



Prosimian Husbandry Workshop, April 30 - May 2, 2009

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Introduction to the First Prosimian Husbandry Workshop
Hosted by The Cleveland Metroparks Zoo
30 April - 2 May 2009

A prosimian husbandry workshop was hosted by Cleveland Metroparks Zoo from 30 April through 2 May 2009. A total of 60 professionals from 35 institutions attended the workshop. The workshop attendees' prosimian husbandry experience ranged from extensive (30+ years) to limited (1 year). The idea of having a workshop to focus on the husbandry and captive management issues unique to prosimians evolved from the Association of Zoos and Aquariums (AZA) Prosimian Taxon Advisory Group (PTAG) mid-year meeting hosted by The Indianapolis Zoo in 2007. Although workshops focusing on the care and management of other primate suborders are routine in AZA member zoos, a workshop focusing on prosimians is a unique event.

The AZA PTAG management group made workshop subject matter suggestions and from this a topic agenda was created. Workshop sessions covered the topics of nutrition, health, reproduction, exhibit design, introductions, mixed species exhibits, training, and environmental enrichment. Unlike many lecture heavy, discussion light zoo conferences, the Prosimian husbandry workshop format was designed to stimulate discussion of the topics, using short presentations as vehicles to drive subject matter conversation. This allowed the extensive experience of the workshop attendants to inform and educate everyone present. Each topic had an assigned Moderator that oversaw and coordinated presentations and discussions during their session. Most moderators were members of the AZA PTAG.

The workshop was advertised in a variety of print and electronic information sources months in advance. The workshop was also utilized as an opportunity to generate conservation funds for prosimians in the wild. We designated the Madagascar Fauna Group as our recipient organization of funds raised through the sale of unique items made by Cleveland Metroparks Zoo Staff and items from Madagascar. Funds were also generated from extra workshop t-shirt sales and surplus funds from the registration cost after workshop expenses. This totaled in excess of \$4,000 going to MFG. In conjunction, the AZA PTAG held their annual mid-year meeting immediately following the workshop to plan captive managed Prosimian species strategies for the coming year.

Overall, the workshop was viewed as a huge success and all participants indicated the experience would prove helpful when they returned to their home institutions. Talks began immediately for a way to replicate this workshop and continue to communicate prosimian husbandry best-practices and develop young professionals working with prosimians.

Tad Schoffner
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Agenda

WEDNESDAY, APRIL 29, 2009

7 - 11 p.m.	Icebreaker, optional at Winking Lizard Tavern, Independence, OH Directions to Winking Lizard Tavern from Workshop hotels (Red Roof Inn and Holiday Inn)
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THURSDAY, APRIL 30, 2009

8 - 9 a.m.	Continental Breakfast
9 - 9:30 a.m.	Introduction and Welcome
9:30 - 10:30 a.m.	Keynote Speaker <i>Ingrid Porton, Curator Of Primates, St. Louis Zoo</i>
10:30 - 10:45 a.m.	Break
10:45 - Noon	Prosimian Nutrition <i>Moderator: Cathy Williams, DVM, Duke Lemur Center</i>
Noon - 1 p.m.	Lunch
1 - 2 p.m.	Prosimian Health <i>Moderator: Cathy Williams, DVM, Duke Lemur Center</i>
2 - 3 p.m.	Prosimian Reproduction <i>Moderator: Ingrid Porton, Curator Of Primates, St. Louis Zoo</i>
3 - 3:15 p.m.	Break
3:15 - 4:30 p.m.	Nocturnal (and Diurnal) Prosimian Exhibit Design <i>Moderator: Kris Arnold, Busch Gardens, Tampa Bay, FL</i>
4:30 - 5:30 p.m.	Nocturnal Prosimian Reproduction <i>Moderator: Helena Snyder, San Diego Zoo</i>
5:30 - 5:45 p.m.	Wrap-up and Housekeeping Items

FRIDAY, MAY 1, 2009

8 - 9 a.m.	Continental Breakfast
9 - 10:30 a.m.	Prosimian Introductions <i>Moderator: Chris Kuhar, Curator of Primates, Cleveland Metroparks Zoo</i>
10:30 - 10:45 a.m.	Break
10:45 - Noon	Prosimian Mixed Species Exhibits <i>Moderator: Monica Mogilewsky, Lemur Conservation Foundation</i>
Noon - 1 p.m.	Lunch
1 - 5:30 p.m.	Free Time In Zoo
5:30 - 9 p.m.	Dinner in Primate, Cat & Aquatics Building

SATURDAY, MAY 2, 2009

8 - 9 a.m.	Continental Breakfast
9 - 10:30 a.m.	PTAG Prosimian Management <i>Moderator: Lynne Villers, Indianapolis Zoo</i>
10:30 - 10:45 a.m.	Break
10:45 - Noon	Prosimian Enrichment <i>Moderator: Kris Becker, DAK</i>
Noon - 1 p.m.	Lunch

1 - 2 p.m.	Prosimian Training <i>Moderator: Megan Elder, St. Paul's Como Zoo</i>
2 - 3 p.m.	Open Forum <i>Moderator: Tad Schoffner, Cleveland Metroparks Zoo</i>
3 - 3:15 p.m.	Break
3:15 - 4 p.m.	Wrap-Up and Conclusion <i>Dr. Kristen Lukas, Curator of Conservation & Science, Cleveland Metroparks Zoo</i>

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Session Notes

The following notes were provided by Elena Hoellein Less with assistance from Grace Fuller and summarized for each session. Information attributed to participants is an interpretation of what was said, not a direct quote. When available, supplemental materials such as handouts have been included as appendices.

Session One: Prosimian Nutrition

(Moderator: Cathy Williams, DVM Duke Lemur Center)

Topics

- Intro to session
- The importance of proper diets
- Comparison of lemur gastro-intestinal tract morphology
- Wild diets and feeding ecology- what we know and don't
- Common ingredients in captive diets
- Feeding challenges in captivity
- Diet myths
- Example diets

Session Notes

Intro to session

This session is going to start with some general background on nutrition in case attendees do not have strong nutrition programs at their zoo. Nutrition is the foundation for healthy animals which is why this session is before the health session. It is impossible to completely re-create the wild diet, but captive diets are often anthropomorphized by keepers and influenced by financial concerns. We are not only trying to create normal feeding behaviors, but healthy animals which in turn will create better display animals. Lemurs have very different feeding styles and physiology, so we need to consider this when preparing diets. Many people have concerns regarding obesity, diabetes, iron overload and hemosiderosis, and hand-raising formulas.

The importance of proper diets

Primate chow is fed because it is nutritionally complete according to what we know to be complete. Also, fruit and leafy greens make up a significant amount of the diet. Browse is considered differently by caretakers, i.e. leafy greens or alfalfa may also be considered browse. Mealworms (nocturnal prosimians), nuts, eggs, milk products are all part of lemur diets. Important to consider that food fed for enrichment purposes is all considered to be part of the diet.

Comparison of lemur gastro-intestinal tract morphology

We are going to compare gut tracts from three species: ruffed lemur, ring-tailed lemur and sifaka.

Ruffed lemur:

They are frugivorous and have a simple stomach (not ruminants). They can eat a lot of food very quickly and have a very short small intestine. Gut transit time is approximately two hours meaning they do not have a lot of processing time. They put a lot of food in because they do not process it so much. Foods that require bacterial fermentation do not work well with ruffed lemur digestive tracts. They assimilate nutrients that are easy to assimilate.

Ring-tailed lemur:

They are omnivorous and have a longer digestive tract, therefore gut transit time (7 to 8 hours) is slower. Cecum is similar in size to the ruffed lemur cecum, this is where fiber is broken down by bacteria. Volatile fatty acids are produced by breakdown of fiber in cecum and are absorbed by the mucosal wall. Because of their longer gut, they can be fed high-fiber diets.

Sifaka:

This is a folivorous species with a very long gut. Fiber fermentation occurs in the cecum and gut transit time is 24-48 hours.

Question: (Monica Mogilewsky) Are crowned lemurs closer to ruffed and mongoose closer to ring-tailed?

Answer: They are all very similar to the ring-tailed gut morphology.

Comment (Karen Weisenseel): Gut transit time studies have been done in mongoose lemurs.

Comment (Chris Kuhar): We have been trying to use dye to identify vomit in a ruffed lemur, short transit time may be the reason we have had issues with this.

Moderator (Cathy Williams): Ruffed lemurs can utilize a lot of simple sugars, if you give the sifaka simple sugars you will switch the bacteria population in the gut. This can cause diarrhea.

Necropsy of folivorous animals fed high sugar diets, have died quickly.

Question: (Monica Mogilewsky) What about feeding Varecia fiber?

Moderator (Cathy Williams): There can be benefits to doing this. Humans don't have a cecum, but still need fiber for water balance, stool consistency, transit time, colon health, slows rate of sugar entering bloodstream. However, ruffed lemurs cannot get energy from the fiber.

Question: (Jessica Franke) If an animal has been fed a bad diet, can they develop the good bacteria if their diet is changed?

Moderator (Cathy Williams): Yes, over time it will shift.

Question: (Jessica Franke) What happens during the initial switch-over?

Moderator (Cathy Williams): There is time where they have to get used to new diets. Best way to do this is through gradual change which helps animals adjust better.

Question (Megan Elder): Are probiotics helpful?

Moderator (Cathy Williams): No data on this. Probiotics are in the lactobacillus family, they are not the same bacteria in the intestinal tract of the lemur. Probiotics are not cellulose or fiber digesting bacteria. It shouldn't hurt or benefit lemur diets.

Question: Can we process carbohydrates by cooking to create simple carbohydrates i.e. yams?
This can be a cheaper alternative.

Moderator (Cathy Williams): Problem with simple carbs is that they cause a spike in the glucose which over time is not good, even for ruffed lemurs. The effect is more negative. If they are getting enough nutrients, they do not need this many simple carbs.

Question: Where is the preference to get the simple carbs from?

Moderator (Cathy Williams): All simple sugars are absorbed easily without much processing along with starch. When you start binding the glucose into hemicellulose etc., this takes time to process and slows down the absorption of the carbs into more of a steady peak.

Question: Can you tell us anything about intestinal tracts of Asian nocturnal prosimians?

Moderator (Cathy Williams): Jenny Campbell has studied this. Intestinal tracts and cecums were very small and more associated with a high protein, insectivorous diet. No info on gut transit time.

Moderator (Cathy Williams): Antibiotics can have an effect on GI microbes. Each antibiotic has a different effect and depending on the type of species and their own gut.

Comment (Monica Mogilewsky): We use probiotics after giving antibiotics. Anything else to help with antibiotic effects?

Moderator (Cathy Williams): It depends on the type of antibiotic. The antibiotics that kill gram positive organisms do not cause diarrhea as much as gram negative organisms.

Question: What about clindamycin?

Moderator (Cathy Williams): Clindamycin kills anaerobic bacteria. The microbes in the tract are not anaerobic so should not be that affected.

Question (Kris Becker): What about having extremely hard feces?

Moderator (Cathy Williams): First, the animal is dehydrated. In this case, need to increase water consumption. Fiber absorbs water (soluble) and can help with this problem, i.e. pectin. You can also provide Metamucil.

Moderator (Cathy Williams): Comparison of items fed in wild and captive diets:

Protein is same between captivity and the wild. However, fiber (NDF) is at least double in wild diets compared to captive diets. Even feeding more produce is still lower in fiber than what they would be getting in the wild. The fruits consumed in the wild are much different from the fruits we feed...there is more husk, fiber and structural plant compounds.

Question: How do you feel about grapes?

Moderator (Cathy Williams): Is there a general consensus? Some people did not feed them because of iron and some feed them all the time. DLC does not feed a lot of grapes because of expense. In some ways, they can be better than other fruits. Glycemic index is a measurement of how fast sugar in a food item is absorbed into the bloodstream using glucose as a percentage. Low glycemic index are absorbed more slowly and this is used in developing diets for diabetics.

Question: How does the addition of biscuits help to even this out?

Moderator (Cathy Williams):: It depends on the biscuit you are feeding. Canned primate diet is different than a biscuit. Even among Leafeater biscuits, there is variance in the fiber.

Question: How are animals tolerating spikes in vitamin C from difference in in situ vs. ex situ diets?

Moderator (Cathy Williams): We don't know the effect of vitamin C. We will get to this later.

Diseases Associated with Diet

Obesity:

One of the side effects of our high carbohydrate diets leads to obesity. The feeling of satiety doesn't last long when you eat sugars and carbohydrates. You tend to eat more whether you need the extra calories or not. They don't have to work to get food, but they keep building the fat stores up because their diets are not high enough in fiber.

Ways to control obesity:

First, educate the staff on the proper amounts of food to feed their animals. Limit diet to 2 to 2.5% of body weight. More than this is more than they need, especially because their energy output is not that great. Second, keep the animals feeling like they are full longer and limiting simple

sugars, like fruit. Giving fresh leafy browse is the best thing you can do. They should be getting more leafy greens and vegetables with a lower glycemic index.

Question (Monica Mogilewsky): When animals are inside, animals may get fatter. If they offer browse in the morning and diet in the afternoon, which seems to help (despite animal attitude).

Moderator (Cathy Williams): This is an easy way to get them to eat more browse, but really need to educate caretakers that they are ok without fruit.

Question: What about a seasonal diet?

Moderator (Cathy Williams): This can be worked into their diet. They can metabolically tolerate lean times (except for dwarf and mouse lemurs that do this normally). However, it may be best to keep them on a moderate, steady-state diet all the time.

Question (Kris Becker) Can see some cyclical change in ring-tailed lemur, should this just be monitored?

Moderator (Cathy Williams): Yes, best way to tell what is happening with your animals, should get monthly weights. Cyclical changes can be based on heat, climate and breeding season.

Question (Sabrina Squillari): How do you deal with one obese animal? They hand-feed fruit items which could change, but what about chow?

Moderator (Cathy Williams): What is the dominance hierarchy?

Sabrina S.: She is in the middle.

Moderator (Cathy Williams): If you can shift that animal for the major part of the feeding, this is a good way to handle this. You can add browse and cut the chow down because it is so dense or go on a higher fiber chow. Also, limit treats for this animal.

Sabrina S.: So gradually cutting out fruits and vegetables is ok?

Moderator (Cathy Williams): More to food than nutrition. Animals also need variety and enrichment. Limit the fruits and vegetables to those with lower glycemic index, like apples and grapes.

Comment (Laura Suski) For free-ranging catta, they get fruit items once or twice a week. They do eat mostly chow besides natural browse.

Question (Heather Purdeu) In winter we cannot provide browse, what do we do?

Moderator (Cathy Williams): You can provide leafy greens and cut back on fruit. You have to choose your leafy greens and it may take time to get the animals used to them. You need to try a different variety and see what works.

Comment (Chris Kuhar) We have done a chow-free diets with some monkey species. Diets were matched calorie for calorie, but needed to consume fewer calories on chow-free diet. Have you seen patterns with this?

Moderator (Cathy Williams): We have not done a chow-free diet. It is hard to get a nutritionally complete diet that will take care of diets long-term. You may not get enough protein and vitamin/mineral balances that are tricky to provide if you don't have someone who is knowledgeable about this. You can go to a much less chow-dependent diet and then increase the non-chow portion which may be safer. Biscuits have pros and cons, they provide nutritional completeness. However, they are grain based items which they are not adapted for. The concern is long-term nutritional stability.

Question (Megan Elder) What biscuits are your favorite?

Moderator (Cathy Williams): We prefer newer ones with dentaguard, but don't really have a favorite one. Animals like variety which is important to consider.

Question: Do you like Marion?

Moderator (Cathy Williams): Never fed this, we feed Purina or Mazuri. This is not to say the other ones are bad, just don't have a lot of experience. You need to look at what your goals are. Marion has a higher sugar content.

Question: What about animals that go through torpor?

Moderator (Cathy Williams): Some animals do have seasonal hormonal cues that trigger weight gain before torpor and can slow their metabolism. If you give same diet, you get huge animals. May be good to have summer and winter diets.

Just because an animal is obese, they may still have nutritional deficiency. They do not have a calorie deficiency, but may not have an enough nutrients.

There are normal weight ranges and diet is adjusted to keep them in a particular range. Being outside of this range, may lead to sickness. The ranges are based on wild weights.

Question (Monica Mogilewsky) Do you find that juveniles take a long time to get to full weight?

Moderator (Cathy Williams): Juveniles need to consume more calories because they have a higher metabolism. Just give them extra calories.

Comment (Desiree Haneman) Dominance hierarchies may affect weight as well.

Comment (Karen Weisenseel): Doctor working on Alzheimer's said no broccoli or kale.

Iron Overload and hemosiderosis:

This can be toxic in excess. Iron is regulated in the small intestine, but you can absorb more than you need. Animals bind iron into ferritin and store it in the liver. Hemosiderin is the precipitated form. Hemosiderosis means there is iron stored in that tissue. Hemachromatosis is when there is so much iron that it is causing damage to the tissue.

Iron IQ:

Iron overload is not necessarily a serious problem in captive lemurs. It is not seen very much in necropsies.

Wild diets do not contain less iron than captive diets, but differ in the form that iron is in. Iron present in plant tissues is in a form that is poorly absorbed. Diets low in fiber are not binding iron very well.

There are no studies regarding tea in the diets, plus a concern that lemurs would get tea instead of water.

Question: Is eating oak an issue?

Moderator (Cathy Williams): We don't know what lemurs can assimilate and what secondary plant compounds are a problem.

Comment (Karen Weisenseel) Sometimes they choose tannin rich barks.

Comment (Jacqueline Broder) No problems with oak.

Moderator (Cathy Williams): Tannins are not the only thing that binds iron; fiber also binds iron.

Chow may provide too much iron, but this could create a problem in other nutritional imbalances.

We do not know if Vitamin C contributes to the development of hemosiderosis, however studies in humans seem to indicate that it is not a huge issue. Anemia is a large problem in humans, especially women. If people are fed iron in conjunction with vitamin C, it helps to absorption of digestion. If you are not iron deficient and you add vitamin C, it lowers absorption of iron. Vitamin C should not be a huge concern in diets.

Comment (Karen Weisenseel) They do not even metabolize vitamin C.

Some species of lemurs process iron differently than others, ruffed lemurs store iron the most. They have never seen hemosiderosis in insectivorous or folivorous animals.

Animals if they are fed appropriately should not be given supplements and never iron supplements.

Question (Jacqueline Broder) Is a mineral salt lick ok?

Moderator (Cathy Williams): Yes, as far as we know this is fine.

Question: (Scott Gamerl) Is there an effect when feeding different types of oak?

Moderator (Cathy Williams): All types of tannins bind iron even though there are different types of tannins in different types of oak.

Question (Monica Mogilewsky) Has anyone located low-iron infant formula?

Answer (Chris Kuhar) Premie formula.

Answer: Also, low-iron infamil and Neosure can be fed.

Hand-rearing vs. supplementation

Refer to chapter on CD

It is important to go to great lengths to not hand-raise a lemur. Aside from general hand-rearing issues, we do not have good formulas. Hand-rearing is different from supplementing, where the individual is still with the mother. Hand-rearing leads to a potentially nutritionally deprived individual. Growth curves are much lower in hand-reared individuals and are not getting as much contact. This does not mean they don't need help with nutritional or medical support. Even when mother is not producing enough milk, the individual can be pulled and given milk, but can still learn behavior from the mother.

