface.



Little Rock Zoo  
Photo by Karen Caster



Little Rock Zoo  
Photo by Karen Caster

# SCENT MARKING

RING-TAILED LEMUR



Little Rock Zoo  
Photo by Karen Caster



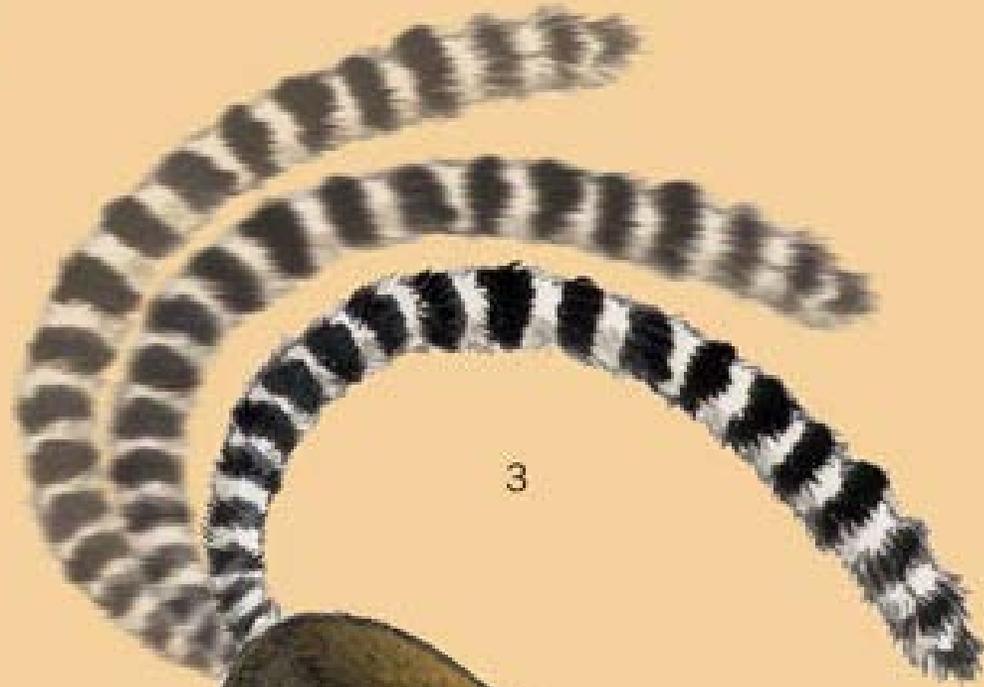
Little Rock Zoo  
Photo by Karen Caster

# SCENT MARKING

RING-TAILED LEMUR



1



3



2



# RING-TAILED LEMUR

“Stink Fight”



