LEMUR TALKING POINTS

LEMUR CART INVENTORY

- Pelts: Black & White Ruffed Lemur, Ring-tailed Lemur
- In Plastic Box:
  - Skulls of Black & White Ruffed Lemur and Francois Leaf Monkey
  - Ring-tailed Lemur Tail & Forearm
  - Artificial orchid flowers
  - Bottles containing Vanilla Beans and Cloves
  - Sample of Lemur Chow in small box
- Lemur Resource Binder

LEMUR GENERAL CHARACTERISTICS

- **Strepsirrhini** (or **Strepsirhini**) is a suborder of primates that includes the infraorder of Lemuriform primates, comprised of the lemurs of Madagascar, galagos ("bushbabies") and pottos from Africa, and the lorises from India and southeast Asia.
- All strepsirrhini are "prosimians," which, roughly translated, means "pre-primates" or "before monkeys."
- **All Lemurs are endemic to the island continent of Madagascar** located off the eastern coast of southern Africa. Madagascar is literally as far away from San Francisco as possible (You can check this out with a globe or by digging a hole straight down.)
- The Lipman Family Lemur Forest presently houses 7 lemur species: **Ring-tailed lemurs, Blue-eyed black lemurs, Crowned lemurs, Red-bellied lemurs, Red-fronted lemurs, Black and white ruffed lemurs, Red-ruffed lemurs** and **Coquerel's Sifaka**. (see map)
- There are approximately 100 Lemur species in the wilds of Madagascar. Many species have already been hunted to extinction, including a gorilla-sized lemur that became extinct about 350BC.

LEMUR PHYSICAL ADAPTATION

1. **Skull/Head**
   - Lemurs have a smaller brain-to-body mass ratio relative to monkeys and apes.
   - Lemurs have long faces with relatively large eyes. Although the eyes point forward, allowing stereoscopic vision, the orbits do not face fully forward like those of monkeys.
   - Most or all species of Strepsirrhines are thought to possess a reflective layer behind the retina of the eye, called a tapetum lucidum, which improves vision in low light, but they lack a fovea (focal point for daylight vision) and also do not have color vision.
   - Thus it's important that they have an excellent sense of smell, facilitated by their elongated snout, "wet nose" and relatively large olfactory lobes.
   - Lemuriform primates are characterized by a "toothcomb" composed of six of their lower front teeth, (all four lower incisors and the two narrow, elongated canines), that are closely pushed together and pointing forward forming a "dental comb" used to comb the fur during oral grooming. (see photo)
   - Lemurs have two tongues. A second, little tongue is made of a tissue called cartilage. Located beneath the regular tongue, the "little tongue" is used to clean hairs from between the teeth of the toothcomb.
   - The lower jaw is unfused with the two pieces held together by a ligament.

2. **Body/Extremities**
   - Thick fur of most lemur species sheds water, helping protect from rain

- Lemuriforms also possess a grooming claw on the second digit of each foot for scratching.
- Grasping hands and feet have semi-opposable thumb and toes. Big toe of hind foot is widely separated from other toes allowing for a secure grip.
- Most species have long tails for balancing in the trees.
- Hind limbs are longer than forelimbs, providing a powerful launch when jumping through the trees.

LEMUR BEHAVIORAL ADAPTATIONS

1. **Lifestyle**
   - Most Lemurs are arboreal; living in trees, they spend most of their time at the top of the rain forest canopy or in mid-level forest. Ring-tailed Lemurs live in scrub forest and spend more time on the ground.
   - Scent marking is an important behavior in all the species. Lemurs are generally the most social of the Strepsirrhini and communicate more with scents and vocalizations than with visual signals.
   - With the exception of the red-fronted brown lemur, females are dominant in lemur social groupings.
   - Fruit-eating Lemurs may also use their toothcomb to pick out seeds from the fruit.
   - Reciprocal grooming is a socializing pastime in Lemur troops.
   - Definite breeding season: Keeper says each of the species are somewhat different
   - Ring-tailed Lemurs especially, like to sunbathe during the early morning hours. They can be seen sitting upright on the ground, arms held out from the sides and resting on their knees, palms open exposing their stomach skin to the sun (much like a human in a yoga meditation position) allowing them to warm their bodies in the cool mornings.
   - Lemurs are largely vegetarian, consuming shoots, leaves and fruits. They are important for seed distribution of forest trees.
2. **Communication**
   - Glands on chest, wrists and anal area produce strong scents used for marking troop territories and communication with troop members.
   - The tail also plays a significant role in signaling both visually and by wafting pheromones.
   - Black and white ruffed lemurs make very loud and dramatic sounds. The most characteristic calls are an intense roar of alarm and a powerful plaintive-sounding call for territorial expression, followed by loud, rather birdlike clucks.