Question (Julie Taylor) What about oxytocin and lactation?

Moderator (Cathy Williams): We will pull infants and put in incubator or restrain mothers, but only for so long. We are not opposed to knocking down a female and putting the baby on her. To help lactation, oxytocin can increase uterine contractions and help milk let-down. It also is a feedback loop to the brain to produce more milk. Also, can use metaproclamide (Reglin).

Question: What is the dosage?

Moderator (Cathy Williams): Not sure, given three times a day.

Comment (Julie Taylor) Also, important to remember there may be other reasons a mother is not lactating.

Question: Does it work in other species?

Moderator (Cathy Williams): Yes.

Question (Kristen Lukas): What about fenugreek?

Moderator (Cathy Williams): I don't know much about it. It works well in human females.

Answer (Julie Taylor): We tried this briefly, but she didn't like it.

Question (Monica Mogilewsky) Is there a way to nutritionally supplement mothers before birthing so infants develop larger?

Moderator (Cathy Williams): You can look into this. However, if they're eating a balanced diet, there is reluctance about prenatal supplements. If you need supplements, do not give ones containing iron. The best way to stack the odds is the best diet you can give and keep stress levels down.

Question (Scott Gamerl): What is the best way to handle when a mother first has a baby?

Moderator (Cathy Williams): If we know a mom is pregnant, she is kept separated. There is a high-rate of infanticide in crowned lemurs. There is a need to keep stress low and keep them in a lower-density area. Trying to keep the mother calm is important.

Comment (Laura Suski) If you need to separate, keep olfactory senses intact.

Question (Monica Mogilewsky): Has anyone given oxytocin to aggressive dams to bond with infant?

Answer (Karen Weisenseel): This works in *Nycticebus*.

Answer (Megan Elder): There can be a side effect of depression with Reglin.

Session 2: Prosimian Health

(Moderator Cathy Williams, DVM Duke Lemur Center)

Topics

- Intro to session
- Exams and diagnostic testing
- Species specific disease problems
- Common health problems in captivity (dental problems, diarrhea/gastro intestinal, obesity, diabetes, infections, kidney disease, cancer, other)

Cancer:

The better diets we provide and the better we are at husbandry, the more cancer we will get. Animals die eventually and cancer is often an old-age disease. A study was just done examining medical records and the types of cancer observed. They found 123 cases of cancer in 101 animals. The digestive system was affected the most with the liver being the most affected organ. This was followed by hematopoietic, endocrine, reproductive, urinary, skin, respiratory and nervous systems in that order. We do not find many mammary tumors, but other reproductive organs can be affected. The most common tumor in the liver is a hepatocellular carcinoma. Humans that experience iron overload are more likely to develop liver tumors. They found no relationship in lemurs. Also, found no hepatitis viruses. Age 11 to 15 is the most common age at death.

Question (Grace Fuller): Is there a relationship between light cycle and development of mammary tumors?

Moderator (Cathy Williams): Higher estrogen levels stimulate breast cancer. Blind people have a lower incidence of breast cancer and the more light they see the higher their risk. People with breast cancer have lower melatonin levels. In animals, melatonin has an anti-estrogen effect. Melatonin-like compounds may be a treatment for women with breast cancer. We do not know if lemurs housed in environments housed in high light intensity at higher risk for developing cancer. Its better to provide a more natural light spectrum.

Diabetes:

Type 1-juvenile diabetes, deals with an immune response, early-onset and inherited.

Type 2-used to be considered old-age onset, more closely related to diet and food intake, occurs more in obese people.

We most likely see Type 2 diabetes in our animals and can be controlled with proper diet. If an animal has untreated diabetes, blood sugar is very high. If they have too much insulin, blood glucose can be very low. Average blood glucose is about 100. Lemurs are very prone to developing stress hyperglycemia...this does not mean they are diabetic, but that they are stressed or scared. If the blood sits too long, you may get lower values.

Question (Dawn Stone) How long does it take for increases in glucose from stress from catch-up to go down?

Moderator (Cathy Williams): This is not known.

Case study: Female brown lemur..her glucose came back at 400 ug/dL (very high). There was also sugar in the urine. Once blood sugars get over 300, sugar starts spilling over into urine. You can also test serum fructosamine, which tells what glucose has been over the long term. This female was 289 and normal is 450, so she was not diabetic. Lesson learned: never believe one set of tests ever, need to take multiple tests.

Question (Chris Kuhar): Can you use a urine sample collected in a non-stressful environment to look at sugar?

Moderator (Cathy Williams): Yes, but you need to consider what is on the floor and how that may influence the content. Also, matters how long the urine has been sitting. Samples taken off the floor are more likely to come up positive, which may be an interaction with the cleaning agent. Also need to ensure that the environment is in fact non-stressful at the time of collection.

Diabetes treatment and prevention:

Insulin is one option, but given inappropriately it can give a lot of problems. This should be a last resort. Diet is one great way to deal with this. Remove simple sugars and starches and increase dietary fiber. It is helpful to split diet into three feeding periods. There is a strong correlation between weight and insulin resistance. It is important to keep them within their weight range.

Renal disease:

58% of animals at DLC has kidney disease and 20% of these were euthanized. You need 25% of your kidney capacity to survive. It is hard to know what caused injury to kidneys. Kidney disease affects bamboo and mouse lemurs more. Polycystic kidney disease where kidneys develop clear fluid filled cysts. This can be from a genetic predisposition, but don't know from lemurs. Some lemurs with renal disease develop thickening of the joints, which probably deals with calcium deposition.

Question (Monica Mogilewsky): Have you seen kidneys full of crystals?

Moderator (Cathy Williams): Were the crystal stones primarily in the pylorus?

Response: Yes, hardly any tissue, just a big stone.

Moderator (Cathy Williams): We don't see kidney stones often in lemurs because they have dilute urine. I have heard of calcium oxate crystals. This can occur if they have a high levels of calcium in the diet. You will need to get the crystal analyzed.

Question (Dawn Stone): Do you see a thickening of joints from other things, like lymphoma?

Moderator (Cathy Williams): This is very possible.

Dental disease:

Feeding a primate biscuit with Dentaguard, it is a good thing. Tooth root abscesses are the most common. If the pulp cavity gets exposed, bacteria can form an abscess. Antibiotics will relieve swelling temporarily. So you can remove the tooth or get a root canal.

Comment (Jodi Wright): We have had problems with abscesses on the bottom teeth.

Moderator (Cathy Williams): Just need to take the tooth out, cannot do a root canal on these teeth.

Question: What biscuit has Dentaguard?

Moderator (Cathy Williams): Mazuri, Purina, and Primates. It is more expensive.

Ocular Problems:

This occurs most commonly in the nocturnal prosimians. Cataracts is a clouding of the lens and can get opaque. It can be partial or complete. If the cataract starts leaking protein into the eyeball, this causes inflammation. This can then lead to glaucoma which is an increase in pressure in the fluid of the eye. If production of fluid is greater than drainage, this leads to glaucoma. Retinal degeneration is age related changes to the retina. Retinal detachment and blindness may be associated with hypertension and renal disease. It is good to cultivate a relationship with a veterinary ophthalmologist.

Contraception:

Ingrid Porton is a great resource. DLC has used Deproprovera. There has been aggression from female ruffed lemurs to the males. MGA last 2 yrs. if they stay. This has been difficult with ring-tailed lemurs. The male and female can be separated during estrus. Deslorelin can be used in contraception and has been used to decrease aggression. Deslorelin acts on pituitary gland and stops production of precursors of testosterone development. We have not observed side effects as of yet. Currently, there is a trial occurring on two male sifakas.

Question (Monica Mogilewsky): Has anyone tried using it as male contraception?

Moderator (Cathy Williams): We do not know if this works in lemurs just because there is no information.

Question: Would you need to implant both males and females?

Moderator (Cathy Williams)r: When you give Deslorelin, his testosterone peaks. If you give it to both, need to separate because they will breed. You should wait a month or so if you are planning to introduce a male.

Comment (Chris Kuhar) You need to implant yearly.

Comment (Cyndi Griffin): What does Deslorelin work on?

Moderator (Cathy Williams): It decreases testosterone and sperm, but urge and behavior still be there.

Response: Implanted one macaque and he died within 15 minutes. We thought there may be an allergic reaction.

Comment (Chris Kuhar) This has been reported in a Hamadryas baboon.

Comment: We have contracepted with MGA, but had issues with female dominance hierarchy. Would Deslorelin help?

Moderator (Cathy Williams): It would change, but may not necessarily help.

Question (Jodi Wright) How far will MGA implant travel?

Moderator (Cathy Williams): Yes, they can migrate.

Non-reversible methods are also used such as vasectomy, castration, and tubal ligation or ovariectomy. If vasectomize, they will look like females.

Question (Desiree Haneman): Used Deproprovera in ruffed lemurs and had a huge weight spike, has anyone else experienced this?

Response (Monica Mogilewsky): Yes, female went up 1 kg.

Moderator (Cathy Williams): Common with all animals, but Deslorelin does not cause a weight increase.

Neonatal Care:

Hard to address because every case is different. First time dams have trouble with babies. It is always important to try to minimize stress. Infant failure to nurse is a big problem. It is hard for dams to address this. The most common results are hypothermia, low blood sugar, and difficulty finding the nipple and latching on. DLC always catch infants up right away and get weights, etc. 25% dextrose and warming them can be apart of supportive care. Infants will not nurse if the latter two situations are not constant. Body temperature should be 96-98.

Comment (Monica Mogilewsky): Feet should be grabbing too.

Moderator (Cathy Williams): Gripping is the last thing that goes so not a good gage.

Comment (Karen Weisenseel): Don't worry about a first-time dam losing a baby. If you can, kenneling the dams can work (especially *Varecia*).

Question: Do you have aggression when you crate them?

Moderator (Cathy Williams): When we pull dam for weighing and then put her back with the baby and she takes aggression out on baby.

Response (Jodi Wright.) There can be aggression when they are kenneled together.

Response (Monica Mogilwesky.) When dam was first crated, she was very aggressive and stepped on baby several times. However, after eight hours she was good with the infants even though they did not survive. You need to give them time.

Moderator (Cathy Williams): Dams do not like cold, lethargic infants.

Toxoplasmosis:

This is a protozoal parasite that has a natural symbiotic relationship with cats. It cannot complete its life cycle in any other animal. When the cat defecates, they cysts live in soil, earthworms, etc. If these cysts are ingested by lemurs and will migrate out of intestine into other areas. People are losing ring-tailed and galagos to this. Lemurs are not all equally affected, some species have more problems. Depending on the concentration of ingested cysts, you may see sudden death, but could take awhile. Ring-tailed lemurs can experience respiratory problems. Ruffed lemurs can develop titers and not get sick. It is very difficult to diagnose because a titer must be run on a blood sample, then again in 4 weeks. By then, the lemur is dead. You can get cellular aspirates from the liver, but you need to look for it. Treating it is also hard. There a variety of antibiotics that may or may not work. Prevention is the best thing to do. You need to remove feral cats or watch your exotic cats. Be careful of drainage from exotic cats to prosimians. You also need to be careful of exposure to fruits and vegetables. Everything should be scrubbed.

Question (Cyndi Griffin): If exposed, are they at risk for re-infection?

Moderator (Cathy Williams): In theory, they shouldn't be.

Comment: You can see neurological symptoms.

Question: Have you heard of lemurs contracting *Baechlispirus*?

Moderator (Cathy Williams) Associated with raccoons and can migrate to the brain. This is very hard to diagnose and there is no way to treat it.

Response: May have been treated at one institution with Albenezol.

Response (Jodi Wright.): A ring-tail is housed next to serval. Are they resilient because they have been exposed?

Moderator (Cathy Williams): This depends if the serval is being served raw meat or if serval has already had taxoplasmosis.

Session 3: Prosimian Reproduction

(Moderator Ingrid Porton, St. Louis Zoo)

Birth control methods:

Contraception

Why?

- Exhibit and off-exhibit holding is the main limiting factor for breeding lemurs in captivity
- Many species reach sexual maturity at a younger age in captivity because of better nutrition; reversible contraception can allow these offspring to remain in their natal groups longer.
- AZA acquisition/disposition policy- ensure that animals from AZA member institutions are not transferred to individuals or organizations that lack the appropriate expertise or facilities to care for them. Ensure that the welfare of individual animals and conservation of populations, species and ecosystems are carefully considered during acquisition and disposition activities. At no time can animals be brought into the pet trade.

Options to reduce surplus animals

- Euthanasia (more common in Europe)
- Transfer to non-AZA facilities
- Prevent non-recommended reproduction- often a greater challenge
- Code of professional ethics allows for a level of population and personal responsibility.

Contraception Methods

- Contraception will not eliminate surplus animals but will greatly reduce their number and demonstrate to the public our institutions' commitment to insuring every birth is a planned birth.
- Requires an Understanding of species reproductive physiology
- Female contraceptive implants: MGA, depo provera, birth control pills, norplant, deslorelin.
- There are different types of synthetic progestins in the above methods and they will have different effects.
- Mode of contraceptive action: can inhibit ovulation, modify LH/FSH levels, prevent implantation- there are a variety of methods of action. Duration of efficacy differs by progestin type and by species, so it's hard to know how long contraceptives are effective.
- Behavior and contraception may not match; animals can still express reproductive behavior even if the contraceptive is working.
- Male contraceptive option: reversible vasectomy.
- Different options for different stages of life. May not want to use untested methods on selected breeders, take more risks with animals later in life.
- To evaluate success: change in behavior, is the contraception effective. Recording these data for the contraception database maintained at St. Louis is important because we are basically conducting research here. We are using new methods on new species and need to be constantly evaluating their efficacy.
- Specific Contraception methods:
 - MGA implant (but problems with keeping implants in)
 - GnRH agonists: Lupron depo or deslorelin. Has behavioral implications. More research needed to determine species-specific dose and the duration of efficacy. Used in males and females. Causes initial stimulation for the first 3 weeks followed by suppression for 6-12 months. Not recommended for timed reversals because the implant is difficult to recover. Research needed for male use (dose, duration of efficacy, interval to fertility- complete sperm depletion difficult to determine). Lion-tailed macaques at St. Louis given GnRH agonists: one of the males was never suppressed, so whether deslorelin is ever really contraceptive is difficult to know.

BUT scary: some males after a single tx never recovered any levels of sperm. So hesitant to use deslorelin with potential breeder males.

Case study-lion-tailed macaques: Deslorelin-one male was never suppressed based on blood samples. You may see a decrease in testosterone, but you need to make sure no sperm is still being produced. We have had reversals from this product in other species. There is hesitation in using this in males who may be a potential breeder in the future.

Reversible vasectomies:

This has been done on bushdog, gorillas and other animals.

You need to consider delivery method: oral, surgery, implant, etc. If you use an MGA implant, you need to separate the female from her companions or you are more likely to lose implant. Many times institutions have thought this method failed, but the implant had fallen off. Depoprovera can be darted, but the problem is you are never sure you got the whole dose in. If you can't retrieve an implant, this is also an issue. The behavioral ramifications along with health and age must be considered with birth control. There can be color changes that seem to be associated with sex of the animal (i.e. male lightened in color similar to a female). For Depo-Provera, the interval between injection and when they conceived to determine the dose needed. DLC has done vaginal cytology in the past, but involves catching them up and having someone to read the signs. Diane Brockman was looking at seasonality—capital or earned reproductive strategy. Even though these animals are supposed to be seasonal, they can cycle many times. There is more variation in seasonality in captive animals, often on a nutrition basis.

Case example-Propithecus---if contracepting, put implants in instead of Depo-Provera. Faustina has become pregnant many times despite breeding season.

When animals become sexually mature (usually 1.5 years) needs to be considered.

Question: Is this across lemur species?

Moderator (Ingrid Porton): Eulemurs and lemur (1.5) and ruffed lemurs (2-2.5)

Comment: DLC is compiling data on age at maturity.

Question: What if a female is contracepted when she is already pregnant?

Moderator (Ingrid Porton): She can end up not being able to deliver the offspring resulting in death. These detrimental effects have not been observed yet.

Reversibility:

How do we evaluate? We need to compare contracepted and non-contracepted females at the same age and reproductive levels. Just because a female hasn't reversed, doesn't mean the contraception is ineffective.

Study-ruffed lemurs: Study examined who has been contracepted and have they had offspring after. 130 MGA implants were examined and there were no failures in 155 breeding seasons. There were 518 bouts of Depo-Provera and had 9 treatment failures. There were 23 cases of female breeding post-contraception which shows it does not cause sterility. 12 of these females were nulliparous.

Question (Megan Elder): What is going on with *flavifrons* in our captive population?

Moderator (Ingrid Porton): I don't know. Why are females not producing?

Recommended book: Wildlife Contraception: Issues, Methods, and Applications by Ingrid Porton and Cheryl Asa. Also, contraception questions can be asked at the St. Louis Zoo Wildlife Contraception Center.

Question: Females are not very seasonal and vet wants to do an MGA implant, is this a good idea?

Moderator (Ingrid Porton): There may be problems getting them to stay in. This has worked successfully in ring-tailed lemurs. If you can check the email, often, it is effective.

Question: Can you do Depo year-round?

Moderator (Ingrid Porton): You can, but recommended against because of the andronizing effects.

Comment (Monica Mogilewsky): Audubon Zoo vet has a technique to keep MGA implants in so he could be contacted.

Moderator (Ingrid Porton): The female needs to be isolated for 5-7 days. If you put the female back in, you need to watch or put steel sutures over the site to keep them from grooming. Must sterilize the MGA implant. All species have been contracepted with this.

Question: Do they migrate more in ring-tails?

Moderator (Ingrid Porton): They can migrate in any species. A steel suture can be put in the implant to allow it to be found on X-ray.

Comment: To keep animal away from suture, they put other sutures on animal and painted the toenails. Or put gum in the hair to occupy them.

Question (Scott Gamerl): Female is on contraception from another zoo, how easily can you flip the contraception?

Moderator (Ingrid Porton): If you remove MGA and go to Depo, you need to do it right on top of each other. Cannot allow an interval or she may start to cycle. You can also do it the reverse way.

Comment (Julie Taylor): With a ring-tail, waited 41 days and got pregnant.

Session 4: Nocturnal (and Diurnal) Prosimian Exhibit Design

(Moderator Kris Arnold Busch Gardens Tampa)

Topics

- Intro to session.
- Nocturnal Exhibits
 1. Light Cycles- duration of phases, color of lights.
 2. Temperature changes in connection with light cycles.
 3. Display Set-Up. (substrates, branches, nest boxes and sleeping sites, feeding location, guest viewing considerations)
- Diurnal Exhibits
 1. Exhibit Needs (arboreal, terrestrial)
 2. Feeding Sites (feeding encouragement, guest views)
 3. Outdoor Exhibits (moats and mesh barriers)
- Lorisidae Light Cycle Behavior Study Data Discussion (Grace Fuller, CMZ)

Intro to session

Case study: Attempting to make bushbaby visible to the public. We tried a reverse light cycle. He stayed in his next box and he did not move once for several hours and eats between 3:00 and 8:00. Bright lights are used at night and red light during the day. Blue light is used in some bat exhibits. There is a problem with visibility when animals are hiding in next boxes.

Comment (Dawn Stone): Pygmy slow lorises like cross ventilation and prefer baskets to boxes.

Response (Helena Fitch Snyder): Lorises sleep more out in the open.