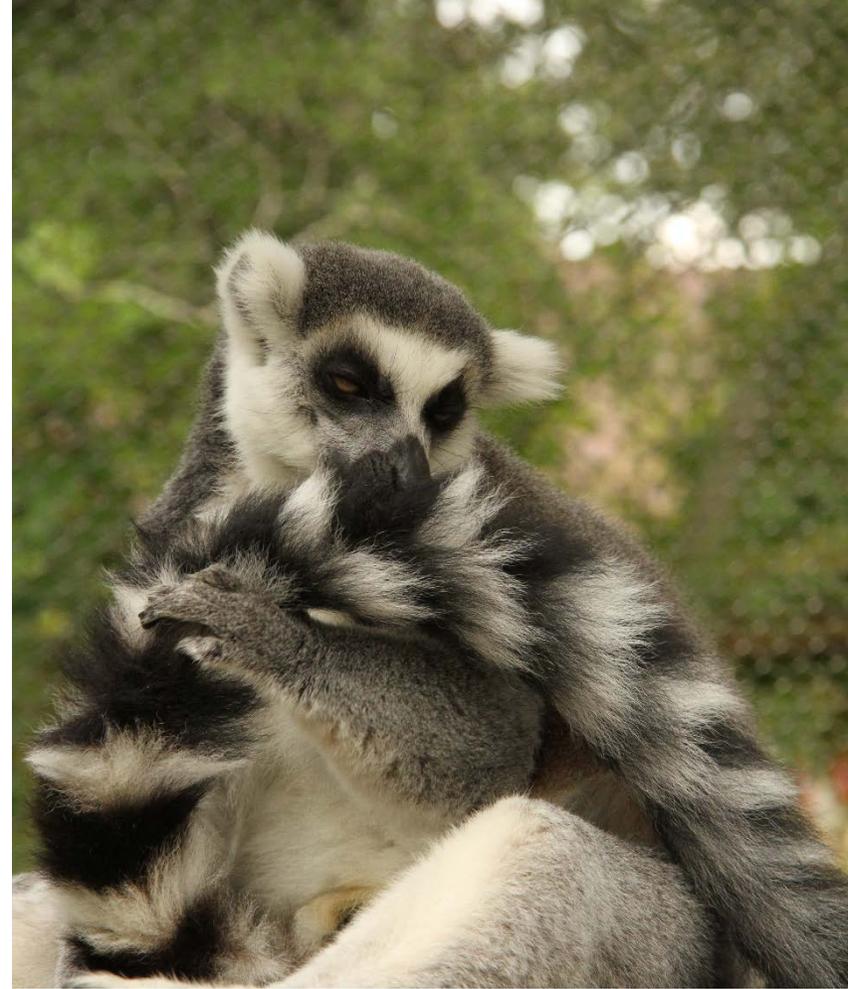
## RUFFED LEMURS



Communicates information on sex, location, and identity. Also plays a role in greetings, with one animal marking another.

Females mark with ano-genital glands (mostly on horizontal surfaces) and males with chest, neck, and mandible glands (on horizontal and vertical surfaces). Sometimes they mark using methods typical to opposite sex.





Little Rock Zoo  
Photo by Karen Caster



Little Rock Zoo  
Photo by Karen Caster

# RESTING – AN IMPORTANT NATURAL BEHAVIOR



# REST



Ring-tailed and Ruffed lemurs in the wild sleep in trees.

