BEHAVIOR-BASED HUSBANDRY FOR LEMURS

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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](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.
FOCAL SPECIES

RING-TAILED LEMUR
BLACK-AND-WHITE RUFFED LEMUR
RED RUFFED LEMUR

Jacksonville Zoo and Gardens
Photos by Brian Price
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)

Ring-tailed lemur:
- Feed: 46%
- Rest: 25%
- Travel: 19%

Ruffed lemur:
- Feed: 53%
- Rest: 28%
- Travel: 19%
1. Setting Goals
2. Planning
3. Implementing
4. Documenting
5. Evaluating
6. Re-Adjusting
Feed/Forage

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)
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.)
Feed/Forage

- Scatter feed
- Puzzle feeders
- Browse/herbs
- Hidden foods
- Whole/diced produce
- Novel foods: tamarind pods, insects
- Food in ice blocks
- Feeding schedule/frequency change
- Enclosure-top feeding
- Diverse feeding sites (ground, mid-level, high)
- Training

Safety considerations!

RING-TAILED LEMUR
Feed/Forage

Safety Observation

Omaha’s Henry Doorly Zoo
Photo by Lauren Darnold
Feed/Forage

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

RING-TAILED LEMUR

Little Rock Zoo
Photo by Karen Caster
Feed/Forage

Analyze records –
• Were the behavior goals met?
• How well?
• Which initiatives were most successful?
• Safety concerns?
Feed/Forage

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

San Francisco Zoo
~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)

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Little Rock Zoo

Photo by Karen Caster
SUSPENSORY POSTURE

RUFFED LEMUR

Little Rock Zoo
Photo by Karen Caster

Tulsa Zoo
Photo by Rick Kotarsky

Little Rock Zoo
Photo by Karen Caster
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.)
Feed/Forage

- Feed up high
- Puzzle feeders
- Enclosure-top feeding
- Training
- Feeding schedule/frequency change
- Food in ice blocks
- Novel foods
- Hidden foods
- Whole/diced produce
- Browse/herbs
- Scatter feed

RUFFED LEMUR
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:
LOCOMOTION

RUFFED LEMUR
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
Locomotion

- Natural Vegetation
- Space (vertical & horizontal)
- Tree branches
- Chutes & Ladders
- Ropes & Swings
- Shelves
- Access to ground (substrates)
- Hammocks
ENCLOSURE TYPES

MOATED EXHIBITS/ ISLANDS

Warning: Drowning hazard!
ENCLOSURE TYPES

mesh enclosed
ENCLOSURE TYPES

SEMI-FREE RANGE FORESTS

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

Tulsa Zoo
Photo by Pat Murphy

Fresno Chaffee Zoo
Photo by Victoria Karabanova

Jacksonville Zoo and Gardens
Photo by Jeannie Gordon
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 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.
MIXED-SPECIES GROUPS

Jacksonville Zoo and Gardens
Photo by Tracy Fenn

Endangered Primate Foundation's Prosimian Sanctuary
Photo by Tracy Fenn
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.
SUN-BATHING
RING-TAILED LEMUR

Little Rock Zoo
Photo by Karen Caster

Little Rock Zoo
Photo by Karen Caster

Little Rock Zoo
Photo by Karen Caster
SUN-BATHING

RUDDED LEMUR

Tulsa Zoo

Fresno Chaffee Zoo

Photo by Victoria Karabanova
Sun-bathing

Access to outdoors/sun

Choice/control in temperature gradients

Comfortable resting surfaces

Thermoregulation function

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

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.
SCENT MARKING
RING-TAILED LEMUR

Little Rock Zoo
Photo by Karen Caster

Little Rock Zoo
Photo by Karen Caster
SCENT MARKING
RING-TAILED LEMUR
RING-TAILED LEMUR

“Stink Fight”
Scent-marking

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.
Problem Solving

- Feeding strategies
- Social interaction
- Cognitive trials
- Enclosure furniture changes
- Training
RESTING – AN IMPORTANT NATURAL BEHAVIOR
Access to elevated surfaces

Clam/ quiet environments

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
PHYSICAL ENRICHMENT

Little Rock Zoo
Photos by Karen Caster
DIETARY/ FEEDING ENRICHMENT
SENSORY ENRICHMENT
PAINTING – SENSORY & OCCUPATIONAL ENRICHMENT

Little Rock Zoo
Photo by Karen Caster
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
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.
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.
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
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0069215
https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0022050
https://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

▪ 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 and she will send you a link to a survey regarding joining this collaboration.