Moderator (Kris Arnold): The biggest balance is visibility and comfort.

Nocturnal Exhibits

1. Light Cycles- duration of phases, color of lights.
2. Temperature changes in connection with light cycles.
3. Display Set-Up. (substrates, branches, nest boxes and sleeping sites, feeding location, guest viewing considerations)

Question (Cathy Williams): DLC had always used blue lights and switched to red a year ago to encourage reproduction. The lorises were more active under red light.

Response (Mike Dulaney): Cincinnati switched to blue for the lorises. It doesn't matter how dark the night is, it matters how bright the light is. Exhibits don't need to be that dark, if the light part is very light. No complete darkness is provided.

Response (Karen Weisenseel): Graduate advisor says you need dark. Bushbabies were most often seen in non-full moon.

Response (Helena Fitch-Snyder): Same with pygmy lorises.

Response (Mike Dulaney): You can mix nocturnals with many animals so if they are not active something else might be.

Response (Tad Schoffner): Pottos were not active. Elephant shrews were moving in exhibit, put reverse light cycle and neither animal was moving. The pottos will occasionally move around even after we switched to a diurnal exhibit.

Response (Dawn Stone.): When off exhibit, pottos were in dark and moved around. Now we are experiencing with neutral density filter.

Response (Chris Kuhar): It looks like a brown out and we didn't turn off light. The blue light appears like white light to the animals.

Question: What is a neutral density filter?

Answer (Chris Kuhar): Reduces light, but doesn't change spectrum.

Response (Dawn Stone): We have bright lights during the pygmy slow loris day, but they prefer to come out during bright light then during their night.

Comment (Briana Evarts): We are having guided tours through the nocturnal aye-aye exhibits. It is dark using blue light. As peoples eyes adjust, they can see the animals.

Comment (Karen Weisenseel): Mesker Park has a great exhibit.

Comment: If a white light burns out, animal will not come out.

Question (Scott Gamerl): Can it be less binary, instead of just red and just blue? Light changes would be gradual.

Moderator (Kris Arnold): This is occurring right now. There is an interest in doing temperature changes along with light cycles, it has helped with bats.

Question (Chris Kuhar): What are Cincinnati's white lights?

Answer (Mike Dulaney): Most of it is a 4 ft fluorescent tube as white and one fluorescent tube of blue.

Comment (Laura Suski): We can do whatever we want at DLC because of no public. We have a dense canopy over sleeping area by placing fleece blankets over their trees. Instead of going in the box, they prefer to be out in the open, but under this canopy. They took a shavings bag and putting it over the branch, without being a tight fit. This causes them to locomote a lot more. They prefer the brushier areas and they need a corridor of brush.

Comment (Sue Rifai): A pygmy loris female has food in six different areas each day and she has to go out and look for it.

Comment (Helena Fitch Snyder): If you spread gum on branches, they will spend a lot of time trying to get it.

Response: We try jello and crickets.

Response: You can put crickets in the fridge to help the prosimians get them.

Response (Laura Suski): You can use fishing bait cages to get the crickets. The cage is a tubular bucket with a handle, usually wire mesh with a plastic rim on top and bottom, and plastic insert in middle. Animals can climb around and animal can use it to hunt.

Comment (Kathleen Milk): Use red light, when used target stick animals responded more to a blue target.

Comment (Adrienne Saunders): A hamster ball can be used for crickets. Has anybody used extra UV light?

Response (Kathleen Milk): Use can lights or screw-in bulbs so provides dark corners for them.

Response (Jim Metzinger): 500 watt light increases the heat.

Question (Grace Fuller): Slow lorises like to roll in sawdust to improve coat, any thoughts on this?

Answer (Helena Fitch Snyder): You can have respiratory problems with sawdust, so use bark and straw.

Response (Laura Suski): We use pine shaving, but never see pygmy lorises on ground.

Response (Helena Fitch Snyder): They do like to be on the ground. We never saw pygmy lorises on ground but slow lorises go on the ground.

Question (Tad Schoffner): Has anyone tried incorporating a hollowed out tree into the exhibit?

Answer (Monica Mogilewsky): We do this for diurnals.

Response: Vets sometimes have problems with bringing in trees just from out in the woods.

Response (Mandy Fischer): Philadelphia Zoo has a deal with a neighboring park. We have an approved browse list with our vets.

Response (Tad Schoffner): A log you bring in has larvae, etc. that primates might enjoy.

Answer: Also can swap perching between different exhibits.

Answer (Scott Gamerl): You can get trees and grass clippings from recycling center. They will occasionally put a nice log aside for their use. Recently, re-did their exhibit, cut timber bamboo and ruffed lemurs love it. It is pest resistant, provides natural effect and diffuses light.

Answer: Have to deal with restrictions from manager.

Answer (Karen Weisenseel): Be careful with bamboo because can split and crack. A finger got caught and an animal died at Duke.

Question (Chris Kuhar): How many institutions have nocturnal exhibits in a nocturnal building vs. a diurnal building? (Raised hand count about 50:50.)

Response (Desiree Haneman): Philly Zoo has a nocturnal curtain.

Response (Tad Schoffner): Our nocturnal exhibits are in a diurnal building...ambient light streams in.

Question (Cyndi Griffin): Can tinted car window glass be used?

Answer (Jodi Wright): Our zoo did this with amphibians, but it didn't work.

Response (Mike Dulaney): Noise also keeps nocturnals awake when public is there.

Diurnal Exhibits

1. Exhibit Needs (arboreal, terrestrial)
2. Feeding Sites (feeding encouragement, guest views)
3. Outdoor Exhibits (moats and mesh barriers)

Question (Kris Becker): What are general moat widths?

Response (Jodi Wright): 5 or 6 feet.

Answer: We have a 10 ft moat.

Response (Desiree Haneman): We have a moat where public can row up on boats next to lemurs on island.

Response (Tad Schoffner): We have used our islands on our lake: reds, mongoose lemurs.

Mongoose lemurs were best at escaping, but overall we have had no real problems.

Response (Monica Mogilewsky): Group stability has a lot to do with this. We use electronet and highly motivated lemurs will take 800 volts.

Question (Tad Schoffner): How many people swap perching between lemur exhibits?

Response: Several institutions do.

Response (Tad Schoffner): This is probably considered taboo.

Response (Jodi Wright): Also switching predator and prey perching.

Response (Desiree Haneman): They will spend quite a bit of time scent marking when this occurs.

Response (Tad Schoffner): We had a low-ranking male and he went crazy scent-marking on the island until he was exhausted.

Response (Karen Weisenseel): Hediger says don't clean too much for the lorises.

Response (Monica Mogilewsky): Same is true for crowned lemurs.

Question (Monica Mogilewsky.): Does anyone get sores (nest box callus) under tail from scent marking or sitting on nest box? Is there a material besides wood to be used?

Response (Karen Weisenseel): You need something porous or also you need to be careful with what you're cleaning with or treating wood with.

Response (Desiree Haneman): You can use corkwood.

Response (Julie Taylor): We have plastic shelves, but we see the problem.

Response (Monica Mogilewsky): We see this in multiple species.

Response (Laura Suski): It helps to heavily branch on top of the box.

Lorisidae Light Cycle Behavior Study Data Discussion (Grace Fuller, CMZ)

There are currently many different practices employed by different institutions which leads the stage for more research. I collected 12 hours of data for each animal. The individuals spent the most time resting, asleep or in their nest boxes. Activity levels are low, regardless of lighting. Active behaviors did occur throughout the day. 10 AM is the time the animals are fed and the building is open to the public which may have an influence. My central hypothesis is that high intensity lighting alters circadian rhythms of activity and hormones in captive lorises. I am using three lines of research to address lighting, activity and health. The first part of my research will include a survey and records review. The second part of this research will involve validating the use of accelerometers. The third part of this study will look at changing lighting on behavior and health. We are particularly interested in suppression of melatonin. Blue light knocks out melatonin more than other wavelengths, which is not a good thing. Zoos can help by filling out in survey, sending copies of medical and diet records, contribute banked serum, participate in an actigraph study and participate in lighting study.

Session 5: Nocturnal Prosimian Reproduction (Moderator Helena Snyder, San Diego Zoo)

Topics

- Intro to session. (General information provided)
- Reproductive biology: sexual maturity, estrus frequency, gestation length
- Reproductive monitoring: determining gender and estrus cycles
- Mating behavior and pairing management
- Monitoring pregnancy: confirming pregnancy, birth preparations
- Neonatal management: when to hand-rear, housing and social groupings
- Future breeding: when and how to separate kids and pair for breeding

Intro to session. (General information provided)

There is quite a bit of overlap between reproduction in diurnal and nocturnal prosimians. Today we are going to talk about the factors that influence and maintain nocturnal prosimian reproductive health.

Reproductive biology: sexual maturity, estrus frequency, gestation length

It is important to know species-specific life history factors. Awhile ago, people assumed that pygmy lorises could be managed the same as slow lorises, but this is not necessarily true. Some species have more information available than others.

Question: Does anyone not know the basic biology of their species? Not a problem.

Case study: Bengal slow loris and pygmy loris—found that there were some distinct differences. 1. Seasonally vs. reproduce throughout year, 2. multiple births common vs. rare, 3. males testes may or may not change.

All of these populations should be considered a research population so we can learn more.

Question: What are natural light conditions?

Moderator (Helena Fitch Snyder): We came in during the night to watch behavior.

Question (Laura Suski): Is the an effect of photoperiod or effect of natural light?

Moderator (Helena Fitch Snyder):: Could be both.

Question (Mike Dulaney): Are they seasonal in the wild?

Moderator (Helena Fitch Snyder):: Yes, that could play a role specifically for pygmy lorises. The breeding season was the same in San Diego as in the wild.

Environmental factors

Social housing, lighting, and olfactory processes are all important environmental factors. One institution kept several generations together and other institutions have moved infants out once they started getting older.

Question: Anyone have issues with social housing?

Response (Laura Suski): Does the presence of other species have an effect?

Response (Mike Dulaney): We had slender lorises with mouse deer and did not have any problems.

Moderator (Helena Fitch Snyder): This would depend on the mixed species.

Question (Cathy Williams): Is there an advantage to housing as pairs or just putting males in at breeding season?

Moderator (Helena Fitch Snyder):: In my study, there was no difference. I would put them together just for breeding, then different males could be swapped out. There are some cases where pairs worked.

Question (Laura Suski): How long was visitation with other males?

Moderator (Helena Fitch Snyder): Long enough to mate. Sometimes it would take the male two hours to figure out the gate was open.

Question (Laura Suski): How long will female wear plug?

Moderator (Helena Fitch Snyder):: Half a day, but there is quite a bit of variation.

Question (Chris Kuhar): Have you seen activity pattern differences between females housed solitarily and those housed socially?

Moderator (Helena Fitch Snyder): Never been studied, but that does make sense, although visual or olfactory processes can help.

Comment (Karen Weisenseel): The fluctuating light cycle was important.

Response (Grace Fuller): Pygmy lorises are far enough north, but there is enough fluctuation in light.

It is important to be careful regarding overcleaning cages in nocturnal prosimian cages. One study looked at olfactory communication and mate selection. Males and females were housed separately. Female would be exposed to male scents and she could choose. Females chose to mate with familiar and “top-marking males”. This is important to consider if you are trying to get a pair to mate.

Question (Ingrid Porton): How long did the female have to investigate?

Moderator (Helena Fitch Snyder): She had access at least one month before breeding season.

Question (Grace Fuller): Counter marked is more important than more familiar males.

Reproductive monitoring: determining gender and estrus cycles

It is really important to keep good records of what is going on with the pygmy lorises for breeding. It helps to have trained staff good at identifying and realizing that it is hard to identify gender. Pictures can help with gender identification
See CD for loris cycle monitoring systems

Estrus cycle ratings:

Stage 1. Vagina sealed, pale and dry

Stage 2. Vagina partially open, pink, moist

Stage 3. Vagina fully open and flushed, mucus or moist

Important to focus on what is normal for each individual. It is very important to be consistent between keepers. It really helps to carefully monitor each species. Ex. Lion-tailed macaque male that was thought to be infertile, but immediately got a 3 month old female. It turned out to be a problem with the females.

Mating behavior and pairing management

Keeping pairs together or during estrus is up to each institution, but need to monitor female.

Monitoring pregnancy: confirming pregnancy, birth preparations

At San Diego, developed assays to detect pregnancy in urine samples and could predict whether she was pregnant with twins or a singleton.

Question: Do any of you have access to endocrinology labs where you access fecal and urine?

Answer: They do at Duke, Cleveland, etc.

Comment (Cathy Williams): Can palpate to determine pregnancy.

Comment (Karen Weisenseel): I think you can palpate diurnal animals and do not stretch when holding them.

Question (Monica Mogilewsky): Are you worried about stress of handling causing spontaneous observations?

Response (Cathy Williams): Have not had a problem.

Question (Scott Gamerl): What about when the cycle ends?

Moderator (Helena Fitch Snyder):: If they are monthly cycles, this would provide an indication.

Question (Ingrid Porton): How many times do they come into estrus if they don't get pregnant?

Moderator (Helena Fitch Snyder):: Not a lot of data, but did not happen. If a female came into full estrus, then she didn't go into another full estrus.

Comment (Karen Weisenseel): Be careful if female goes out of estrus, it could indicate illness.

Comment (Kathleen Milk): One pygmy loris went immediately into estrus, right after she got pregnant.

Comment (Jeanine Jackle): Female would get bitten by male every time she was pregnant.

Question: Hand raised red ruffed lemur is due soon and is aggressive, will this aggressive behavior towards males continue after she has the baby?

Response (Ingrid Porton): You can take out the males, but she is not going to get nicer. Will aggression increase? Yes, probably. There was not a significant difference between hand-raised and mother-raised parents in rearing their young.

Response (Mandy Fischer): I had a good relationship with female sifaka, but need to be ready for anything.

Question: How many take males out when female is pregnant?

Answer (Jeanine Jackle): We've done both.

Response: My usual plan was to take the male out because we wanted to know who bit the animals. Also they are solitary in the wild so this is more natural. Some argue that the males may help out with the birth.

Neonatal management: when to hand-rear, housing and social groupings

Question: Has anybody had experiences with cross-fostering?

Answer (Cathy Williams): DLC has done some of this.

Question (Kathleen Milk): Are there any problems with twin infanticide?

Answer: We never did, but other institutions have had some problems with this. Those with smaller birth weight typically are the ones selected.

Future breeding: when and how to separate kids and pair for breeding

Case study of parental aggression where female was stressed and then she bit the baby and it became infected. This caused us to take the male out ahead of time.

Question: Have you had a problem with inbreeding potential?

Comment (Julie Taylor): When should kids be separated from relatives?

Moderator (Helena Fitch Snyder): 1.5 years.

Response (Julie Taylor): Slow loris female that conceived at 7 months of age.

Response (Karen Weisenseel): That's the youngest I've ever had.

Moderator (Helena Fitch Snyder): 14 or 15 years old for the slow loris is the oldest age at reproduction. Oldest potto is 28 years old.

Question (Kris Arnold): Do nocturnal prosimians produce more males?

Moderator (Helena Fitch Snyder):: There is variation.

Question (Adrienne Saunders): Will pygmy loris captive population increase?

Moderator (Helena Fitch Snyder):: We now know that they are CITES 1, more zoos are interested in bringing in slow lorises. If we do good with what we have with pygmy lorises, we won't need to import for awhile.

Comment (Kris Becker): There is a huge male bias in Eulemurs.

End of day 1

Session 6: Prosimian Introductions

(Moderator Chris Kuhar, Cleveland Metroparks Zoo)

Topics

- Intro to Session
- Eulemur Introduction Guidelines
- Challenges with Introducing Prosimians
 1. Horror Stories
 2. Species Differences
- Introduction Approaches
 1. Species Differences
 2. Mixed Species Exhibits
 3. Breeding Season
- Pros and Cons of Individual Approaches
- Success stories
- What knowledge gaps do we need to fill?

Intro to Session

We want to collaborate and come up with a general introduction outline.

List of considerations for introductions:

Individuals

Species

Age

Group size/demographics

Timing/season

Exhibit

Time of day

Reproductive condition

Howdy/visual

Staffing

History

Familiarity

Public

Management style

Communication

Neutral site

Health

Plan

Eulemur Introduction Guidelines

1. Make a plan

2. Who, what, when and where

Comment (Cyndi Griffin): Before visual, I would start with olfaction or auditory access.

3. Non-visual access—ex. sharing toys, etc.

4. Visual access (non-contact)

5. Limited access

Comment (Cyndi Griffin): We have skipped step 5 because of injuries based on frustration with mesh. We will come back to this.

Comment (Laura Suski): By limited, I did not mean putting fingers through mesh, but access to each other.

6. Full body contact

Comment (Kathy Vires): Keepers need to be monitoring individuals during steps 5 and 6

Comment (Mandy Fischer): You can decide when to monitor in the who/what/when section.

Comment (Desiree Haneman): The full contact can only occur for a short period of time.

7. Expanded time spent together

Comment (Laura Suski): During Step 5, need to start coming up with an emergency plan B.

Comment: At some point, need to test the waters with new types of enrichment. Make sure they will come into a tight space together and then see if they will feed.

8. Competition

9. Overnights

Comment (Scott Gamerl): One point should be maintenance of social relationship.

Response: For Eulemurs, the intro can occur quickly and a few days later things can turn sour.

10. Maintenance

Comment (Laura Suski): They could be peaceful for a week or two and suddenly everything breaks apart.

Comment (Grace Fuller): Does anyone use cooperative feeding with introductions?

Comment (Dawn Stone): Yes, I think this is important. This is where I see a lot of the aggression between the group.

Comment (Tad Schoffner.): Wouldn't that fit into competition?

Comment (Dawn Stone): I would work with the dominance hierarchy and moving from the dominant to the subordinate animal.

Question: What other type of training?

Comment (Dawn Stone): Stationing and recall

Comment (Karen Weisenseel): I'm not familiar with cooperative feeding, can you explain this?

Comment (Dawn Stone): You are feeding multiple groups and only rewarding good behavior, not aggressive behavior.

Response: You are allowing dominant animals to tolerate more subordinate ones.

Comment (Karen Weisenseel): I've had problems with giving animals special treatment, you need to treat the group as a whole from the start. Sometimes making plans too complex, but eventually you may need to go back to the simplicity.

Comment (Scott Gamerl): It is important to keep a record that you have done your best to have a smooth introduction, this helps you defend against USDA, AZA or local TV station.

Comment: I am using cooperative feeding with my mandrill and dominant animal is rewarded if he allows the subordinate to take food.

Comment (Grace Fuller): Margaret Whittaker brought up a type of training called gentle contact training which involves rewarding them for positive interactions with each other.

Comment (Laura Suski): We tried this and it was unsuccessful. After the training session, they reverted right back to their original behavior. We tried this for 6 months. This was a group of 6.

Comment (Dawn Stone): It works to a point, but then you can't fight biology and they'll fission when they need to.

Response: Dominant animal may learn he needs to sit next to subordinate all the time which is stressful.

Comment (Monica Mogilewsky): This brings up an important point that sometimes introductions are not going to work so need a plan B.

Response: Evaluate should be a part of your plan throughout the entire development process.

Comment (Kris Becker.): Enrichment could be used as a management tool in introduction. It is important to give them a complex environment to provide distractions and hiding places.