LEMUR CONSERVATION TALKING POINTS

- Lemurs have suffered extensively from deforestation for charcoal, crops and cattle, from habitat fragmentation and from hunting. Orchids, cloves and vanilla beans are exported crops of Madagascar.
- Deforestation has resulted in a significant soil erosion problem. Astronauts have commented that it looks as if Madagascar is bleeding to death with its rivers running blood red and staining the surrounding Indian Ocean.
- **Humans,** however, are the biggest problem for the lemurs. Due to trapping and hunting many species are now endangered. In some locations they have been killed because there is a cultural belief that they are evil spirits. They don't want lemurs lurking around bringing strife to their people. Especially true of the Aye-aye, a strictly nocturnal lemur.
- In many areas of Madagascar lemurs are the victims of humans cutting away the forests for timber to make charcoal for cooking and to create fields for cattle and crops such as

rice. With the trees removed the habitat of the lemurs is reduced and they find it harder and harder to find enough food to survive.

- Of the 100 species of lemurs, 24 are now considered 'Critically Endangered', 52 are 'Endangered, 19 are 'Vulnerable' and two are 'Near Threatened'. For the present, just three lemur species are listed as 'Least Concern'.
- Conservation in Madagascar must address the needs of local people. Efforts must focus on alleviation of extreme poverty and economic development as well as protecting wildlife and ecosystems.
- The promulgation of solar cookers to relieve the extensive dependence on charcoal.
- Madagascar must promote sustainable agriculture for its native crops such as coffee and the vanilla orchid, which produces the vanilla bean. *Vanilla planifolia* has long been a lucrative, but eco-friendly crop for many farmers in northeastern Madagascar since the orchid grows best under the shade of canopy trees.
- Madagascar is a very poor country. To sustain themselves, many families were clearing the rainforest to plant a variety of food crops. Farmers know that to continue to raise a harvest and put food on the table in the future, they must switch to new sustainable farming techniques. A farming cooperative is making it possible for these families to earn a living by growing and processing vanilla in a sustainable way.
- Orchids and cloves are also exports of Madagascar that can be grown sustainably as well as coffee and raffia. Note: orchids are covered under CITES regulations and export permits are required to transport any plants out of Madagascar.

LEMUR INTERESTING/FUN FACTS

- Latin for "lemur" means "spirits of the night" or "haunter". In Malagasy (language of Madagascar), the word for lemur means "ghost".
- Malagasy people held the belief that lemurs embodied the spirits of their ancestors and should be respected.
- Our SF Zoo lemurs love a favorite treat of grapes.
- When the eucalyptus trees in Lemur Forest blossom, lemurs can be seen up in the trees eating the blossoms. Unlike the leaves, blossoms are not toxic and are a favored food.

LEMUR PREDATORS (see photos)

- The **Fossa** is the main natural predator of the Lemur. This is a type of cat-like mammal that is only found in Madagascar. It is closely related to the Mongoose family and is very strong and agile. The fossa is cathemeral, hunting and napping around the clock on no set schedule. Fossas do not eat lemurs exclusively, but hunt basically "anything with a heartbeat." Nevertheless, fossa predation is critical as it prevents some members of the island's primate family from outcompeting others. This helps maintain both mammal and plant diversity, since lemurs are important dispersers of plant seeds.
- The **Harrier Hawk** is also a common predator the Lemur. Mainly crepuscular but even a nocturnal hunter, it will swoop down and attack with powerful talons. Many young Lemurs are taken right off the backs of their mothers by this particular predator. Harrier hawks have great eyesight and the trees don't provide sufficient protection to prevent a lemur from becoming a fast meal.
- **Madagascar tree boa** possesses heat sensory organs allowing them to detect and capture lemurs even in the dark.
- It is interesting is that Lemurs may use tools in their natural setting to help them fight predators. These include rocks and sticks.