# ENRICHMENT CATEGORIES (EXAMPLES)

- Social
- Physical
- Dietary/ Feeding
- Sensory
- Occupational



Little Rock Zoo  
Photo by Karen Caster



Little Rock Zoo  
Photos by Karen Caster

# PHYSICAL ENRICHMENT



Little Rock Zoo  
Photo by Karen Caster

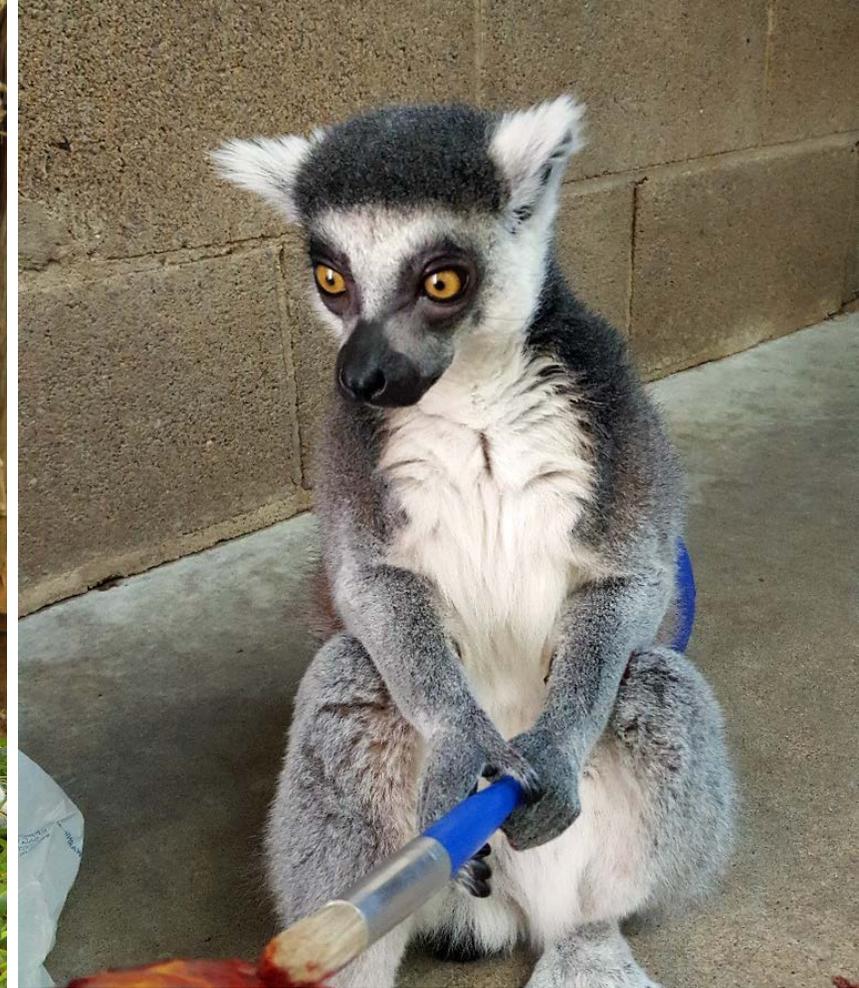
# DIETARY/ FEEDING ENRICHMENT



Fresno Chaffee Zoo  
Photo by Jessica Watters



Little Rock Zoo  
Photo by Karen Caster



Little Rock Zoo  
Photo by Karen Caster

# SENSORY ENRICHMENT



## PAINTING – SENSORY & OCCUPATIONAL ENRICHMENT

Little Rock Zoo

Photo by Karen Caster



Little Rock Zoo  
Photo by Karen Caster



Little Rock Zoo  
Photo by Karen Caster



Fresno Chaffee Zoo  
Photo by Victoria Karabanova

# OCCUPATIONAL ENRICHMENT - TRAINING

# TRAINING FOR HUSBANDRY AND MEDICAL CARE IS IMPORTANT TO ANIMAL WELFARE



Think you don't have a training program or time for one? Think again!

Every interaction between a human and an animal is teaching it something...good or bad! It is best to acknowledge this and strategically plan rather than have a haphazard program with little consistency between trainers.

Little Rock Zoo  
Photo by Karen Caster

# IMPORTANT BEHAVIORS



Shifting

Separation

Medicating

Weighing

Training lemurs to voluntarily participate in their own medical care reduces stress to them and personnel and improves medical monitoring and treatment capabilities. In some cases, it can be life-saving.

Little Rock Zoo  
Photo by Karen Caster

# ABERRANT BEHAVIORS IN LEMURS

- Hyper-aggression (toward conspecifics and/or humans)
- Stereotypic bouncing
- Pacing
- Self-biting
- Head tossing

Proper rearing and social experience is critical to avoiding aberrant behaviors and preserving overall behavioral competence. Hand-rearing should be avoided at all costs. When necessary, early reintroduction to conspecifics is key.



*In cases of insufficient milk supply, supplemental feedings are effective and allow infants to remain with the dam.*

Jacksonville Zoo and Gardens  
Photo by Tracy Fenn

# RESPONSIBLE PRACTICES IN PUBLIC MESSAGING

- Scientific research indicates that viewing non-human primates with humans or in human environments skews public perceptions of conservation status and/or appropriateness as pets.

<https://docs.com/plosone/6295/impact-of-visual-context-on-public-perceptions-of>  
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0069215>  
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0022050>  
<http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0026048>

- Regular removal of lemurs (even temporarily) from their social group for “demonstrations” poses risks to animal welfare, social group cohesion, and human health/ safety.
- With over 15,000 non-human primates in personal possession in the US alone, we all have a responsibility to do our part to stop the demand!



*Leash-walking or otherwise “handling” lemurs misrepresents their nature and skews public perceptions, diminishing animal welfare and conservation efforts.*

# ONLINE RESOURCES (ASSOCIATION OF ZOOS AND AQUARIUMS – AZA)

- Personal Possession of Non-human Primates White Paper  
[https://www.aza.org/assets/2332/personal\\_possession\\_of\\_non-human\\_primates\\_7212015.pdf](https://www.aza.org/assets/2332/personal_possession_of_non-human_primates_7212015.pdf)
- AZA Animal Care Manuals  
<https://www.aza.org/animal-care-manuals>

# LEMUR SANCTUARY NETWORK

- Collaboration of vetted, reputable lemur sanctuaries working to address the tremendous demand for placement of lemurs from personal possession and other sources.
- If your organization currently houses or is interested in housing lemurs, please e-mail Tracy Fenn at [info@endangeredprimate.org](mailto:info@endangeredprimate.org) and she will send you a link to a survey regarding joining this collaboration.