Comment (Mandy Fischer): We feed our animals before an introduction, but not their favorite food. Do people not feed their animals during an intro?

Comment (Jodi Wright): We feed them before the intro and then take it out.

Response: You can either give no food or tons of non-preferred diet items.

Comment (Mandy Fischer): Our ring-tails will eat during any circumstance.

Comment (Karen Weisenseel): Browse works really well.

Comment (Dawn Stone): I worked with a group of 5.11 lemurs and burlap was used a visual barrier, but after about 5 minutes the females would find the subordinates they wanted to attack.

Comment (Laura Suski): It is important to monitor the group even if the group is established, then you can see the cliques and stop the trend of target aggression. You need to stop the target aggression before it becomes established.

Comment (Karen Weisenseel): You could try pulling them apart and starting again.

Comment (Laura Suski.): All this has done is buy us time. We bought a year with one male, but he was booted out three times.

Comment (Monica Mogilewsky): The further we get from natural biology the more uphill it will be.

Comment (Kathleen Milk): Is there a risk if you take away their favorite food causing more frustration and aggression?

Moderator (Chris Kuhar): My thought is no, but if you think it might be an issue then eliminate the food items early and let them get frustrated in advance.

Comment: When do behavioral altering drugs come into play?

Comment (Julie Taylor): We've never used them.

Comment (Monica Mogilewsky): I've only used it on an infant.

Response: Oxytocin has a short-term effect.

Comment: I've used Halidol for a calming effect.

Moderator (Chris Kuhar): Drugs may work for one animal and not another. This has been done more in gorillas.

Comment (Julie Taylor): We have an aye-aye on Clomicalm.

Comment (Mandy Fischer): Its important to try to keep one day the same as the last day.

Comment (Megan Elder): You need to be relaxed around animals.

Comment (Desiree Haneman): Some aggression is good, it is natural for the matriarch to be dominant.

Response: I'm more nervous when I see no social behavior from individuals.

Question: When do we decide that our introduction is successful?

Comment (Cyndi Griffin): I get comfortable when I see grooming and sleeping together.

Comment (Tad Schoffner): I had a mongoose lemur intro and they were sitting together tight as can be, but came in next morning and one was torn up. So it's hard to be officially comfortable.

Moderator (Chris Kuhar): When you introduce chimps they will groom each other in a "please don't hurt me" type of way. Your director thinks it's a success once they are in the same room.

Comment (Monica Mogilewsky): We have the luxury to tolerate a large amount of aggression. Sometimes somebody gets lacerated and there is a blowout, but then that's it. This might be hard to tolerate in public places. Often times the one that is beat up the most becomes the dominant animal. I will tolerate brief bursts of aggression as opposed to long drawn-out aggression.

Moderator (Chris Kuhar): I try to make sure Education and Guest Services staff know what is going on so they can relay it to the public.

Comment (Laura Suski): It's important to revisit the plan and define accepted parameters. You need to decide if all of the effort is worth keeping the group together.

Response: That is a good point, this is something not often done in zoos.

Question: If one gets injured to the point they need stitches, do you recover them and get them right back in?

Comment (Monica Mogilewsky): It depends on situation. Our vet doesn't stitch until he absolutely has to. We try to get them back in as quickly as possible.

Comment (Julie Taylor): We have a three strikes and you're out rule to introductions.

Comment (Laura Suski): We can hospitalize some animals near the group.

Comment (Monica Mogilewsky): If one animal gets ill, the whole group comes in.

Comment (Scott Gamerl): If you pull an animal, you could be interrupting an important turnover which might have long-lasting effects.

Question (Briana Evarts): I've had a cohesive group for seven years and now one red ruffed is targeting one of the black and whites---we will hold until the mixed species exhibit.

Question: Does this plan not work for nocturnals or ringtails or is it generalizable?

Comment (Karen Weisenseel): In my experience with nocturnals, I would put the male in with the female so that she had the territory.

Comment (Helena Fitch Snyder): I would recommend putting them in a neutral area.

Comment (Mandy Fischer): I disinfected the sifaka area after they had been fighting and it worked well for a little bit, but then the female remembered the male.

Comment (Dawn Stone): Its always just a matter of time before things fall through.

Question: Could we use these guidelines for interspecies introductions?

Comment (Laura Suski): For nocturnals again, it is important to consider the territory issue.

Comment: You need to make sure that each species gets their important physical needs.

Comment (Laura Suski): We use tic-tac boxes where we could feed each individual animal.

Comment (Monica Mogilewsky): In mixed-species exhibits, you need to encourage each one to fill its separate niche.

Questions: What about housing prosimians with non-prosimians?

Comment (Desiree Haneman): We have lemurs with giant jumping rats.

Comment (Wendy Gardner): We have prosimians with armadillos and we have to be careful because prosimians may eat armadillo food. Partitioning is very important to protect each individual's food.

Question: What about if you are just focusing on infants?

Comment (Sabrina Squillari): Our female had three babies and needs to be introduced back into the group. The male is curious about the babies and they have visual access. It is just the dam, sire and three babies. When is a good age for her to get back in the group?

Comment (Laura Suski): We don't usually separate because the sire protects the nest from the rest of the group. We let this play out. We do separate our sifaka parents for about 2 months and then we start family visits. First we let the male go back with the mother and see how that goes. Then he will go out with the rest of the group. After we know that the primary pair is still ok, then we will bring in the next volunteer with mom and the kids until the entire unit family is in a controlled atmosphere. There is a lot of reconnecting. Then mom and the kid go out with the rest of the family.

Comment (Monica Mogilewsky): Should they do it early before they are all over the place?

Comment (Sabrina Squillari): They are already out of the nest.

Comment (Laura Suski): Your male should be relaxed then and more risks will be allowed by the parents.

Comment (Desiree Haneman): We didn't separate, but at 2 months the female stopped being as protective of the group.

Comment (Tad Schoffner): Peacock is the female form hell and has such iron-clad control over the group that we separated her with her young because males were afraid to move. She had a different whipping boy when here so she changed that. We never separated males out.

Comment (Laura Suski): You can let the subordinate animal take care of himself, if you offer to let him visit the family he may not do so.

Question: Are large groups of males common?

Response: It is mostly ringtails and ruffed.

Question: Why not place male elsewhere?

Comment (Tad Schoffner): Because she may target another male and it may vary seasonally.

Question (Sabrina Squillari): If they want to go onto the exhibit, how will we be able to recall them to get the babies out?

Comment (Laura Suski): Generally, they will follow mom but it may take awhile.

Response: It should be less of a problem because they're mobile.

Comment (Kris Becker): Are they on solid food because you could start training the behavior?

Comment (Sabrina Squillari): They are just starting them on it.

Comment (Tad Schoffner): Dawn worked a lot with getting that group very tactile for injections.

Comment (Laura Suski): It helps to train the mother in front of them so they'll learn by watching.

Response: How often do intros occur with humans in the exhibit? We didn't recommend this in the SSP guidelines because we didn't want this to be a standard.

Comment (Jennifer Donovan): We were in the exhibit with mixed species and we had nets/airhorns to break up if needed.

Comment: We introduced our female in with the males and one keeper will get in between the two individuals to stop the aggression.

Comment (Briana Evarts): We went in our mixed-species exhibit and it worked fine (not during public hours).

Moderator (Chris Kuhar): The institutions that use this as a tool like it.

Comment (Karen Weiseneseel): Some institutions will not allow you to go in with any primate.

Comment (Helena Fitch Snyder): Another key factor is enclosure size.

Comment (Sue Rifai): We stand nearby so we could go in if we needed to at any point.

Comment (Julie Taylor): We generally go in, but we go in daily anyways so they are used to it.

Comment (Laura Suski): We just have two people for initial release, but others are aware by radio in case they are needed. Some are more routine than others, but we don't surround the cage and create a big scene.

*We will revisit intros in the open forum tomorrow.

Session 7: Prosimian Mixed Species Exhibits:

(Moderator Monica Mogilewsky, Lemur Conservation Foundation)

Topics

- Introduction to the session
- Goals of Mixed Species Exhibits
- Advantages of Mixed Species Exhibits
- Challenges of Mixed Species Exhibits
- Solutions to Mixed Species Challenges
- Close

Moderator (Monica Mogilwesky): How many institutions have mixed-species lemur exhibits? (Lots of raised hands.)

Moderator (Monica Mogilewsky): What species are people putting together:

Cats of the World: brown and ring-tailed

Potter Park: red ruffed and mongoose

Capron Park Zoo: black and white ruffed and coronotus

Advantages of Mixed Species Groups:

- (Desiree Haneman): to provide companionship for social outcasts
- (Jacqueline Broder): because director thinks mongoose lemurs are boring; to make exhibits more interesting.
- (Helena Fitch Snyder): for nocturnals, to make exhibits more interesting, to maximize use of space
- To make animals more active
- (Kris Arnold): to educate the public that there are many types of lemurs, not just ring-tailed and ruffed lemurs. They have a gorgeous red-fronted brown lemur. Provides educational opportunities with camps.
- (Sarah Armstrong): but generally ring-tailed lemurs are the most successful in mixed-species groups.

Disadvantages of Mixed-Species Groups:

- Ring tailed and ruffed just aren't getting along
- (Laura Suski): *E. flavifrons* will not tolerate other animals; *Vaercia* won't tolerate other animals either
- Moderator (Monica Mogilewsky): complexity of managing groups is increased; have multiple group dynamics to regulate.
- (Karen Weisenseel): know that species can be aggressive. *Cheirogaleus* broke the neck of galago in one exhibit she worked with.
- (Mike Dulaney): have to watch diets for nocturnals housed with diurnals (and in general)
- Moderator (Monica Mogilewsky): diet issues are common, particularly with mongoose lemurs which will tend to overeat.
- (Laura Suski): Diet issues are common, they feed different chows to different species so it may be better to house species together that have similar diets.
- Management pushes for mixed-species exhibits.
- (Helena Fitch Snyder): disease issues. Lorises housed with provost's squirrels have died from infectious disease contracted from squirrels; lorises carry a parasite that is fatal to callitrichids.
- (Tad Schoffner): we had a provost's squirrel give pasturela to a loris.
- Moderator (Monica Mogilewsky): we may not know disease risks until too late.

- (Jessica Franck): what about lemurs hybridizing? A lot of zoos have had this problem with eulemurs.
- Moderator (Monica Mogilewsky): Eulemur introductions are the hardest and least likely to succeed, and hybridization is a definite risk.
- (Laura Suski): the problem is that these are animals that want to occupy the same niche

What makes mixed-species groups successful?

- Enclosure space
- Enclosure complexity (Karen Weisenseel)
- Flexibility of space (Briana Evarts): give animals options, places to hide, as well as options and flexibility for keepers who are caring for them. Moderator (Monica Mogilewsky): especially true for seasonal breeders, who may be getting along just fine until someone goes into estrus. Give keepers flexibility to pull animals for parts of the year. (Mandy Fischer): we have to be able to change strategies, conditions for the benefit of the animals.
- Try to avoid dead ends, generally the more space the better.

Question (Tad Schoffner): Does anyone think that the type of space (indoor vs. outdoor, not just size) makes a difference?

- Moderator (Monica Mogilewsky): yes, this makes a difference, plus this is probably a type of complexity.

Question (Noelle Weisen): They are thinking of housing a munjac with a b&W ruffed. What does everyone think? Others say this could work.

- (Katherine D'Andrea): had problems with training, but have had lemurs with small deer, porcupines with galagos.
- (Karen Weisenseel): What species (A: G. moholi), and were all the animals active? (A: yes).
- (Desiree Haneman): maintaining species-specific enrichment needs is important as well.
- (Laura Suski): ungulates with lemurs. Their lemurs are free-ranging so fox, deer can be in the area with their ring-tailed lemurs. The lemurs are very adaptive but will chase deer away from their chow. They will eat with geese too. They were worried about infants with foxes but it has worked out ok.
- Moderator (Monica Mogilewsky): St. Catherine's has feral pigs that show up for morning feedings, and the lemur center has raccoons that do the same. They do worry about disease risk too.
- (Laura Suski): they do well with predators and have developed alarm calls for raccoons, copperheads, and red-tailed hawks.
- (Jessica Franck): Do these sound like wild alarm calls?
- Answer: calls were similar for aerial predators but the snake call was unique.
- Follow-up: did they do playback experiments?
- Answer: Yes, and did research with other vocalizations as well.
- (Noelle Adams): they are a sanctuary and have brown lemurs with a domestic cat (group mentioned toxoplasmosis risk) and raptors and everyone is ok.
- (Jacqueline Broder): have had mixed-species with raptors, and when they were sick the raptors got predatory.

Question (Laura Suski): Has anyone given a non-lemur companion to a solitary lemur?

- (Sue Rifai): had a pygmy loris with a tortoise and it worked out fine except that the loris gained weight from eating the tortoise's salads.

- (Briana Evarts): Denver mixed a white-fronted brown with a black howler monkey and they are good friends.
- Moderator (Monica Mogilewsky): When you do mixed-species for companionship, it can be easier to just put a single animal with a friend. These tend to be the most successful for Eulemurs because there is such a strong need for companionship.
- (Tad Schoffner): We have a very old mongoose lemur that they tried to match with geoffrey's tamarin for companionship, but it did not work out at all; he attacked the tamarin.
- Moderator (Monica Mogilewsky): It's important to know the natural history of the animals you're putting together. Like putting a lemur with small birds, which they may eat.

Question (Katherine D'Andrea): they have a timid B&W ruffed that is solitary for various reasons. Has anyone put this species with a non-prosimian?

- (Kris Arnold): they put one with a crested porcupine.
- Moderator (Monica Mogilewsky): Did this benefit the lemur in any way? If it's just for space, you can put animals together that will partition the exhibit and avoid each other, but if your goal is interaction then you have to consider the species in a different way. They use *L. catta* as companions all the time. They have one who is the dominant animal in a group of ruffed lemurs.

Comment (Grace Fuller): We have a slender loris and pygmy loris that affiliate and sleep together.

Comment (Karen Weisenseel): I have had a slender loris fight his way out of a cage to kill a pygmy loris baby.

Question: Our group of 8 ringtails with collared lemur, collared lemur had a baby and will often leave baby unattended. There have been observations of ringtails grooming baby, but could there be aggression towards it?

Comment (Karen Weisenseel): It can happen.

Comment (Laura Suski): It depends on the status of the individuals in the group.

Response: The infant being groomed is a good sign.

Comment (Megan Elder): Has there been luck with mixed-species all female groups?

Comment (Laura Suski): We have 5 lemurs mixed-sex and mixed-species and they all live together. There has been grooming between the different species. They all have various social roles.

Moderator (Monica Mogilewsky): There are fewer bachelorette groups, but as long as they are smaller groups it shouldn't be a problem.

Comment (Desiree Haneman.): We had a female ruffed lemur and a female ringtailed lemur which was working, but management changed.

Response: Male ringtails will seduce female ruffeds, but the females are not receptive to this.

Comment (Briana Evarts): A group may break down with seasonality and flexibility is very important.

Response: We try to have various food bowls.

Comment (Karen Weisenseel): A researcher at Duke said to spread the chow in an arc in an open area so all lemurs can see it.

Response: We feed up and down for the lemurs.

Comments (Laura Suski): Researchers often need to keep things random and we can't concentrate where the food is.

Response: Food isn't the only resource an animal can dominate. Sleeping spots or shaded spaces are also dominated. Water could be dominated.

Comment (Laura Suski): No one can drink until one is done. There is also trouble with putting water in the shade which is the popular resting spot. You need to spread out all resources so one lemur cannot dominant.

Comment (Cyndi Griffin): We have had some issues with a red ruffed lemur and black and white ruffed lemur group.

Comment (Laura Suski): We had a similar issue where the female would chase the males for a month, but then she would be so exhausted she couldn't do this any longer. She would live in her own rooftop cage at first, but the plan was to put her down in the larger space. They had a lot of height they could use.

Response: Do they have access in any way?

Comment (Cyndi Griffin): They have visual access. Did they not chase in the morning?

Comment (Laura Suski): I would sit in front of exhibit for an hour and her behaviors would get less as the time went on.

Response: At what point did you feel comfortable?

Comment (Laura Suski): When there was no longer any chasing.

Response: I wait until they ignore each other and show affiliative behavior before moving on to the next step. At what point are you not allowed to try anything anymore?

Comment (Cyndi Griffin): As much as is needed.

Comment (Sabrina Squillari): Always end a session on as positive note as possible.

Question (Desiree Haneman): What do you feel about chasing vs. displacing?

Comment (Julie Taylor): Displacing occurs forever and chasing does not need to.

Comment (Laura Suski): No aggression or injuries come from that behavior.

Comment (Kris Becker): We are putting together a mixed-species manual based on an institutional survey. We are building a database of successful practices for mixed-species exhibits.

Moderator (Monica Mogilewsky): I want people to leave with the top three things that make a mixed-species exhibit work. My favorite is flexibility.

Comment (Briana Evarts): The knowledge of your staff is importance. Many people put new staff on lemurs because they are safe, but the knowledge is so important.

Moderator (Monica Mogilewsky): The hierarchy is going to influence how one group interacts with another.

Comment (Kris Becker): Space availability and complexity is important.

Comment (Cyndi Griffin): Having control of that space is important.

Comment (Nicole Smith): We do our intros of mixed-species in holding.

Question: Do you actively intervene in a fight?

Comment (Laura Suski): We do, especially with male and male.

Question: Do your keepers get injured?

Comment (Laura Suski): There are some minor injuries, but lemurs may not come out of certain fights alive.

Comment (Karen Weisenseel): You can always hose them.

Comment (Laura Suski.): Hosing may not work particularly with Propithecus.

Comment (Kris Arnold): You need to be able to recall your animals as well.

Response: Doing some training before an introduction is very helpful.

Comment (Jennifer Donovan): An obnoxious or novel sound will split up any fight because it scares them.

Comment (Nicole Smith): Animals can habituate to the sound of an air horn.

Comment (Laura Suski): Sometimes you can rush the animals and scare them, but again doesn't work for Propithecus.

Moderator (Monica Mogilewsky): Mongoose have a reputation for not mixing well. Some particularly skittish animals should not be put in with a group of red ruffeds. Communication is key.

Comment (Scott Gamerl): We have to make our pygmy slow loris exhibit multi-species.

Comment (Laura Suski): Aye-eyes might be good.

Comment (Scott Gamerl): They are breeding.

Comment: Our lemurs are with sloths and there are no problems. The sloths sleep all day long.

Comment (Desiree Haneman): We have jumping rats with mongoose, I'm not sure how they would work with a nocturnal.

Comment (Kathleen Milk): Our vet wants to stray from putting armadillos with the pygmy slow loris because he thinks they're dirty.

Comment (Mike Dulaney): Some have used mouse deer.

Question: What about a fruit bat?

Comment (Karen Weisenseel): This can work. Helena has a book of records of what has been used in mixed-species exhibits.

End of day 2

Session 8: PTAG Prosimian Management:

(Moderator Lynne Villers, Indianapolis Zoo)

Topics

- Regional studbooks
- Managed Programs – SSPs, PMPs, DERPs
- The TAG

We will use ring-tailed lemurs as an example species throughout this session.

AZA Species Management

Studbook

The governing body of AZA is WCMC, which is followed by TAGs and SSPs. Management starts with a studbook which keeps vital records of an entire population of a species. Most of the studbooks are North American Regional Studbook, but some can be international in scope. Non-AZA institutions are also included in the studbook.