MADAGASCAR TALKING POINTS (see climate map)

- Once part of the supercontinent of Gondwanaland, the island of Madagascar separated from India and Africa between 100 and 200 million years ago, thus creating a time capsule of evolution.
- The island of Madagascar is hugely rich in biodiversity with over 80% of its species found nowhere else on Earth. Madagascar provides habitat for 283 bird species (more than 100 are endemic), 12,000 vascular plant species (of which more than 90 percent are endemic), more than 300 amphibian species (about 99 percent of which are endemic), 346 reptiles species (of which 90 percent are endemic), and 30 bat species (18 are endemic).
- Madagascar's biodiversity is endangered by deforestation, with over 90% of the country's rainforest already destroyed.
- 4th largest island but the 12th poorest country
- Madagascar has two seasons: a hot, rainy season and a cooler, dry season.
- The east coast is the wettest part of the country and thus home to the island's rainforests.
- The central highlands are considerably cooler and drier.
- The west coast is home to dry deciduous forests; the deciduous trees lose all their leaves during the dry season.
- The southwest of Madagascar has the island's driest climate; parts of this area can be considered desert because so little rain falls.
- Madagascar's chief exports:
    - **VANILLA ORCHID: THE VANILLA BEAN PLANT**
        - Vanilla beans are the seeds of the orchid *Vanilla planifolia*. Like many orchids, the vanilla bean orchid is an epiphyte, and lives on a host tree without drawing nutrients from it. The vine clambers up to the treetops in a zigzag fashion, exhibiting long succulent lance-shaped leaves.
        - Vanilla was probably introduced to the island in the 1800s.
        - This orchid grows wild in southeastern Mexico, where its flowers are pollinated by birds and insects. Most of the world's vanilla now is grown in Madagascar (approximately 80% of the world's vanilla), where these native pollinators don't exist. Pollination must be done by hand. Each flower is fertilized by hand, with a little stick. This is very time-consuming and labor-intensive. Hence, vanilla is the second-most expensive spice after saffron.
    - **CLOVES:**
        - Cloves are the unopened buds of an evergreen tree, *Syzygium aromaticum*.
        - Their Latin name, clavus, means "nail." Cloves are native to the Spice Islands of Indonesia in southeast Asia.
        - Cloves were one of the first spices to be traded in the world.
        - Today, Madagascar is the second largest producer and exporter of cloves in the world. Indonesia remains the top producer of cloves.
    - **RAW NICKEL:**
        - Raw Nickel is the top export of Madagascar.
        - Mining this mineral is tearing up primary rainforest that houses nearly 1,400 species of flowering plants, 14 species of lemurs, and more than 100 types of frogs.
        - The mining company is trying to minimize its environmental impact, including moving endangered wildlife, replanting trees, and establishing buffer zones near protected areas.
        - Mining is very profitable for this poor country. The Malagasy government will need to balance regulation and conservation with development.

LEMURS IN THE LIPMAN FAMILY LEMUR FOREST:
Specific Species, Adaptations and Home Ranges

1. **Ring-tailed Lemur (*Lemur catta*)** (see map)
   - Resident in south and southwestern Madagascar, living in the brush and scrub forests, closed canopy deciduous forests, dry, rocky mountainous areas with patches of deciduous forests.
   - Ring-tailed lemurs are numerous, with estimates of wild populations running from 10,000 to 100,000 and a captive population of well over 1,000.
   - Ring-tails spend more time on the ground (15%) than any of the other lemur species, commonly running on all fours. They forage and travel at all levels in the forest, running along branches or leaping between them, with their powerful hind legs touching first. The tail acts like a balancing rod in leaps.
   - Females are dominant over males, and remain in area they were born, while males move between troops.
   - Ring-tailed lemurs tend to form the largest troops, containing from 3 to 24 individuals of both sexes.
   - Fights among males range from a threatening stare, through lunging and cuffing, hair pulling and serious biting, to “stink fights” wherein males impregnate their tails with scent and then shake and quiver the tail over the head at their opponent.
   - Listed as **Endangered** on the IUCN Red List

2. **Blue-eyed Black Lemur (*Eulemur flavifrons*)** (see map)
   - Males and females of this lemur species look very different. (sexual dichromatism) Males are completely black and females are brownish grey with a grey face framed by spiky white tuffs of hair.
   - Blue-eyed black lemurs are the only primate other than humans with blue eyes.
   - Blue-eyed black lemurs travel in noisy bands of about 7 – 15 individuals, eating, sleeping and vocalizing together. They are polygamous and give birth approximately once a year to a single offspring, although twins do occur. For the first few weeks of life the baby will cling to the underside of the mother. Later on, it will ride on her back.
   - Blue-eyed black lemurs come from the rainforests of western Madagascar.
   - Blue-eyed black lemurs are most adaptable and are able to live in disrupted forests and closer to human activities than other lemur species.
   - They are also hunted for food and for the pet trade.
   - Blue-eyed black lemurs are killed because they are known to raid crops.
   - Blue-eyed black lemurs are listed as **Critically Endangered** on the IUCN Red List, with the primary threat being deforestation.

3. **Crowned Lemur (*Eulemur coronatus)*** (see map)
   - Males have chestnut brown backs, with lighter-colored fur on their bellies. Females are grey with cream-colored bellies. Both have a distinctive “crown” pattern of fur on their heads, from which they get their name. (sexual dichromatism) **Note:** the male crowned lemurs in SF Zoo are castrated and look more like females.
   - Crowned lemurs are found at the very northern-most tip of Madagascar, in dry and semi-dry deciduous forests.
   - They live in groups of 5 – 15 and are mostly active during the day.
   - Crowned Lemurs are listed as **Endangered** on the IUCN Red List.

4. **Red-bellied Lemur (*Eulemur rubriventer*)** (see map)
    - Live in small groups that consist of an adult pair and their offspring. The offspring are ejected from the group when the reach maturity, around 3 years of age.
    - Red-bellied lemurs live in medium to high altitude rainforests of eastern Madagascar.
    - Male red-bellied lemurs are predominately brown with white eye patches while females are brown white bellies, both male and females have black tails. (sexual dichromatism)
    - Red-bellied Lemurs are listed as **Vulnerable** on the IUCN Red List.

5. **Red-fronted Brown Lemur (*Eulemur rufifrons)*** (see map)
    - Males have grey-brown fur with a reddish crown on their head, while females are reddish-brown with a dark crown. Both genders have orange eyes with white furry eyebrows. (sexual dichromatism)
    - Red-fronted brown lemurs are one of the only lemur species with troops not led by a dominant female. They live in groups consisting of up to 18 individuals. The females usually stay with their family group while males leave when they are 2-3 years old. They are a notably less aggressive lemur species.
    - They are found in both western and eastern Madagascar with the western population having a smaller home range and higher population densities than the eastern populations.
    - Red-fronted Brown Lemurs are considered **Near Threatened** on the IUCN Red List and are listed on CITES Appendix I.

6. **Black & White Ruffed Lemur (*Varecia variegata variegata)*** (see map)
    - There are two species of ruffed lemur, the largest members of the living Lemuridae family. The black and white ruffed lemur and the red ruffed lemur are very similar, differing in coloration and territory. White-ruffed has three subspecies. Red-ruffed has been elevated to a separate species.
    - The black and white ruffed lemur and the red ruffed lemur are very similar, differing in coloration and territory
    - One of the main reasons suggested for female dominance is for allowing females to establish feeding priority over males. The energy demands of reproductive females are higher as they often carry and provide primary care for the offspring.
    - Parenting in this species of lemurs is unique as females bear litters of multiple offspring.
    - Instead of clinging to the mother, offspring are placed into a nest that is guarded by both parents.
    - Males will also play a role in the parenting of the offspring especially in smaller groups where the certainty of paternity is high.
    - Black and white ruffed lemurs are found in eastern Madagascar in the coastal rain forests, at the canopy level.
    - Black and white ruffed lemurs are main pollinators of the traveler's palm trees. They are the world's largest pollinator.
    - The black and white ruffed lemur is listed as **Critically Endangered** on the IUCN Red List and is on Appendix I of CITES.

7. **Red-Ruffed Lemur (*Varecia rubra)***
    - Red-ruffed lemurs are forest dwellers, and are restricted to the tropical forests of the Masoala Peninsula of northeastern Madagascar. Red-ruffed lemurs are found north of the Antainambalana River and the black and white ruffed lemur to the south.
    - Ruffed lemurs live in groups of two to ten individuals, usually a mated pair and offspring
    - Red-ruffed lemurs are very vocal, using a series of at least 12 different sounds to warn each other of predators, such as snakes, eagles, and humans.
    - The *Varecia* lemurs often hang upside down to feed as may be observed in the exhibit.
    - The young red-ruffed lemurs are born in a nest built by the female and are born with fur and their eyes are wide open. Red-ruffed lemurs do not carry their young on their backs. Like birds, they leave their young in the nests while they forage for food.
    - Ruffed lemurs are the only primates to have litters of up to 6 pups; the usual number is 2-3 young.
    - Red ruffed lemurs listed as **Critically Endangered** on the IUCN Red List due to deforestation, hunting, and trapping. Red ruffed lemurs are protected under Appendix 1 of CITES. Estimates suggest there are perhaps as few as 1,000 left in the wild.