Ex. Ring-tailed lemur studbook includes all of the lemurs that have ever been in North America. As of 2008, there are 733 lemurs at 154 institutions. In AZA, there are 473 at 95 institutions.

Animals of unknown origin must be tracked down to keep the studbook accurate. It is impossible to answer every question. The information is only as good as what is provided to the studbook keeper by the zoo's records, so keep good records.

Question (Scott Gamerl): Will the new Poplink database link with ZIMS?

Moderator (Lynne Villers): Yes.

Studbook keepers need to run a validation report with the Population Management Group. The studbook is then ready to be published.

Poplink can also do age pyramids, census report, current institutional holdings, lost to follow up, and pedigree reports.

SSPs

An SSP is a conservation program for various species through the AZA and the goal is to provide a genetically viable situation. The first part of the masterplan involves looking at the demographics of the population (a standard bell curve is best). Next, the genetic diversity is assessed and 85% gene diversity is the goal. It is important to equalize the founder representations. We calculate a mean kinship (value of individual related to the rest of the population) and rank it by order to see who the top breeders are. For ring-tails, we are only going to consider ringtails for which we know over 50% of the pedigree. We need to decide what individual age is too young or too old. We want to pair individuals that increase the genetic diversity of the population. It's not all about the numbers. Other criteria for determining recommendations are institution's needs, exhibit/holding capacity, lemur needs, medical issues, number of individual lemur relocations and date of the move. Breeding and non-breeding recommendations are then made via the masterplan. All of the IRs need to read through the draft and make sure they have no concerns. Issue: 251 or 53% of the population has < 50% known in pedigree.

Pedigree Reconstruction Project

Need to collect blood, tissue or hair samples from all living or dead ring-tail lemurs in the SSP. Over the past four years we have verified samples that have been submitted.

Prosimian TAG

The mission of the Prosimian TAG is to complement, promote and participate in the efforts to conserve prosimians in nature and to advance the highest levels of animal welfare. The main responsibility of the TAG is the regional collection plan. First, we look at the conservation status of all prosimians via the IUCN ratings. As a TAG, you must do a space assessment for your institution. The TAG created a flowchart to decide how to select that taxa to be housed in North American institutions. Within the TAG, umbrella SSPs were created: nocturnal, eulemur, ring-tail, ruffed and propithecus. There are other programs that the populations can be managed under such as a PMP (population management plan) or a DERP (display/education/research populations). There are also phase-out populations or species that are not recommended. One phase out population is the bamboo lemur. Hybrids are SSP animals, but must be assessed to see which are viable to work with.

Ex. Eulemur: The current population is 246 and the target population is 215. Certain species are listed as breeding or exhibit only.

We are also working with Europe and Australia on management plans. You can also find many documents within the prosimian taxon advisory group.

Comment (Chris Kuhar.): If a species is exhibit only, the species is still managed by the SSP and are part of the population even if they are going to be phased out.

Moderator (Lynne Villers): We may still have a need for that animal within the SSP.

Question: Do SSPs ever recommend sterilization?

Moderator (Lynne Villers): Yes, but it is not taken lightly. If an institution is considering this, they should talk to the SSP coordinator.

Question (Dawn Stone): Why are bamboo lemurs being phased out, because of lack of numbers? Can we get some from Europe?

Moderator (Lynne Villers): Duke is looking into this, but the current numbers are passing away. At this point, we will let Europe work on this and see what happens. The TAG is open to discussions, but also don't want to be overly flexible.

Comment (Ingrid Porton): Europe is having trouble finding enough space for their *allotrensis*. We are working on an exchange between Ivo Louin in Madagascar and Europe. *Sinus* is the species of Hapalemur if we do want to bring these animals in.

Comment (Chris Kuhar): It is a lot more complicated than working with Europe. We had planned to send Europe *rubriventer*, but the individuals were old and they would prefer prime breeding animals.

Question (Tad Schoffner): Are institutions more willing to devote more space to prosimians?

Answer (Chris Kuhar): Everyone says they want more individuals, but none are adding groups. Everyone wants huge groups which is not practical. Omaha is the only institution recently that has built for prosimians.

Comment (Ingrid Porton): There is no difference in space. Institutions need to have space to hold the offspring.

Comment (Chris Kuhar): This is why we need to phase out species with small numbers because we need the space for breeding SSP species.

Question (Kristen Lukas): Are the animal care guidelines at the SSP level and are they done?

Answer (Chris Kuhar): Eulemurs are done.

Question (Kristen Lukas): Did you pull out research priorities?

Answer (Chris K.): I don't know we've pulled these out, but it's written based on ring-tails and ruffeds and we don't know if these same guidelines apply to Eulemur.

Moderator (Lynne Villers): Originally the guidelines were written as requirements for AZA, but we didn't know whether to build recommendations for the ideal institution or the average institution. Now they are Animal Care Manuals. Eulemur does have to be put in the new format.

Question: How do you go about getting animals for your exhibit, i.e. rubriventer?

Answer (Chris Kuhar): That's a recent development.

Moderator (Lynne Villers): Institution can contact Chris or Tammie which would start the ball rolling.

Question (Kris Arnold): How do we deal with institutions that import phase-out?

Moderator (Lynne Villers): The accountability was not held in previous situations throughout AZA. This has been tightened by AZA and institutions and studbook keepers could experience consequences for not complying. This doesn't mean that recommendations are not negotiable and communication is always important.

Comment (Mike Dulaney): There is a 30-day comment period.

Comment (Kristen Lukas): The board recently voted to tighten the interactions between TAGs and institutions. I've been through this twice and there is a process that does get followed.

Question (Scott Gamerl): With the economy, do institutions need to be pulled who can't pay for shipping and can AZA help?

Moderator (Lynne Villers): We have not had this happen, but it is up to the institution to pay for shipping.

Comment (Monica Mogilewsky): They are creative on the registrar listserv on trying to share transportation in a positive way.

Question (Mike Dulaney): Is there a phase-in category?

Moderator (Lynne Villers): Don't have any right now.

Question (Laura Suski): Is there a wish list for phase-ins?

Moderator (Lynne Villers): We need to focus on our current species before we can look into future species.

Comment (Kris Becker): This is the first collection plan we've had in awhile.

Session 9: Prosimian Enrichment:

(Moderator Kris Becker, Disney's Animal Kingdom)

Topics

- Introduction to the session.
- Basics of enrichment
- Enriching mixed species exhibits – challenges, using enrichment as a behavioral management tool
- Enrichment on a shoestring budget – recycling and reusing items from home – dumpster diving, enrichment drives
- “Natural” enrichment for exhibits
- Problem solving
 1. Geriatrics vs. kids
 2. Small group break out
 3. Nocturnal/diurnal unique needs

Question: How many people do enrichment? Everybody.

We want people to look at the bigger picture of enrichment. It is not just an object or event, this is a process. It is important to think of natural species behaviors, to consider aspects of the environment, to provide choices and control, to promote animal welfare and enhance guest experience. It is important to go to a reactive approach (how do we stop pacing) to proactive (how do we stop this behavior from starting in the first place). You need to first set goals (what to encourage or discourage). Safety needs to be considered both in terms of staff and animals. It is also important to consider natural and individual history. There are also issues of natural or non-natural enrichment as well as food or non-food enrichment. It can be useful to create a questionnaire to encourage thinking about natural and individual history as well as exhibit considerations before even setting up an enrichment program.

We've set goals now how do we manage our enrichment? It is important to have some type of schedule. Calendars can be used with two-week variability or as complex as you would like.

Comment (Chris Kuhar): AZA accreditation now requires enrichment calendars from 5 yrs. They are also looking for enrichment coordinators.

Comment (Jennifer Donovan): We just had accreditation and had to pull out a calendar from three years ago for one specific individual.

There are different ways of scheduling. You can lay it out in advance or you can have a menu option where you look at enrichment as a behavior. Ex. If you want to create foraging behavior, you can pull this up and see what types of enrichment will promote this. It can also be useful to have a blank enrichment calendar and document what you've done each day. Documentation of the enrichment is most important.

Comment (Tad Schoffner): You really have to rely on your keeper staff to come up with unique ideas. It is important for people that are working with and in tune with the animals to come up with ideas.

Comment (Monica Mogilewsky): We have a form where enrichment can be reviewed. Even volunteers are allowed to come up with enrichment ideas.

Comment (Lynne Villers): You can also use current enrichment but modifying it for new uses.

Case example: We have wire mesh treat cages. A keeper had flipped the cages 90 degrees which was a whole new way of viewing and thinking about the enrichment.

Comment (Laura Suski): You can change food cages completely depending on hanging and positioning. You can get a week's worth out of one object by doing it this way.

Comment (Mandy Fischer): I try to make a very general enrichment calendar—such as a puzzle feeder day or spices and scents so there is still some level of creativity.

Comment (Monica Mogilewsky): We use the menu technique where it is a foraging day and there are a variety of ways that keepers can accomplish this.

Comment: We have someone that compiles a database of approved enrichment at the zoo so you can print out what is approved for each animal.

Comment (Chris Kuhar): To encourage creativity, a matrix was designed to be used by keepers with categories of object, item, location and presentation. He designed it so that keepers could randomly select a lot of different combinations.

Question (Scott Gamerl): How variable does AZA want enrichment to be?

Answer (Chris Kuhar): They are not concerned with how variable, but that you are thinking about it.

Comment (Kristen Lukas): Enrichment must follow goal setting, implementation and evaluation processes and one person must be overseeing this.

Comment (Megan Elder): Time is a factor as well.

Comment: We do have to go through and evaluate each piece of enrichment.

Comment (Jennifer Donovan): We have a committee and every area has a member on there and every animal from millipedes to elephants is enriched. The enrichment can only stay in exhibit after 48 hours and enrichment can only be repeated so many times a month.

Question: Are there places to go for ideas on other animals besides primates?

Response: Check out the CD for some other reference ideas.

Comment (Megan Elder): Honolulu and Fort Worth have good sites.

Comment (Helena Fitch Snyder): If time is a factor, volunteers and public love to get involved in these types of things.

Moderator (Kris Becker): This is a good idea. We will plan and spend a half-hour to make lemur toys or parrot toys.

Comment (Monica Mogilewsky): One way to keep volunteers coming back is to pair tedious projects with more fun enrichment projects.

It is also important to build enrichment into the daily routine.

Comment (Chris Kuhar): I've never heard a keeper say I don't have time to feed. Enrichment is not extra, it is part of husbandry.

Comment (Kathleen Milk): Each team has an ethogram to assess enrichment every week. They also match enrichment for the public that matches the enrichment the animals get.

Comment (Laura Suski): A good way to get enrichment in is to eliminate the use of bowls for feeding and then you are forced to use other items like bowls or boxes. This is also less dishes to wash.

Comment: From a management standpoint, keepers are evaluated on this in their end of the year evaluations.

Comment (Jennifer Mattive): We take advantage of boy and girl scout troops. Also, all high school seniors have to do a project and this can be utilized as well.

Comment (Jacqueline Broder): We are starting a program with docents to make pre-prepared enrichment items and this is done in a public area where the public can get involved.

Comment (Scott Gamerl): We work with our local university's engineering department to make enrichment.

Comment (Jodi Wright): The enrichment is made available by being ready in plastic bins so there is no excuse that they didn't have time to go find the enrichment.

Comment (Desiree Haneman): Our vets won't let others help with enrichment because of TB.

Comment: We get our volunteers TB tested which is paid for by the zoo.

Comment (Monica Mogilewsky): TB can't live on plastic so why would this be an issue?

Comment (Cyndi Griffin): Our vet doesn't want the general public making enrichment.

Comment (Laura Suski): Our volunteers pay for their own testing. We have a sanitizer and if it can be sanitized then it can go in the animal areas.

Comment (Karen Weisenseel): You can tell your volunteers to just ask their doctor to do it.

Question (Chris Kuhar): In terms of time, we have more complaints about cleaning up after enrichment. How do people handle this?

Comment (Sabrina Squillari): I try to do the messier stuff when I know I'll be there the next day. I've cleaned up my share of other people's messes so they can clean up after me.

Comment (Nikki Smith): It depends on your staffing and the type of animal that is cared for.

Comment (Jodi Wright): I will make three piles of hay so that it is not all over the exhibit so it is not as bad to clean.

Comment: It can help to have old-school keepers watching the animals enjoying the enrichment.

Comment (Megan Elder): If you get keepers to buy stuff themselves, they may be more likely to want to see the animals enjoy it.

Question (Dawn Stone): What about using natural enrichment and how do you deal with this?

Comment (Lynne Villers): It is the challenge of keepers to make the enrichment look natural. You can coat PVC, etc.

Comment (Tad Schoffner): Sometimes it's all about color and there are a lot of enrichment companies that are making different types of enrichment.

Comment (Laura Suski): We will use natural items and just toss them in the sanitizer.

Moderator (Kris Becker): It is important to document not just what you've put in there, but how well did it work. This should be as much of the routine as general keeper records and comments can be very important in providing some information.

Comment (Monica Mogilewsky): You need to define what successful use of enrichment is.

Question: What other scales do people use to rate enrichment?

Comment (Jennifer Donovan): We were having problems with not having enough comments so I encouraged adding detail. Sometimes avoidance of an object is as enriching as interacting with an object.

Moderator (Kris Becker): This goes back to the re-evaluating and re-adjusting phase.

Removal of items can be just as enriching as adding items.

Comment (Laura Suski): The day after we sanitize exhibits the enrichment is out of the exhibit and the large empty space is enriching. Then as you rebuild the cage, the animals can enjoy each item as it is added back in.

Dumpster diving (as long as you can sanitize) is useful.

Comment (Lynne Villers): I show and train dogs. We just use pop-up crates and as they wear out they can be used by the lemurs.

Comment (Mandy Fischer): Around Thanksgiving, we put up a Christmas tree with items that keepers can write wish-list items and put on the tree. The docents really enjoy buying the enrichment for the animals. We have a party for all docents in February and keepers can then come to the party and interact with donors and docents.

Comment (Desiree Haneman): Keepers can share ideas of enrichment. It helps to write down cost and be very specific with what is needed.

Comment (Cyndi Griffin): We get food enrichment from grocery stores...cereal, peanut butter, etc.

Comment (Mandy Fischer): We have just done a similar thing with pet stores.

Comment (Julie Taylor): We post an enrichment newslist on our website.

Comment (Lynne Villers): Garage sales are great for kids toys.

Comment (Scott Gamerl): We have tried birthday parties, but had issues with money coming back to them. Then we tried using gift cards to buy large ticket items, then this was nixed by finance. We then told people to go buy \$40 worth of enrichment rather than providing money, so this could go straight to the animals.

Comment: We have had birthday parties where kids brought gifts for the animals rather than the birthday kid.

Moderator (Kris Becker): We can collect typically recycled items and add that.

Comment: We have created gift registry for our baby gorilla.

Question (Kristen Lukas): Does asking for help reinforce the idea that enrichment is something that is extra and special?

Comment (Tad Schoffner): Some of the stuff we buy is expensive and the idea of a shopping week or day for staff is a great idea.

Comment (Cyndi Griffin): It is important to be specific so you get what you need.

Moderator (Kris Becker): You can also use this as an education component to bring more of a connection.

Comment (Jennifer Donovan): I will bribe my team by creating a keeper grab bag with variable reinforcement from movie tickets to a stick of gum. Any keeper that did a good job reinforcing.

Comment (Nikki Smith): I agree with Kristen that enrichment should be allotted for by zoos as much as food and medicine.

Comment (Chris Kuhar): We would take medical donations or food donations, but may be harder to get. The enrichment budget is the first to be cut.

Comment (Monica Mogilewsky): You can't recycle food or medicine, but this is something that can be done with enrichment. It depends on how you spin the enrichment program.

Comment (Tad Schoffner): I think we are going through a natural progression where enrichment is starting to not be considered as extra and soon it will be a larger part of husbandry.

Moderator (Kris Becker): Training has gone through a similar progression.

Comment (Lynne Villers): Many people have an "other" operating budget. As long as the person in charge of this is very pro-enrichment than there can be funding available for enrichment.

Comment (Helena Fitch Snyder): Recycling is important, if you can tie conservation and enrichment together.

Comment (Ingrid Porton): This is re-using rather than recycling, just an environmental tip.

Comment (Karen Weisenseel): Using uniforms for enrichment would be better as mattress stuffing because then it does not ultimately end up in a dump.

Comment (Nikki Smith): We have a wish list on Amazon and get a ton of items.

Comment (Jodi Wright): We had a boomer ball that was shredded and pieces were sold to public to generate money.

Question (Grace Fuller): Does enrichment differ for nocturnals and diurnals?

Reponse (Myron Shekelle): Olfaction is important. Nocturnals like to scent-mark and switch trees between exhibits. Also, using auditory stimulation with calls and sounds.

Response: Olfaction and audition get overlooked a lot.

Session 10: Prosimian Training:

(Moderator Megan Elder, St. Paul's Como Zoo)

Topics

- Basics of training (how it works, benefits, setting up a program)
- Examples (basics thru advanced)
 1. Describe voluntary physicals at Indianapolis
 2. Buffalo Zoo will describe success with insulin injections
 3. Busch Gardens will discuss depo injections.
- Problem solving (ask audience what issues they have), Q & A, misc applications- if time allows (public demos, painting etc)
- Close, provide resources & contact information

Basic Concepts

Husbandry training is a program that incorporates the concepts of operant conditioning in daily management routines. Antecedent leads to a behavior which is bridged and then a consequence happens. We are discussing positive reinforcement by rewarding behavior you want and ignoring unwanted behavior. See CD for references.

One of the first steps is determining what is reinforcing for your animal.

Question (Kathleen Milk): Does anyone use secondary reinforcement?

Response: Tactile contact or access to space can serve as a reinforcer.

Next you need to introduce your bridge which marks the bridge. You need to come up with shaping plans where you make small approximations of behavior. It is important to have both a visual/verbal cue. When you are starting out, you need to have primary and secondary trainers. One person trains the behavior first and then other keepers can then begin to learn that behavior.

Question: What about having one animal with different trainers training different behaviors?

Response (Jacqueline Broder): If the bridge is consistent, this should not be an issue.

Response: It is important to watch each other train.

Comment (Kris Becker): You can videotape the behavior as well.

Comment (Julie Taylor): We don't have more than one keeper training a behavior at a time.

Comment (Jennifer Donovan): Make sure trainers are communicating so behaviors don't break down.

Moderator (Megan Elder): Creating a training manual is very important and including pictures of trained behaviors.

The final step is to execute, evaluate and modify your plan. It is extremely important to set up animals to succeed and to end on a positive note.

Some basic behaviors being trained:

Stationing-this helps reduce competition.

Question (Ingrid Porton):- What is the difference between the targets?

Moderator (Megan Elder): Usually the targets are different shapes and colors.

Comment (Dan McLaughlin): We started with locations and then moved to shape/color.

Comment (Laura Suski): It is important that you let them choose their positions and then let them decide where they are comfortable.

Targeting- this can help with allowing animals to follow you and A-B behaviors.

Taction- prosimians need to be comfortable with touch.

Ex. (Kris Becker). Old ring-tail lemur was starting to have poor condition. We started a training program where we could groom him ourselves with a cat comb and he really enjoys this.

Comment (Ingrid Porton): It is important to start training geriatric animals for range of motion behaviors.