8. **Coquerel's Sifaka (*Propithecus coquereli*)** (see map)
    - Sifaka are distinguished from other lemurs by their vertically clinging and leaping mode of locomotion; sifaka have long, powerful hind legs and an upright posture. They are able to leap over 20 feet from tree to tree.
    - Coquerel's sifaka are a diurnal species found in northwestern Madagascar in dry, deciduous forests including along coastal areas. They are mainly arboreal but occasionally descend to the ground.
    - On the ground, sifaka move by a bipedal, sideways hopping.
    - They are sexually dimorphic; males can be differentiated from females by their gular (throat) gland, which is used for scent marking. The skin and hair surrounding the gland is often stained.
    - Coquerel's sifaka live in social groups of between 3 and 10 individuals. Females are dominant and get first choice of food and mates.
    - Leaves make up a significant portion of the sifaka's diet. Diet consists of young leaves, flowers, fruit, bark and dead wood in the wet season, and mature leaves and buds in the dry season.
    - Sifaka often use suspension during feeding; they hang from their rear feet.
    - When eating, sifakas rarely use their hands to handle their meal. Instead, they usually grab the food directly with their mouth.
    - Sifaka give birth to one offspring in June/July (in southern hemisphere), after a gestation period of approximately 162 days.
    - Sifaka are independent at 6 months and sexually mature at 3.5 years.
    - The name sifaka, a Malagasy word, comes from its distinct call as it travels through the treetops: "shi-fakh."
        - The lemur on the PBS Kids television program *Zoboomafoo* is based on a Coquerel's sifaka
    - Coquerel's sifaka are listed as **Endangered** on the IUCN's Red List and are protected under Appendix I of CITES. The principal threats to their existence are deforestation, habitat fragmentation, and hunting pressure.

GENERAL PRIMATE TALKING POINTS

PRIMATE EVOLUTIONARY HISTORY (Note: see primate taxonomy charts)

- Transitional, arboreal primate-like creatures appeared around 65 million years ago after the dinosaur extinction and the first primates evolved around 60 million yrs. ago, squirrel-like insectivores with grasping hands and feet.
- The Eocene Epoch (beginning 55 million years ago) saw the appearance of a proliferation of prosimians in North America, Europe and Africa, ultimately reaching Madagascar, where isolated, they evolved into lemurs.
- Changes occurred in some of the Eocene prosimians, resulting in larger brains and eyes, smaller snouts; the foramen magnum (hole at base of skull where the spinal column passes through) began to move from the back of the skull towards the center, giving some prosimians a more erect body posture.
- With the beginning of the Oligocene Epoch (o/a 34 million years ago) world temperatures cooled and the first monkeys appeared.
- Many prosimian species were outcompeted by the new species and became extinct, except on Madagascar, where there was no other primate competition.
- The first monkeys had fewer teeth, smaller snouts, larger brains and more forward looking eyes than did the prosimians; they lived in trees and mainly ate fruit.
- The evolution of monkeys brought larger brain size, more vertical posture, less reliance on sense of smell and different use of fore and hind limbs.
- New World monkeys appeared o/a 30 million years ago, perhaps isolated groups of Old World monkeys drifting on clumps of soil and grass from Africa to South America or via a land bridge to North America and then to South America.
- Apes evolved during the early Miocene Epoch, 17-23 million years ago.
- 14 million years ago the ancestors of all modern primates lived in southern Europe, but with climate change, migrated to Africa and South Asia.
- Eight to nine million years ago two lines emerged in Africa, one leading to gorillas and another to humans, chimpanzees and bonobos.
- Five to six million years ago there was a divergence separating the ancestors of modern chimpanzees and bonobos from hominids (human-like primates).

GENERAL PRIMATE TRAITS

- There are 13 living primate families with more than 500 species and subspecies.
- There are three major types of non-human primates: prosimians, monkeys and apes.
- See attached taxonomic chart.
- 5 digits on each hand and foot
- Flat nails on toes/fingers (Some with modified claws), allowing for easier manipulation of objects
- Two separate bones in the forearm and lower leg, allowing better limb motion and more precise movements
- At least one opposable pair of digits (except colobines)
- Large clavicle
- Eyes:
  - Surrounded completely by bone (except lemur, partially surrounded)
  - Generally facing forward
  - Stereoscopic vision, providing depth perception
  - Color vision to some degree
- Paired mammary glands