Scale- weights are important for health monitoring.

Medication delivery- animals need practice with these items before an actual exam.

Comment (Kris Becker): You can even train them to start to get used to bitter taste that they may get from medicine.

Comment: Surpalta is a grape-flavored compound that will make everything more palatable.

Comment (Laura Suski): Don't limit your thoughts to what might taste good to animals.

Crate training- useful because it is limiting the need to net.

Injection training- reduces the need to stress the animal for knockdowns. This would start with taction work.

Squeeze cage- this is the next best option if you can't injection train.

Reproduction and infant monitoring

Ex. Measurements are made on ring-tails to monitor growth.

Comment (Laura Suski): We are doing this with *Propithecus*.

Ex. Case study- there was a sifaka birth, except that they had trouble removing the baby from the mom. They would wait until dad had baby and then trade the baby for almond.

Comment (Laura Suski): We have been paying peanuts to remove infants from mothers to get weights.

Moderator (Megan Elder): Be careful how much food enrichment you use for weight issues.

Training helps the vet no longer be scary to the animal. Have vets establish a good relationship by randomly hand feeding when they walk by.

Comment (Tad Schoffner): Lemurs don't hold a grudge like monkeys do.

Question (Sabrina Squillari): Does anyone have any suggestions to gain trust more for tactile training?

Comment (Jacqueline Broder): It is important to make very small approximations. It is important to reinforce for not being scared. It will take time.

Question (Monica Mogilewsky): If we train free ranging lemurs, researchers will have issues?

Answer (Laura Suski): I established a training area in the free-ranging area. This way the lemurs would not consider researchers as trainers.

Comment (Julie Taylor): We wear different clothes so they are viewed differently.

Response: Stationing can help let animals know training is beginning.

Comment (Kris Becker): We had a collared that was not tactile and some sessions were only 30 seconds long.

Comment (Laura Suski): Sometimes it helps to get them to touch you first and then to reward that.

Moderator (Megan Elder): It is important that you end the session and not the animal.

Comment (Kris Arnold): We have trouble with a lemur that does not want to be touched. We worked on her not fleeing and eventually were able to help inject Depo-provera- every 45 hours.

Case study (Cyndi Griffin): We had a diabetic aggressive individual. We tried meds and diet modification and realize they had to start insulin injection. We took a piece of plexiglass with a hole in the middle and animal was trained to put arm through the hole and touch the dowel rod. She began to target to PVC. We had to delineate the hole in the plexiglass. The target kept moving and then phased out target stick. She would be injected in the shoulder. She wouldn't hold for very long and fruit was removed from diet so it became an important reinforcer. We tried saline first and she never refused an injection. This female died and then a diabetic macaque was trained to hold a PVC pipe for injection. We attached PVC to mesh with four holes and zip ties. Having a grip bar at the end of the tube is helpful.

Zoos that injection train Mesker Park, Busch Gardens, Indianapolis Zoo and Happy Hollow Zoo.

Comment (Desiree Haneman): Depo stings more than other injections.

Comment (Julie Taylor): Ringtails may be tougher than other species. How long did it take for Depo training?

Answer (Kris Arnold): After 2 weeks of desensitization we were able to inject.

Moderator (Megan Elder): Start introducing syringes outside of holding early on in animal's development.

Comment (Kris Arnold): We blunted our needle for desensitization.

Question: What gage?

Comment (Kris Arnold): We use larger gages with apes.

Moderator (Megan Elder): The smaller the needle size the harder it is.

Comment (Dawn Stone and Julie Izold): We provided a top of a pineapple while injecting them.

Question: How are diabetic individuals being monitored?

Comment (Cyndi Griffin): I was doing by collecting fructosamine while restrained.

Comment (Laura Suski): Don't get discouraged because type of species may dictate how long it takes to train them.

Question (Adrienne Saunders): Has anyone tried injection training with a loris?

Answer (Kathleen Milk): I was starting with the loris in a howdy, but there are no squeeze cages small enough for a loris. She needs to be able to see what is going on.

Question (Julie Taylor): Do maintenance departments make squeeze cages?

Answer (Desiree Haneman): We have a company that makes really good squeeze cages.

Comment (Lynne Villers.): An animal may seem to have picked up on a behavior, but two weeks later it may seem like they have never learned that behavior.

Response: You can apply operant conditioning in what you do every day.

Comment (Karen Weisenseel): You can create a plywood plunger for a simple squeeze.

Question (Briana Evarts.): Is it possible to give fluid therapy?

Comment (Julie Taylor): Its best to use a butterfly catheter.

Question (Monica Mogilewsky): Has anyone used training to minimize aggression and introductions?

Case study (Sabrina Squillari): We are sending young gorillas to Calgary. We would start training them next to each other. During the introductions, we kept training and distracted aggression.

Comment (Lynne Villers): Training an incompatible behavior is useful.

Response: Protected contact is safer and sometimes the boundary is more comfortable for the animal. Operant conditioning is voluntary.

Question (Samantha Burleson): How do you show a male that you are not fearful?

Moderator (Megan Elder): You need to check any baggage from the rest of your day at the door.

Comment (Mandy Fischer): Venting to co-workers can be very useful. Also, try stationing the animal before you walk in there.

Comment (Jodi Wright.): You can stand at the door and give him a timeout until he stops the stalking behavior.

Moderator (Megan Elder): It is important to consider seasonality.

Comment (Kris Becker): It may be useful to do the station training at the entrance to the exhibit and using two people can help.

Question (Lynne Villers): What is stalking?

Answer (Samantha Burleson): We are worried about people teasing the animals.

Comment (Jacqueline Broder): It is important to build a foundation and teaching the animals training manners. We had a lion that it took us 5 months to train to relax while we worked on training.

Case example (Mandy Fischer): We did ultrasound training with our sifaka. The maintenance staff cut a small piece of mesh. We used all baiting, no target training. The vet could stand around the corner and keepers were allowed to use the portable ultrasound probe with monitoring. We did not shave the belly and used the ultrasound gel. The gel was the tricky part. It took 2 weeks worth of hour long sessions. We had to use a lot of approximations every day. The gel was vet approved. It is good to pick a gel and stick with it. We don't keep up with this as much and use tactile touch to monitor infants.

Comment (Jacqueline Broder): You can use alcohol instead of gel.

Comment (Katherine D'Andrea): The apparatus we built for our sifaka was originally for ultrasound.

Question: Has anyone done blood pressure training?

Answer (Julie Taylor): No, but it would be good to know a non-stress blood pressure.

Question (Desiree Haneman): How can I get the public to connect with my ruffed lemurs in their outdoor exhibit?

Answer: We just started training our lemurs to walk on rope.

Comment (Monica Mogilewsky): It would be interesting to capture vocalizations.

Comment (Desiree Haneman): The animals would call more frequently when inside.

Comment: Lemur that has glaucoma in one eye, it would be useful to know how to manage it without restraint?

Answer (Monica Mogilewsky): We had to put drops in a red-ruffed lemur eye. We started training her to hold her head up and back for a grape. We used a lot more than one drop, but eventually got drops in her eyes.

Open Forum:

(Moderator Tad Schoffner, Cleveland Metroparks Zoo)

Topics

- Will be a revisit to topic material that needed further discussion.
- A list will be generated during the workshop and presented to the group for prioritization of importance for discussion in this session.

Enrichment Brainstorming

Natural enrichment:

Coconut shells (will take meat out and use with a hole drilled in or cut in half)

Bamboo in various sizes (doesn't last as long as coconut shells)

Natural browse

- a list of edible tree species)---misting and putting nutweed/acacia in bags can help browse freeze
- tulip and sweet gum freeze well and are preferred, small bags, now water, the tulip gets softer than sweet gum. Sweet gum stays soft enough that they eat it and gets crunchy later-works for all lemur species. However, some leaves may break down when frozen and change nutrition.
- We feed hibiscus flowers to lemurs.
- DLC puts 2:1 bleach to water soak for browse which then gets rinsed out. They have to sanitize any piece of browse that goes through.
- We put browse in browse holders with water in a capped PVC which can be used for nest building and lasts for 7 days.
- Straw or hay can be used or raffia and wood wool.

Nectar feeders---diluted juice or diluted peach/pear nectar can be used. Would like to use a flower as a nectar feeder to be more naturalistic.

Branches with screw bolts in them to move around and chain clips

Hammocks---keep moving these around the exhibit or add more.

Brown paper bag with crickets (nocturnals)

Live crickets (enjoy chasing)

Toads (chasing) or even walking them past the exhibit

Small papier mache balls with insects (nocturnals)

Woven palm fronds in a basket with food inside (took a long time to get food)

Scents (predator or other lemurs)---Bronx put fossa-scented browse in with lemurs, toweling (rub down where they're marking and then hang near air vent)

Phonebook and scents---herbs, cinnamon, vanilla, cayenne?

Spices and herbs (cinnamon, garlic powder, body sprays, children's perfume)---consider seasonality

Gum feeding (nocturnals)---can get from restaurant, Carolina Biologicals (can get organic), powder that comes in big tubs

Snake-sheds, bison-sheds

Fish tank behind barrier (real or fake)

Decoys (battery-operated flipping dogs, rubber snakes---*don't put in front of holding

Log feeders

Misters

Hunting goldfish (nocturnals)

Auditory playback experiments (inter or intra species; familiar vs. non-familiar species, predator vs. prey, type of call)

Question (Grace Fulelr): Has anyone gotten a saliva or urine sample from a loris?

Answer (Julie Taylor): Buccal swabs and banked urine.

Answer (Helena Fitch Snyder): Put them in a transport crate to get urine (floor not good).

Answer (Karen Weisenseel): Put them in a kennel with a false bottom.

Question (Tad Schoffner): How many people have lemurs that vomit on a regular basis and what species?

Answer (Julie Taylor): *Albifrons* and *fulvus*---random and vomit different items.

Answer (Briana Evarts): Black and white ruffeds, it is different food items.

Comment (Tad Schoffner): Our red ruffeds vomit leafeater (Marion),

Comment (Lynne Villers) Selenium in chow and lemurs were though the roof

Comment (Tad Schoffner): We didn't have selenium.

Comment (Dawn Stone): They are on laxatone, might scope them.

Comment (Tad Schoffner): We tried a food dye, but had issues.

Comment (Lynne Villers): Giardia was associated with vomiting in ringtails

Comment (Tad Schoffner): Hair balls may be an associated issue. We are now introducing papaya juice.

Comment (Laura Suski): Try switching the chow---we had animals sensitive to DentaGuard chow.

Wrap Up/Conclusion:

(Moderator Kristen Lukas, Cleveland Metroparks Zoo)

Topics

- Potential prosimian research projects based on workshop discussion.
- Final thoughts

We want to share research needs and summarize relevant prosimian research.

Highlighted papers:

Lynne Villers looking at intestinal bacteria from 50 lemurs at 11 zoos

Dosages in female black lemurs for contraception

Spontaneous social organization and gaze 2008

Research needs

Nutrition:

Chow-free/Chow reduced

Tea, tamarin pods-iron

Increasing fiber

Milk for formula development

Health:

Light cycles and mammary tumors

Blood at end of physical have lower blood sugar

Polycystic kidney disease

Reproduction:

Age at sexual maturity (DLC)

Flavifrons not reproducing

Comment (Chris Kuhar): Eulemurs aren't breeding----successful births

Contraception reversal

Comment (Ingrid Porton): Studbook keepers can contact Ingrid and cataloguing who has reproduced post-contraception.

Nocturnal/Diurnal Light cycle:

Grace Fuller's project

Prosimian exhibit use and environmental preferences

Creating dark spaces that accommodate guest experiences

Nocturnal reproduction:

Olfactory and auditory sensory modalities

Prosimian introductions:

Multi-male groups

Same-sex unrelated female groups

Mixed species:

Database of successful practices

PTAG:

Pedigree Reconstruction Project---Loyola University

Enrichment:

Olfactory

Auditory---database (Cornell has one, we should collaborate with them)

Training:

Blood pressure training

Research priorities:

1. Prosimian reproduction- why don't we have more success (Eulemur, nocturnals)
2. Variables associated with successful mixed-species exhibits
3. Same-sex housing with surplus males---management
4. Long-term effects of using Deslorelin as a reversible contraception
5. Prosimian diet improvement

What will everyone be taking away:

Diet information

Neutral density lighting

Tarsiers

Networking

Training techniques

Multi-species exhibits

Less afraid of iron overload

New enrichment ideas

Good record keeping

Where do we go from here?

Volunteers?

It is important to keep the workshops simple

When? Shoot for 2011

Appendix A

Contents of Prosimian Workshop 2009 CD

Diet Information

-Diets are listed by species, then each institution's prescribed diet submitted for that species

Husbandry, Health, and Behavior Information as submitted by Workshop Participants

-Almonds and Ultrasounds...One Zoo's Journey to the Successful Birth of a Coquerel's sifaka—*Mandy Fischer, Philadelphia Zoological Gardens*

-Hand-Rearing Wild and Domestic Mammals, Chapter on Lemurs—*Cathy Williams, Duke Lemur Center*

-Raising Vera: A Collared Lemur's Tale—*Sabrina Squillari and Katherine D'Andrea, Bronx Zoo*

-Effect of Dietary Manipulation Including Supplementation with *Amorphophallus konjac* on the Amelioration of Blood Glucose in an Insulin Resistant Collared Lemur—*Jason Williams and Jan Ramer, Indianapolis Zoological Society*

-Evaluation of Iron Status in Lemurs By Analysis of Serum Iron and Ferritin Concentrations, Total Iron-Binding Capacity, and Transferrin Saturation—*Cathy Williams, Duke Lemur Center*

-Behavior, enrichment and training resources—*Megan Elder, St. Paul's Como Zoo and Kris Becker, Disney's Animal Kingdom*

-Loris Cycle Monitoring System—*Helena Fitch Snyder*

Prosimian Literature Review from 2004-2009

-Conducted by Elena Hoellein Less, Cleveland Metroparks Zoo

Appendix B

Enrichment Lists

Novel Food Items

Browse (maple or mulberry branches, grapevine)

Food paste [peanut butter, ketchup, mustard, "primate" hummus, jam, honey, baby food, yogurt, mashed produce mixtures w/ or w/out food coloring ("edible paint"), e.g., mango, kiwi, banana, apple, blueberries, strawberries, kiwi, peach, pear, papaya]

Spice paste (cinnamon, nutmeg)

Sicles (fruit, produce, flavored w/juice or unsweetened Kool-Aid) on floor or hung on string

Treats (peanut butter, air-popped popcorn, raisins, grapes, produce, dried fruit, oatmeal w/peanut spread)

Gelatin blocks (unflavored, flavored, clear, colored) w/produce, bugs

Unsweetened cereal (Puffed Rice, Cheerios, Rice Chex)

Fruit (melon, mango, kiwi, pumpkin, banana, apple, blueberries, strawberries, peach, pear, papaya, pomegranate, star fruit, quince, coconut, canned fruit)

Edible flowers (sunflower head, impatiens)

Vegetables (peas, green beans, corn, corn on the cob, dry corn on the cob, pumpkin, fresh herbs, romaine, mustard greens, collard greens, cilantro, parsley, spinach), canned, cooked (carrots, potatoes, yams), dried flakes, or juice

Protein [sunflower seeds, hard-boiled or scrambled eggs (not mongoose lemurs), cooked beans]

Starch (bread, cooked pasta, cooked rice, oatmeal "cookies")

Insects (crickets, waxworms, mealworms)

Biscuit mix (ground diet w/banana)

Liquid (sugar water, juice, vegetable juice, Gatorade)

Novel Food Delivery

Mode -

Whole produce

Scattered around exhibit

Pastes smeared around exhibit, on branches, on leaves

Hanging produce (string, kabob)

Mixed w/hay

Within -

Edible (pinecone, ice cream cone, whole produce, head of lettuce or cabbage)

Cardboard tubes (toilet paper, paper towel, bran container)

Cardboard boxes (various sizes, two boxes put together, box w/in box) open or w/holes, hanging or on ground

Paper (bag, papier mâché, phone book section, phone-book-page packets)

Plastic containers (cup, bucket, tub, box), hanging or on ground

Plastic items w/holes [wiffle ball, waffle-block toy, foraging ball,

"Manuel feeder" (marmoset jelly powder container), water bottle, plastic piñata, margarine tub & top, bucket

w/top, basket, two baskets zip tied together, small crate, mini milk crate puzzle, mini milk crate

or milk crate w/rope criss-crossed across it], hanging or on ground

Miscellaneous bird feeders [suet, carousel, pyramid, feeder w/sliding top on chain, rubber mesh oval/round shape]

Miscellaneous items [PVC tube device, cricket feeder, Kong toys, hanging milk crate, cotton mop-head, socks, eggshell (contents blown out and waxworms/mealworms, blood, or food item put in via small hole)]

Insect parfait (crickets/waxworms/mealworms in damp sand molded in bucket in bin/tub)

Under -

Cardboard box, plastic basket, milk crate, cloth

Filler Material for Foraging Items-

Bran

Shredded newspaper

Phone book pages

Sawdust

Hay/straw

Sand

Leaves (edible)

Novel Smells

Extracts (vanilla, lemon, almond, strawberry, mint, etc.)

Scents (deer)

Perfume (spray or sample sheet)

Deodorant

Novel Auditory

Radio

Recorded nature sounds

Recorded animal sounds

Bells

Novel Visual

Biscuits dyed w/food coloring

Produce cut in shapes

Mirrors

Items for viewing outside the exhibit (mirror, stuffed animals, decoy animals, rubber snakes, disco ball, lava lamp, etc.)

Frozen Kool-Aid cubes

Non-toxic sidewalk chalk or washable paints (to create "artwork" on walls, floor, glass, etc., of exhibit)

Novel Items

Natural items (hay, leaves, cornstalks, feathers, snake shed, sod, pine tree, snow), hanging or on ground

Cloth (bed sheets, pillowcases, towels, cloth pieces, stuffed animal)

Paper (butcher paper, newspaper, phone book pages, toilet paper or paper towels draped)

Plastic (wiffle ball, small plastic basket, miscellaneous baby/dog toys w/no small parts, Boomer ball, Frisbee), hanging or on ground

"Paints" w/paper

Ice cubes/block

Tire swing

Fire hoses/ropes for climbing, hammock

Potter Park Zoo, Lansing, MI

Novel Food Delivery

Almost any dog toy that delivers food will work for lemurs

Large tree branches with diet skewered on branches and hung with bungees. They like just the branches as well to swing from

Novel Smells

Scents from conspecifics

Novel Items

Hula hoops

Soft dog crates (these make EXCELLENT bounce houses when hung with bungee cords)

Grape vine balls, wreathes, baskets

Gold fish in water jugs- the large ones from water coolers. Those also make nice toys in themselves. Or can use kiddie pools. - the lemurs like to follow the fish- beware eulemurs will sometimes catch and eat the fish!

Baby toys- our lemurs and gibbon in particular like the small blocks with things inside them. We also use larger baby items such as swings and slides.

We made a lemur version of a sit and spin- it was a log with a cross branch suspended from a rope.

T shirts stuffed w hay or suspended like a pouch to jump in.

Hammocks are especially good when they incline so the animals can roll down them like a slide.

The theme here is bouncy or swinging.