- General increase in size and complexity of brain's cerebral hemisphere
- Most give birth to single offspring
- Trend toward longer period of parental care
- Trend toward longer gestation period and life spans

LEMUR ADAPTATIONS

- Old world prosimian ("prosimian" means "before monkeys")
- Found only on island of Madagascar
- Long, dog-like muzzle with wet nose and nose leather
- Flat nails and fleshy pads on most digits with first fingers and toes opposable
- Claw on second toes used for grooming
- More developed sense of smell than monkeys or apes
- Prominent whiskers and good vision with large, forward facing eyes (not as forward as monkeys); eye size probably a result of nocturnal ancestry
- Relatively poor color vision
- Long and generally bushy tails
- Dental grooming comb present
- Smaller brain to body size than other primates
- Diverse behaviors – some species maintain family groups and others solitary
- Female dominant in most species; breeding seasonal
- Diurnal and nocturnal species; most species arboreal
- Use scent markings and vocalizations for communication
- Predominant diet of fruit

MONKEY ADAPTATIONS

- Four families, two each Old World (Africa, Europe and Asia) and New World (Central and South America)
- Dry nosed, without nose leather
- Larger, more developed brain than lemurs
- Tails of various lengths present
- Flat nails on digits (marmosets and tamarins with claw-like nails)
- Opposition of thumbs and big toes of varied degrees, better than prosimians, but not as good as apes
- Limbs roughly the same length
- Shoulders do not rotate; do not brachiate
- Eyes face forward; binocular vision with ability to distinguish colors
- Lower molars with 4 cusps
- Heads rounded; short muzzle
- Vegetarian diets
- Virtually all live in social communities with groups stable over generations
- Head held upright
- Females more tolerant of each other than are lemurs
- Flexible, pliable bodies, important for movement in trees
  - **New World Monkey (Platyrrhini) Adaptations**
    - 64 species found only in Central and South America
    - Most species smaller than Old World monkeys
    - Exclusively arboreal
    - Most move quadrupedally on branches of trees or leap from branch to branch

- Some species with prehensile tails
- Marked by broad, flat noses with widely placed nostrils opening to the side
- 3 premolars and relatively large molars
- Thumb oriented in line with other digits, opposing next digit in scissor like grip (spider monkeys do not have thumbs)
- Male involvement common in infant care
- Social groupings range from monogamous to polyandrous to polygynous
- Rely largely on a diet of fruit

➢ **Old World Monkeys (Catarrhini) Adaptations**

- At least 78 species found in Africa and southeast Asia
- Relatively large, ranging in size from small to medium sized dog
- Down facing nose with nostrils close together, opening downward or forward
- Two premolars and molars with sharply connected cusps (raised points on top of molars), facilitating chewing of fibrous plant material
- Large, sharp canines with gap between canines and incisors
- All have tails, but no prehensility
- Ischial calliosities (sitting pads) on rumps to support sitting
- Thumbs rotated and more opposable (exception – reduced or absent in colobine monkeys)
- Most have color vision
- Fingernails and toenails on all digits
- Some species exhibit digitigrade walking (example: patas monkeys)
- Male involvement in infant care rare or absent
- Prominent sexual skin around anus and vagina in females that swells with estrous
- Social groupings rarely monogamous; size of group varies among species and may vary with availability of food
- Rely more on foliage in diet
- Some species have special digestive tracts for processing low value, fibrous diet and some have cheek pouches for temporary food storage.
- Have wider range of habitats
- Species either spend some or most of the day on the ground; may seek shelter of trees at night or for defense – semi-terrestrial