Indianapolis Zoo, Indianapolis, IN

Novel Food Items

flavored/scented browse
bamboo
palm fronds
willow
potted plants (ficus)

Plastic pumpkins
Plastic puzzle box
Puzzle ball
Clear pvc tubes
Small beach pails
Grass flats
Hay
Leaf piles
Shavings
Astro turf carpet
Shredded paper/newspaper
Balls (various sizes)
Doll house
Butcher paper
Towels
Themed water bottle

Novel Food Delivery

Bamboo puzzle feeders
Bamboo tube feeders
Banana leaf burritos
Browse kabobs
Coconut shell feeders
Fruit kabobs/skewers
Pvc cup feeders
Pvc themed puzzle feeder
Smeared props
Soften chow and mix with
produce
Stuffed cholla cactus pieces
Treat cages
Colored puzzle feeders
Coop cups
Hide-a-treats
Mesh cube with hay, shavings,
etc.

Novel Smells

Extracts/spices
Perfume sample
Spiced water

Novel Auditory

Radio sounds

Novel Items

PVC platforms
Brown refrigerator bench
Buckets
Firehose
Hanging bread trays
Milk crates
Plastic flower pots
Large plastic spools
Rearrange furniture
Traffic cones
Ice rings
Grapevine ball
Baby bottles
Boxes
Cardboard tubes
Paper bags
Pillowcases

SIFAKA

²

Food

*Special Produce
*Jello
*Bugs
*Cooked Yam/Carrot
*Seeds
*Dried Fruits
Hanging Feeders
Metal Hoop Rings for Fruit
¹ Treat Boxes w/o Staples
¹ Suet Feeder
¹ Hard-boiled Eggs
¹ Popsicles
¹ Stuffed Pine Cones

Non-Food

Kong Toys
Boomer Balls
Tubs
Hay/Excelsior
Hammock
*Scents
Alfalfa
¹ *Flavor Sprays
¹ Hanging Shoe Bag

MONGOOSE LEMUR

²

Food

*Special Produce
*Condiments
*Jello
*Bugs
Seeds
Nuts w/o Shells
Dried Fruits
Hanging Feeders
Metal Hoop Rings for Fruit
¹ Treat Boxes w/o Staples
¹ Popsicles
¹ Suet Feeder
¹ Hard-boiled Eggs
¹ Stuffed Pine Cones

Non-Food

Kong Toys
Boomer Balls
Tubs

Hay/Excelsior
Hammock
Alfalfa
*Scents
1
*Flavor Sprays
1
Wobbly Log
1
Hanging Shoe Bag

RING-TAILED LEMUR

2
Food
*Special Produce
*Condiments (sugar-free)
*Jello
*Bugs
*Dried Fruits
*Seeds
Hanging Feeders
Metal Hoop Rings for Fruit
1
Treat Boxes w/o Staples
1
Popsicles
1
Suet Feeder
1
Hard-boiled Eggs
1
Stuffed Pine Cones

Non-Food
Kong Toys
Boomer Balls
Tubs
Hay/Excelsior
Hammock
Alfalfa
*Scents
1
*Flavor Sprays
1
Hanging Shoe Bag

BWR LEMUR

2
Food
*Special Produce
*Condiments
*Jello
*Bugs
Seeds
Nuts w/o Shells
Dried Fruits
Hanging Feeders
Metal Hoop Rings for Fruit
1
Treat Boxes w/o Staples
1
Popsicles
1
Suet Feeder
1
Hard-boiled Eggs

¹ Stuffed Pine Cones

Non-Food

Kong Toys
Boomer Balls
Tubs
Hay/Excelsior
Hammock
Alfalfa
*Scents
¹ *Flavor Sprays
¹ Bungee Cord
¹ Hanging Shoe Bag

*Special Produce (i.e. corn, pear, melon)

*Jello (sugar-free)

*Condiments (i.e. jam, peanut butter)

*Bugs (i.e. kingworms, mealworms, crickets)

***Acceptable Scents**

Basil, Cinnamon, Cloves, Lavender, Mint, Oregano, Peppermint Extract, Vanilla Extract

***Acceptable Flavor Sprays**

Raspberry, Bubblegum, Coconut, Strawberry Shortcake

Sacramento Zoo, Sacramento, FL

Novel Food Items

Frozen treats (juice, nectar)

Novel Food Delivery

Food items speared on branches
Paper bag w/ live crickets
Cricket ball- hamster ball w/live crickets inside
Turf board w/ mealworms or wax worms
Blown eggs w/ mealworms inside
Diet in multiple bowls
Diet or treats inside bamboo tubes
Hanging pine cone w/ treats or insects
Diet or treats in PVC tubes
Diet or treats in hanging cups
Covering cups
Diet or treats inside piñata (paper mache)

Novel Smells

Scents sprayed or rubbed in exhibit
Scented cotton balls inside pill bottle w/ holes (hung or placed throughout exhibit)

Novel Items

Objects from other exhibits
Feathers (hung with string or inserted into wooden dowel w/holes drilled in it) Snake sheds

Memphis Zoo, Memphis, TN

Novel Food Items

Live insects
Branches, preferably with fresh leaves

Novel Food Delivery

Pool, vegetable matter in the water
Plastic water bottles with goodies
Paper mache treat balls
Spreading of food items in the bottom layer

Novel Items

Widely ramified tree trunks and branches in exhibit
Dry-rotten wood
Loose suspended ropes, possibly untwined

Cleveland Metroparks Zoo, Cleveland OH

Novel Food Items

Snow cones with juice

Novel Food Delivery

Feeder, probing	PVC pipe outside exhibit with peanut butter or sticky subs. inside
Feeder, PVC	Filled with approved novel foods or browse
Feeder, PVC challenge tube	On file
Feeder, PVC cricket	Tube w/holes, capped ends; can be N w/blowtorch
Feeder, PVC frozen enrichment	On file
Feeder, PVC puzzle	On file
Feeder, seed shaker	On file
Feeder, stick	On file
Ice Treats	Blocks, rings, cubes, piles of ice, treats with approved toys or food items inside. Blood Balls for carnivores: made with blood (from thawed zoo diets) and water solution.
Termite mound	

Novel Auditory

Audio recordings and sounds	a) Music b) animal sounds c) Game caller sounds
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played or made live
* Placed outside of the reach of the animal

Radio

Wind chimes

pipes or bamboo pieces;
outside of enclosure and out of reach of animal only

Novel Visual

TV

Novel Items

Ball, Adobe

On file

Ball, Boomer

Could fill with approved novel foods or add scents, including approved urine
Could be loose on the ground or suspended

Bedding, novel

Timothy, straw

Bowling pins, candlepin

Boxes, cardboard

Clean boxes, with tape and staples removed, including ingestion packing, cereal, beverage, salt containers, etc.

Observe for possible

Bubbles

Bucket, monkey

On file

Bungee seat

Project on file

Carpet pieces

For grooming

Clothing

Fabric

sheets, pillow cases, towels, blankets, ingestion etc.

Observe for possible

Feathers

Remove thick shaft for animals that may ingest and perforate gut.

Fire hose

For climbing

Hammocks

On file, made from upholstery fabrics

Hard hats

Heavy duty, not toy, with inserts removed

Magazines

Remove all staples and tape. Should be used indoors unless care is taken on a windy or rainy day to ensure complete removal of

	scraps and waste.
Mulch	With/without forage In piles or not Remove the same day
Newspaper	Remove all staples and tape
	Shredded or unshredded Should be used indoors unless care is taken on a windy or rainy day to ensure complete removal of scraps
Piñata, paper mache	Stuffed with treats
Pine cones	Dry, no green cones
Rubber boots	
Sand Boxes	Use clean sand
Seed shaker	Use plastic container with screw lid
Sheets	
Snake skins	Autoclaved
Stumps	
Tires	For rolling
Traffic cones	For rolling, sparring, etc.
Tubs	Black or heavy colored
Video cases, clear plastic	For smaller primates under 20lbs)
Water jugs	

Franklin Park Zoo, Dorchester MA

DIURNALS/SMALL NOCTURNALS

Substrate:

Mulch
Sand
Pea gravel
Newspaper
Shredded Paper
Bamboo

Manipulanda:

Feeding devices: Cardboard boxes/tubes, plastic baskets/tubs, milk crates, laundry baskets, rubber tubs, plastic milk jugs/juice bottles, pvc tubes, raisin boards, turf mat feeders

Objects: Kongs, paper bags, boomer balls, phone books, pinecones, stuffed animals

Hanging devices: Bungee cords, synthetic ropes, carabineer clips, plastic chain, metal eyebolts, c-clamps.

Structure: Natural branches, metal poles, sealed 2x4 boards, pvc pipers, hammocks (sheets, fleece), cargo nets (rope, synthetic fiber, cloth), ferret type bags, Playskool play sets, ladders (manufactured and bamboo), fire hose, rubber hose, swings made from hanging branches, plastic chairs, bendable rope swings (parrot type).

Natural Enclosures

Olfactory: Spices, food flavor extracts, perfume, garlic

Auditory: Radio

Approved food items (Amount to be approved by collection manager and/or vet): Browse (only approved species), ice cube treats, flavor extracts, honey, jelly, syrup, fruit syrup, peanut butter, raisins, craisins, dried fruit, sugar-free applesauce, diluted fruit juice and Gatorade, coconut, baby food, fresh garlic and ginger, cereal (corn flakes, rice puffs, shredded wheat, chex, cheerios), air popped popcorn, nuts.

**Sifakas are limited to small quantities of nut butter, nuts, air popped popcorn unless approved by vets.

**Operant Conditioning
Research Projects**

AYE-AYE

Metal box feeders/tubes
Bamboo tubes for feeding gruel
Rotten Logs
Bamboo for nests
Pine boughs and needles for making nests
Linking-logs
Fleece
Cardboard boxes and tubes
Paper items (i.e. bags, envelopes, phone books, cups)
Food Items (see diurnal list)
Operant Conditioning
Research Projects

Duke Lemur Center, Durham, NC

PHYSICAL

< Baby toys
< Baskets
< Boomer balls
< Bungee cord
< Cardboard tubes/boxes
< Cargo nets
< Carpet
< Feeder puzzles
< Fire hoses
< Food foraging
< Kong toys
< Log swing / perch
< Looklou
< Magazines
< Metal rattles
< Milk crates

- < Non-toxic browse, leaf piles or flowers
- < Non-toxic drawing materials
- < Pails
- < Paper (thick cardboard type ... some lemurs have ingested shredded paper)
- < Plastic barrels
- < Plastic feeder logs or “pills”
- < PVC tunnels or feeders
- < Ropes / vines
- < Rubber tubs
- < Running water
- < Tires
- < Training
- < Whiskbroom with seeds in bristles
- < Wood wool

SOCIAL

- < Group-living
- < Training

NUTRITIONAL

- < Paper bags with treats
- < Boomer balls with treats inside
- < Feeder puzzle
- < Food foraging
- < Ice treats
- < Juice
- < Mealworms / crickets
- < New vegetation
- < Non-toxic browse, leaf piles or flowers
- < Plastic feeder logs or “pills”
- < Rotational feeding
- < Seeds / scratch
- < Skewered fruit
- < Spices
- < Training

OCCUPATIONAL

- < Baby toys
- < Bag with treats
- < Baskets
- < Bungee cord
- < Burlap
- < Cardboard tube / boxes
- < Cargo nets
- < Feeder puzzle
- < Fire hoses
- < Log swing / perch
- < Metal rattles
- < Non-toxic drawing materials
- < Pails
- < Plastic feeder logs or “pills”
- < PVC tunnels or feeders

- < Ropes /vines
- < Rotational feeding
- < Rubber tubs
- < Tires
- < Training

SENSORY

- < Audible toys
- < Baby toys
- < Bags with treats
- < Baskets
- < Boomer balls
- < Bungee cord
- < Carpet
- < Chimes (outside cage)
- < Feeder puzzle
- < Food foraging
- < Ice treats
- < Kong toys
- < Log swing / perch
- < Looklou
- < Magazines
- < New vegetation
- < Non-toxic browse, leaf piles and flowers
- < Non-toxic bubbles
- < Non-toxic drawing materials
- < Paper (Thick)
- < Perfume/Cologne
- < Pictures
- < Radio
- < Rotational feeding
- < Running water
- < Seeds / scratch
- < Skewered fruit
- < Spices
- < Television
- < Training
- < Unbreakable mirrors

Bronx Zoo, Bronx, NY

Sensory: Auditory, Visual, Tactile, Olfactory

- Radio
- Heat lamp

Foods and Feeding:

- Multiple Feedings
- Specialty Fruit
- Tamarind Pods
- Frozen corn
- Frozen Peas
- Browse (escalonia, honeysuckle, mini leaf comprosma, comprosma)

Romaine

Manipulative items/ Toys

Boomer balls
Primate forage tubes
Wrapped presents
Laundry baskets
Plastic bowls
Carved pumpkins

Physical Environment

Browse (see list)
Ropes, Nets
Tree stumps
High platforms
Hammocks

Behavioral

Training

San Francisco Zoo, San Francisco, CA

Lemur-Lemur catta, Varecia variegata variegata and Varecia variegata rubra

Novel Items

Hanging boomer balls
Hanging containers (food in containers)
Bubbles
Mulch
Bamboo furniture
Bucket feeders w/lid- usually do not attach lid for lemurs
Paper bags/Feed bags
Dirt
Logs/Branches
Cardboard Tubes- usually do not close off ends for lemurs
Egg Cartons
Newspaper
Phonebook
Magazines
Shredded paper
Plant paper/brown paper
Boxes, big and little
Plastic barrel
Plant pots
Kiddie pool

Novel Food Items

Kool-aid
Browse- frozen and fresh
Ice treats
Jell-o
Parrot Seed Mix
Live bugs
Hay
Straw
Alfalfa

Novel Smells

Scents/Spices/Perfumes

Novel Auditory

Rainforest CD

Loris-Nycticebus pygmaeus**Novel Items**

Hanging containers

Bubbles

Mulch

Bamboo furniture

Paper bags/Feed bags

Dirt

Logs/Branches

Cardboard Tubes- big and little big for hiding in toilet paper size for hiding food

Egg Cartons

Newspaper

Magazines

Shredded paper

Plant paper/brown paper

Boxes, big and little

Plant pots

Novel Food Items

Kool-aid

Browse- frozen and fresh

Ice treats

Jell-o

Parrot Seed Mix

Live bugs

Hay

Straw

Alfalfa

Novel Smells

Scents/Spices/Perfumes

Novel Auditory

Rainforest CD

All items are on a list every month; keepers then chose whatever enrichment they want to do daily. Some categories can be repeated two times a month. We also have seasonal items ex- pumpkins or snow and novel food items if our restaurant has an abundance of something they need to get rid of (usually bread).

Omaha's Henry Doorly Zoo, Omaha, NB

Novel Food Items and Food Presentation

Boxes, bags, paper sacks, cardboard egg cartons, etc. alone or with one or more of items such as: Raisins, popcorn, panda biscuits, daily diet, sunflower seeds or other treat items. Pull off tape, strings, pull out plastic linings before giving to an animal

Leaves (from non-toxic trees), hay or straw - in a pile or in a box - may be given as an activity themselves or with the diet or a treat item in them.

Newsprint paper from a roll can be strung throughout pen or placed in a wad on the floor - as an activity alone or with a treat item in them.

Nuts scattered, partially cracked for the lemurs if they have hard shells.

The ball or puzzle feeders with sunflower seeds or raisins.

Hanging items helps increase the challenge. Pay attention as to how the item is hung so animal can not injure themselves.

Raisins, seeds, nuts, etc. in a sandbox.

Food inside a yogurt-type container with lid on. Can cut your own holes to make a puzzle feeder. The same will work for boxes.

Seeds, nuts, raisins, etc. shoved into "spongy" type fruits or vegetables like squash or apples. Raisins in the heads of romaine are very popular.

Seasonal produce or unusual produce. See senior keeper for types and specifics.

Browse, branches or trees from non-toxic plants.

Ice blocks - Can add fruits and make a frozen fruit juice or sugar-free Kool-aid "popsicles." Sizes of blocks and sizes of fruit can vary.

Make a trail with honey, peanut butter, spices, etc.

Insects in puzzle feeders, live fish in water tub.

Treat ideas: jello, popcorn chains, hardboiled eggs, cooked pasta, cereal, yogurt, cheese, jar baby food.

Make regular diet in different shapes and sizes, whole.

Pinecones with peanut butter and/or spices.

Paper mache' objects (made with newspaper and flour/water paste) filled with treat items.

Drips- containers set on top of mesh etc that drip items such as applesauce or honey at an uneven rate.

Snowballs or snowman – plain or with food items or juice in it.

Novel Environment

Lemurs - Outside access on days that are 50 degrees or above. This is a judgment call on how long to let them out, but even 15 minutes in the winter will help alleviate "cabin fever." Make sure RT pond is sufficiently ice free!

Re-perch holding or redo grapevines

Novel Auditory

Play tapes with interesting sounds.

Novel Items

Plastic toys - milk crates, barrels, traffic cones, puzzle feeders, sandwich feeders, plastic or rubber tough dog type toys. See senior keeper for specifics.

Hammocks, cargo netting, platforms, rope ladders, soft sided dog crates, mirrors (primate safe only if going inside enclosure!) – Make sure they are hung safely for the animal.

Tire swings, PVC swings or log swings

Fire hose can be used to make swings and hammocks. Watch for any fraying of ends that animals might ingest.

Novel Smells

Spices, oils and extracts (packaged for human consumption). See senior keeper for specifics.

Scent marked items and/or hair from another animal- ie a log from the other lemur troop or hair from sheep, yak or llamas.

Novel Visual

Non-toxic washable, sidewalk chalk on holding floors or walls. Can draw colorful pictures or designs for visual enrichment.

Blow bubbles for animals. Bubbles must be non-toxic (child safe).

Children's books with bright, colorful pictures for visual enrichment. Check to make sure books contain to plastic parts.