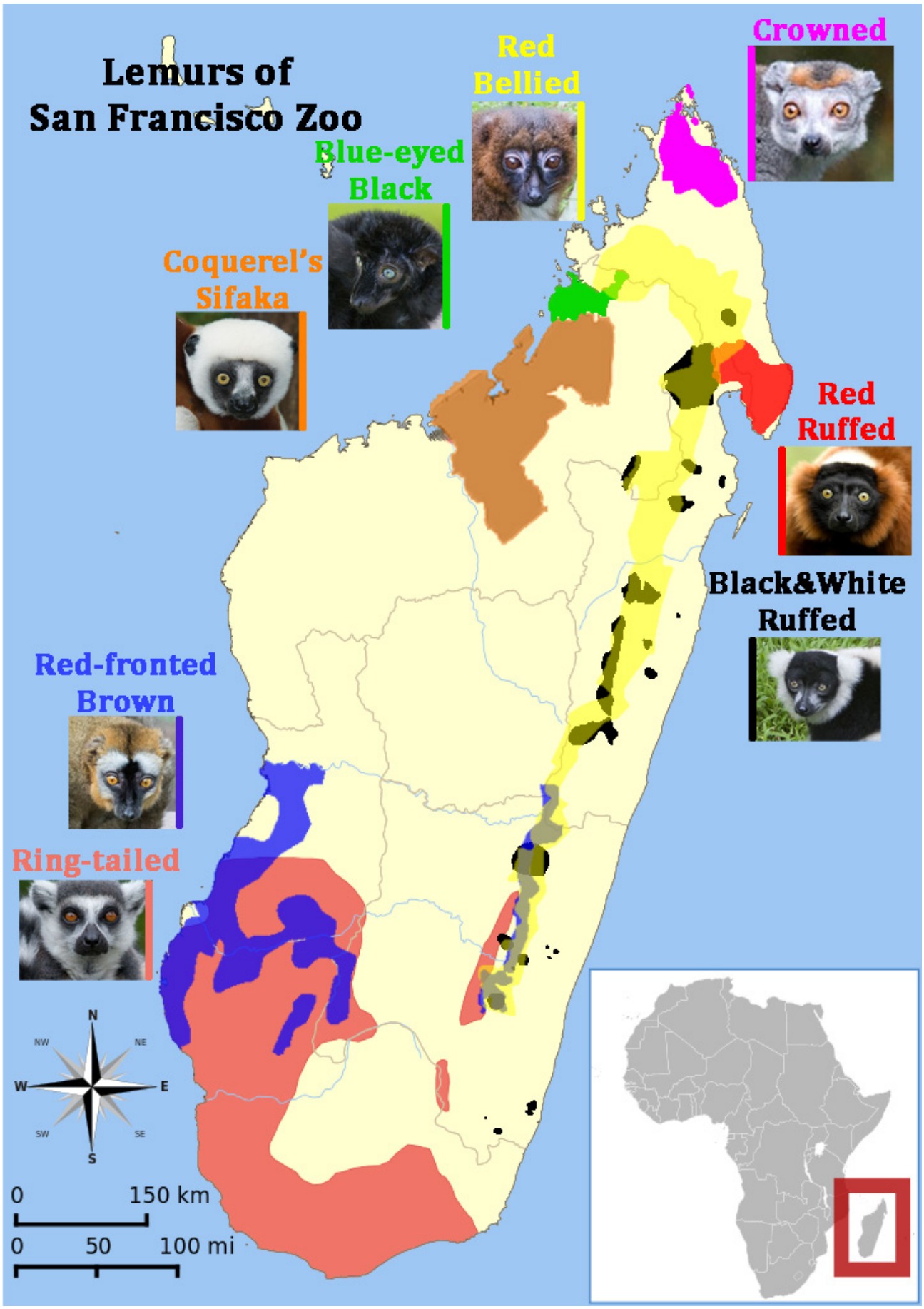
APE ADAPTATIONS

- Two families, the lesser apes and the greater apes
  - ➢ Lesser apes: gibbons
  - ➢ Great apes: gorillas, chimpanzees, bonobos, orangutans and humans (humans excluded from discussion below)
- No external tail present
- Of apes, only gibbons have ischial callosities
- Flat nails on digits
- Thumbs and toes fully opposable
- Forelimbs longer than rear limbs
- Shorter, less mobile and less flexible spine than monkeys
- Noses flat; no muzzle; protruding jaws
- Shoulders rotate for full brachiation (brachiation varies with species)
- Live either in social groups of dominant male with several adult females and young or in case of orangutans, solitary life; some species form monogamous bonds