Indianapolis Zoo, Indianapolis, IN

<u>Environment</u>		<u>Goal Behavior</u>
Substrates: leaves, mud, dirt, sand, grass, pine needles, Straw, hay,	ENB	
Shade		PS
Pool		PS
Add/rearrange branches or stumps	PS	
Resting spots: hammock, cargo net, ropes, fire hose, milk crates	PS	
PVC or log swings		PS
<u>Food/Feeding</u>		
Treats: plain popcorn, hay, baby food, yogurt, nuts, crackers, peanut butter, syrups, hard boiled egg, raisins, cereal, honey cooked pasta, pasta wrap, jello, applesauce, sunflower seeds,	NF	

Scatter/hide any diet or treat	EXP	
Browse: grapevine, bamboo, honey suckle, mulberry, Amur maple, willow		ENB
Puzzle Feeders: hide food in box with holes, suet feeder, carousel toy,	EXP	
Whole fruits		NF
Ice blocks		NF
Pinecone with peanut butter or other food stuffed in it	NF	
Paper Mache filled with treat		NF
Change timing/number feedings per day	UNP	

Social

Sensory

Scent		
Spices, perfumes, etc	PS	
Scent marked items from other animals	PS	
Visual		
Bright non-toxic, washable chalk or paint on walls, Floors	PS	
Bubbles		PS
Wind socks		PS
Auditory		
Bells		PS
Music/nature CD's		PS
Wind chimes		PS
<u>Manipulada</u>		
Stuffed animal	PS	
Kong toy		PS
Peacock feathers		PS

Scovill Zoo, Decatur, IL

Novel Items

- Activity boards (bread crates with toys attached)

- Bags
- Basketballs
- Boxes
- Butcher paper
- Cardboard tubes
- Clothes/sheets
- Dirt box
- Envelopes
- Fire hose
- Hard hats
- Indoor/Outdoor carpet, hard plastic variety
- Kiddie pool – water or sandbox
- Newspaper
- Phone books
- Pinatas
- Rocks
- Snow

Novel Food Items/Food Delivery

- Bamboo frozen jello /juice rods
- Bottles, 2L stuffed with hay/straw/treats
- Browse
- Bundle of sticks (check browse list)
- Corn on the cob
- Cornstalks
- Cricket dispensers, PVC
- Coconuts
- Flavor spray
- Flowers (check browse list)
- Foraging log/board
- Frozen fruit in black tubs
- Goodie grab bags (small brown sandwich bags)
- Greens feeder
- Hay
- Herbs in bags
- Ice cream
- Ice treats
- Jello/Pudding
- Kix puzzle feeders
- Kong treats
- Kool-Aid paste (sugar free kool-aid, flour & water)
- Leaves
- Mealworms
- Peanut Butter Smear – approved but our current lemurs don't care for it
- Pine cone treats
- Plastic jug feeders
- Pumpkins
- Puzzle feeders
- Raisin picker (small logs with holes drilled & eye bolts. Raisins are shoved into the holes & the logs are hung)
- Rhubarb
- Seed shaker
- Sippy cups
- Sticky logs (small logs with eye bolts. They are smeared with honey & hung)
- Straw

Novel Auditory

- Bamboo wind chimes
- Music

Novel Visual

- Finger paints, non-toxic
- Sidewalk chalk (see under "Finger paints")

Ft. Wayne Children's Zoo, Ft. Wayne, IN

Mongoose Lemurs**Novel Environment**

Add/change exhibit furniture

Novel Food Items/Food Delivery

Alfalfa small handful
Apricots (dried) 1/8 cup
Apple chips 1/8 cup
Apricot juice (dil 1:4 water)
Canned cherries 1/8 cup
Chow balls
Chow w/juice
Chow w/spices
Chow w/extracts
Coconut puzzle feeder
Coffee flavored syrup
Cranberries (whole) 1/8 cup
Cranberries (dried) 1/8 cup
Extracts
Feeder balls
Feeder board
Gatorade (dil 1:4 water)
Ground spices
Honey 2 tsp.
Ice cups 1
Jelly/Jam 2 tsp.
Jello 1/8 cup
Ketchup 2 tsp.
Kiwi 1/8 cup
Maple syrup 2 tsp.
Mustard 2 tsp.
Peanuts 2
Peanut butter 2 tsp
Watermelon 1/8 cup
Yogurt 1/8 cup

Novel Items

Ferret balls
Ferret tube
Kong toys
Looky lou
Milk crate
.Pinecones

Plastic gourds

Novel Smells

Scented spray (Bath & Body works body splash)

B&W Ruffed Lemurs

Novel Environment

Add/change exhibit furniture

Novel Food Items/Food Delivery

Alfalfa small handful

Apricots (dried) 1/8 cup

Apple chips 1/8 cup

Apricot juice (dil 1:4 water)

Canned cherries 1/8 cup

Coconut 2" piece

Coconut puzzle feeder

Coffee flavored syrup

Cranberries (whole) 1/8 cup

Cranberries (dried) 1/8 cup

Extracts

Feeder balls

Feeder board

Gatorade (dil 1:4 water)

Ground spices

Honey 2 tsp.

Ice cups 1

Jelly/Jam 2 tsp.

Jello 1/8 cup

Ketchup 2 tsp.

Kiwi 1/8 cup

Maple syrup 2 tsp.

Mustard 2 tsp.

Peanuts 2

Peanut butter 2 tsp.

Sunseeds 1/8 cup

Watermelon 1/8 cup

Yogurt 1/8 cup

Novel Items

Boxes

Cardboard tubes

Ferret balls

Ferret tube

Kong toys

Looky lou

Magazines

Milk crate

Paper bags

Phonebooks

Pinecones

Plastic gourds

Plastic trays

Novel Smells

Scented spray (Bath & Body works body splash)

Ringtail Lemurs

Novel Environment

Add/change exhibit furniture

Novel Food Items/Food Delivery

Alfalfa small handful
Apricots (dried) 1/8 cup
Apple chips 1/8 cup
Apricot juice (dil 1:4 water)
Canned cherries 1/8 cup
Chow balls
Chow w/juice
Chow w/spices
Chow w/extracts
Coconut 2" piece
Coconut puzzle feeder
Coffee flavored syrup
Cranberries (whole) 1/8 cup
Cranberries (dried) 1/8 cup
Extracts
Feed bag
Feeder balls
Feeder board
Gatorade (dil 1:4 water)
Ground spices
Hard boiled egg 1/4
Honey 2 tsp.
Ice cups 1
Jelly/Jam 2 tsp.
Jello 1/8 cup
Ketchup 2 tsp.
Kiwi 1/8 cup
Maple syrup 2 tsp.
Mustard 2 tsp.
Olives 1/8 cup
Peanuts 2
Peanut butter 2 tsp.
Sunseeds 1/8 cup
Watermelon 1/8 cup
Yogurt 1/8 cup

Novel Items

Boxes
Cardboard tubes
Ferret balls
Ferret tube
Kong toys
Looky lou
Magazines
Milk crate
Paper bags
Phonebooks
Pinecones

Plastic gourds
Plastic trays

Novel Smells

Scented spray (Bath & Body works body splash)

Bush baby

Novel Environment

Add/change exhibit furniture

Novel Food Items/Food Delivery

Alfalfa small handful
Apricots (dried, cut up) 2
Apricot juice (dil 1:4 water)
Baby food 1 tsp
Canned cherries 4
Coconut puzzle feeder
Cranberries (dried) 6
Crickets 6
Extracts
Feeder balls
Feeder board
Gatorade (dil 1:4 water)
Ground spices
Hard boiled egg 1/4
Honey 1 tsp.
Ice cubes 2
Jelly/Jam 1 tsp.
Jello 1/8 cup
Kiwi 1/8 cup
Maple syrup 1 tsp
Peanuts 2
Peanut butter 1 tsp
Superworms 3
Watermelon 1/8 cup
Waxworms 6
Yogurt 1/8 cup

Novel Items

Burlap
Ferret balls
Ferret tube
Kong toys
Milk crate
Pinecones
Plastic gourds

Novel Smells

Scented spray (Bath & Body works body splash)

Red Fronted Brown Lemurs

Novel Environment

Add/change exhibit furniture

Novel Food Items/Food Delivery

Alfalfa small handful
Apricots (dried) 1/8 cup
Apple chips 1/8 cup
Apricot juice (dil 1:4 water)
Canned cherries 1/8 cup
Chow balls
Chow w/juice
Chow w/spices
Chow w/extracts
Coconut 2" piece
Coconut puzzle feeder
Coffee flavored syrup
Cranberries (whole) 1/8 cup
Cranberries (dried) 1/8 cup
Extracts
Feed bag
Feeder balls
Feeder board
Gatorade (dil 1:4 water)
Ground spices
Hard boiled egg 1/4
Honey 2 tsp.
Ice cups 1
Jelly/Jam 2 tsp.
Jello 1/8 cup
Ketchup 2 tsp.
Kiwi 1/8 cup
Maple syrup 2 tsp.
Mustard 2 tsp.
Olives 1/8 cup
Peanuts 2
Peanut butter 2 tsp.
Sunseeds 1/8 cup
Watermelon 1/8 cup
Yogurt 1/8 cup

Novel Items

Boxes
Cardboard tubes
Ferret balls
Ferret tube
Kong toys
Looky lou
Magazines
Milk crate
Paper bags
Phonebooks
Pinecones
Plastic gourds
Plastic trays

Novel Smells

Scented spray (Bath & Body works body splash)

*Amounts are based on one animal.

Busch Gardens Tampa, Tampa, FL

Red Ruffed Lemur

Novel Smells

Fox hair w/in an approved container-cannot have direct access to
Goat hair w/in an approved container-cannot have direct access to
Sheep hair w/in an approved container-cannot have direct access to

Novel Items

Pine cones

Black and White Ruffed Lemur

Novel Smells

Fox hair w/in an approved container-cannot have direct access to
Goat hair w/in an approved container-cannot have direct access to
Sheep hair w/in an approved container-cannot have direct access to

Novel Items

Pine cones

Ring-tailed Lemur

Novel Items

Fish-live in water tub
Toilet paper roll
Stuffed animal-remove button eyes or beads

Novel Environment

Hay

Slow loris

Novel Items

Totem pole w/leather ropes
Wood ladder w/beads
Wooden chimes

Novel Environment

Dishtowels
Small towels
Stuffed animal
Wascloths

Pygmy slow loris

Novel Items

Totem pole w/leather ropes
Wood ladder w/beads
Wooden chimes

Novel Environment

5" wicker ball

Dishtowels

Small towels

Washcloths

Appendix C

Browse Lists

*We mentioned this at the meeting, but did not send out another call for institutions to send browse lists so I am just attaching the two that we have available.

San Diego Zoo

Bauhinia brachyia
Bischoffia trifoliata = javanica
Caprosma ripens
Catalpa speciosa
Eugenia cumini
Eugenia jambos
Eugenia peniculata
Ficus benjamina
Ficus macrophylla
Ficus microcarpa nitida
Ficus microcarpa retusa
Ficus religiosa
Ficus thoningii
Hibiscus rosa-sinensis
Morus alba
Techomaria capensis
Tipuana tipu

Sacramento Zoo

Acceptable Browse (RT/M/BWR Lemurs)

Palm Fronds
Acacia (**no A. berlandieri**)
Cape Plumbago
Photinia
Rondo Grass
Bamboo
Willow
Pyracantha (**no berries**)
Ginger
Coprosma
Flowers (**i.e. roses, camellias: check each type**)
Mimosa
Mulberry
Rose of Sharon
Elm

Sweet gum
 Tulip Tree
 Grapevine (**no Parthenocissus quinquefolia- Virginia Creeper**)
 Banana Leaf
 Nasturtium
 Strawberry Tree
 Fringe Flower
 Xylosma

Sifaka: no Palm Fronds, Rondo Grass, Bamboo, Citrus, Ginger, Banana Leaf

Cleveland Metroparks Zoo

*This is a complete institutional browse list. Please note that the browse used for primates contains a “P” in the Approved For column.

Plant Material	Approved For
Alder (<i>Alnus</i> spp.)	H
Apple (<i>Malus</i> spp.)	P,H,M,R,I,T,B,A
Arborvitae (<i>Thuja</i> spp. and var.)	H
Areca Palm (<i>Chrysalidocarpus lutescens</i>)	H
Arrow Bamboo (<i>Pseudosasa japonica</i>)	P,H,M,R,I,T,B,A
Ash (<i>Fraxinus</i> spp.)	P,H
Aspen (<i>Populus</i> spp.)	H,R
Bamboo (<i>Arundinaria</i> , <i>Indocalmus</i> , <i>Phyllostachys</i> , <i>Sasa</i>)	P,H,M,R,I,T,B,A
Bamboo Palm (<i>Chamaedorea erumpens</i>)	P,H,M,R,I,T,B,A
Basil (<i>Ocimum basilicum</i> and var.)	P,?
Beech (<i>Fagus</i> spp.)	P,H
Birch (<i>Betula</i> spp.)	P,H,M,R,I,T,B,A
Blackberry, Black or Red Raspberry (<i>Rubus</i> spp.)	P,H,M,R,I,T,B,A
Box Elder (<i>Acer negundo</i>)	P,H,M,R,I,T,B,A
Bush Honeysuckle (<i>Lonicera</i> spp.)	P,H,M,R,I,T,B,A Do not feed to Elephants!
Butterfly Bush (<i>Buddleja</i> spp. and var.)	P,H
Catelpa (spp. and var.)	P,H,R
Cattails (<i>Typha</i> spp.)	P,H,M,R,I,T,B,A
Conifers (Pines, Spruce, Fir, Hemlock)§	P,H
Corn (<i>Zea maize</i>)	P,H,M,R,I,T,B,A

Cotoneaster (spp. and var.)	P,H,R
Cottonwood (Populus deltoides)	P,H
Crabapple (Malus spp.)	P,H,M,R,I,T,B,A
Croton (Codiaeum variegatum)	H
Daylily {flowers} (Hemerocallis spp. and var.)	P,H,R
Dogwood (Cornus spp. and var.)	P,H,R
Plant Material	Approved For
Dracaena (spp. and var.)	H
Dwarf Palm (Chamaerops humilis)	H
Elm (Ulmus spp.)	P,H,M,R,I,T,B,A
Eugenia (E. uniflora)	H
Ficus benjamina, F. x 'Allii'	Francois Langur/Tree Kangaroo ψ
Fig (Ficus spp.)	P,H,M,R,I,T,B,A *
Firethorn (Pyracantha spp. and var.)	P,H,M,R,I,T,B,A - Rhino 1 st
Forsythia (spp. and var.)	P,H,M,R,I,T,B,A
Giant Reed Grass (Arundo donax)	P,H,M,R,I,T,B,A
Ginger {flowers} (Hedychium spp.)	B
Grape (Vitis spp.)	P,H,M,R,I,T,B,A
Hackberry (Celtis spp.)	P,H,M,R,I,T,B,A
Hawthorn (Crataegus spp.)	P,H,M,R,I,T,B,A
Hazelnut (Corylus spp.)	P,H,M,R,I,T,B,A
Hibiscus (spp. and var.)	P,H,M,R,I,T,B,A
Hickory (Carya spp.)	H
Honey Locust (Gleditsia triacanthos and var.)	P,H,M,R,I,T,B,A
Honeysuckle (Lonicera spp. and var.)	P,H,M,R,I,T,B,A Do not feed to Elephants!
Juniper (spp. and var.)	H
Lady Palm (Rhapis excelsa)	P,H,M,R,I,T,B,A
Linden, Basswood (Tilia spp. and var.)	P,H,M,R,I,T,B,A
London Plane Tree (Platanus x acerifolia)	H
Magnolia (spp. and var.)	H
Maples {Most} (Acer spp. and var.)	P,H \ominus
Mock Orange (Philadelphus coronarius)	H

Mulberry (<i>Morus</i> spp.)	P,H,M,R,I,T,B,A
Plant Material	Approved For
Nasturtium (spp. and var.)	H (P?)
Oak (<i>Quercus</i> spp. and var.)	H ¥
Olive, Autumn and Russian (<i>Eleaegnus</i> spp.)	P,H
Ornamental grasses (Asst. spp.)	P,H,M,R,I,T,B,A
Palms (Asst. spp.)	H
Pine (<i>Pinus</i> spp. and var.)	P,H,M,R,I,T,B,A – Except Polar Bear
Poplar (<i>Populus</i> spp.)	P,H,M,R,I,T,B,A
Pothos (<i>Epipremnum aureum</i>)	Skink ONLY £
Privet (<i>Ligustrum</i> spp.)	I
Redbud (<i>Cercis</i> spp. and var.)	P,H,M,R,I,T,B,A
Rose (<i>Rosa</i> spp. and var.)	P,H,M,R,I,T,B,A – Rhino 1st
Serviceberry (<i>Amelanchier</i> spp. and var.)	P,H,M,R,I,T,B,A
Sunflower (<i>Helianthus</i> spp. and var.)	P,H,M,R,I,T,B,A
Sweetflag (<i>Acorus</i> spp.)	P,H,M,R,I,T,B,A
Sweetgum (<i>Liquidambar styraciflua</i>)	P,H
Sycamore (<i>Platanus occidentalis</i>)	P,H
Tulip (<i>Tulipa</i> spp. and var.)	P,H
Viburnum (spp. and var.)	P,H,M,R,I,T,B,A
Willow (<i>Salix</i> spp. and var.)	P,H,M,R,I,T,B,A
Witchhazel (<i>Hamamalis</i> spp. and var.)	H

Akron Zoo

*Browse list same for lorises

Approved Lemur Enrichment

Browse

Birch

Chinese With Hazel

Common Hackberry

Dogwood

Elm

Ginko Tree

Mulberry

Norway Maple

Paper Birch

Poplar/Cottonwood

Sassafras

Silver Maple

Sugar Maple

Tulip Tree

Western Catalpa

Willow

Appendix D

Advisor Reports

Nutrition – Jason Williams

- Glycemic control continues to be a problem when feeding in captivity. I was recently contacted by the veterinarian at the Buffalo Zoo who is dealing with a situation very similar to Chantal.
- Should be stressed that, in the majority of cases, feeding a diet low in soluble carbohydrates is the way to go.
- Don't be afraid of diet changes... it is not uncommon for it to take months to transition primates to a less palatable pellet or biscuit but this can be very important to long term care. Reducing the sugar content of the diet should be a constant pursuit.
- Probably worth noting the differences (*for the most part*) in sugar content between native vegetation and domestically cultivated produce items. There can be a tendency to over feed "fruits" throughout the year because the animals prefer them. I'd like to start working on the development of a feeding program for our lemurs that resembles a more natural cycle with regards to nutrient availability and seasons.
- Obesity obviously continues to be a factor with geriatric individuals. As these animals age fiber becomes even more important... meeting the individual nutrient requirements i.e. vitamin/mineral/protein etc... while at the same time limiting energy (*soluble carbohydrates*) should definitely be considered when formulating geriatric diets.
- Please stress that as the nutrition advisor for the TAG I am more than willing to help out with general dietary questions, diet formulation, recommending labs for analyses, or anything nutrition related that they may need help with. I rarely receive requests for assistance so please let everyone know that I am available for consultation at any time.

I've attached a list of fairly recent publications that folks might be interested in as well

Nutrition and Behavior of Lemurs

Veterinary Clinics of North America: Exotic Animal Practice, Volume 12, Issue 2, Pages 339-348

R. JUNGE, C. WILLIAMS, J. CAMPBELL

Increase in tannin consumption by sifaka (*Propithecus verreauxi verreauxi*) females during the birth season: a case for self-medication in prosimians?

Primates, Volume 44, Number 1 / January, 2003

VALENTINA CARRAI, SILVANA M. BORGOGNINI-TARLI, MICHAEL A. HUFFMAN AND MASSIMO BARDI

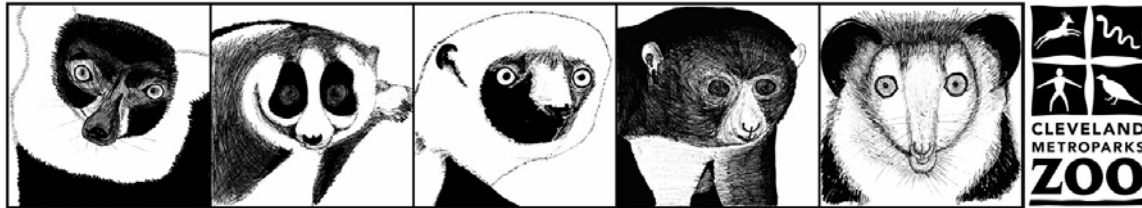
Diet, Nutritional Ecology, and Birth Season of Eulemur macaco in an Anthropogenic Forest in Madagascar

International Journal of Primatology, Volume 28, Number 6 / December, 2007

BRUNO SIMMEN, FRANÇOISE BAYART, ANDRE MAREZ AND ANNETTE HLADIK

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