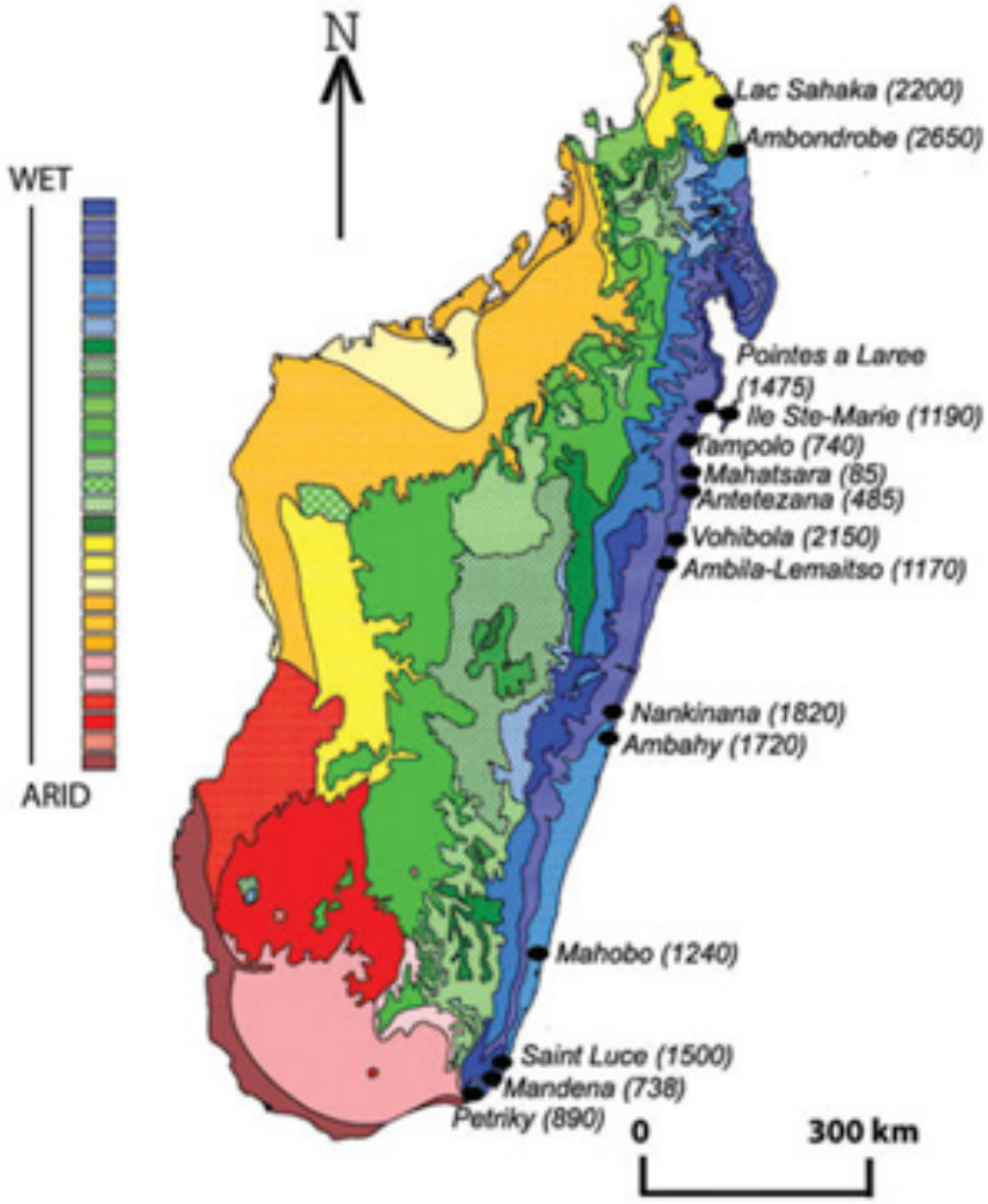
- Have larger brain size and are more intelligent and more dependent on learning behavior patterns than are monkeys; may exhibit tool using behaviors
- Sexual dimorphism varies with species
- Lower molars with five cusps; large canine teeth
- Forward facing eyes; vision in color and binocular
- Shoulders with rotating cup joint – gives ability to brachiate
- Gibbons most arboreal with excellent ability to brachiate
- Quadrupedal gait; chimpanzees and great apes walk on knuckles
- Predominantly vegetarians, though chimpanzees eat some meat

PRIMATES AT THE SAN FRANCISCO ZOO:

- **Lemurs:** ring-tailed lemur, blue-eyed black lemur, crowned lemur, red-bellied lemur, red-fronted brown lemur, black and white ruffed lemur, red ruffed lemur, Coquerel's sifaka
- **New World Monkeys:** pied tamarin, squirrel monkey, black howler monkey
- **Old World Monkeys:** Francois' langur monkey, black and white colobus monkey, patas monkey, mandrill
- **Lesser Apes:** siamang
- **Great Apes:** western lowland gorilla, chimpanzee


Lemurs of
San Francisco Zoo
Red
Bellied
Crowned
Blue-eyed
Black
Coquerel's
Sifaka
Red
Ruffed
Black&White
Ruffed
Red-fronted
Brown
Ring-tailed
N
NW
NE
W
E
SW
SE
S
0
150 km
0
50
100 mi

CLIMATE MAP OF MADAGASCAR



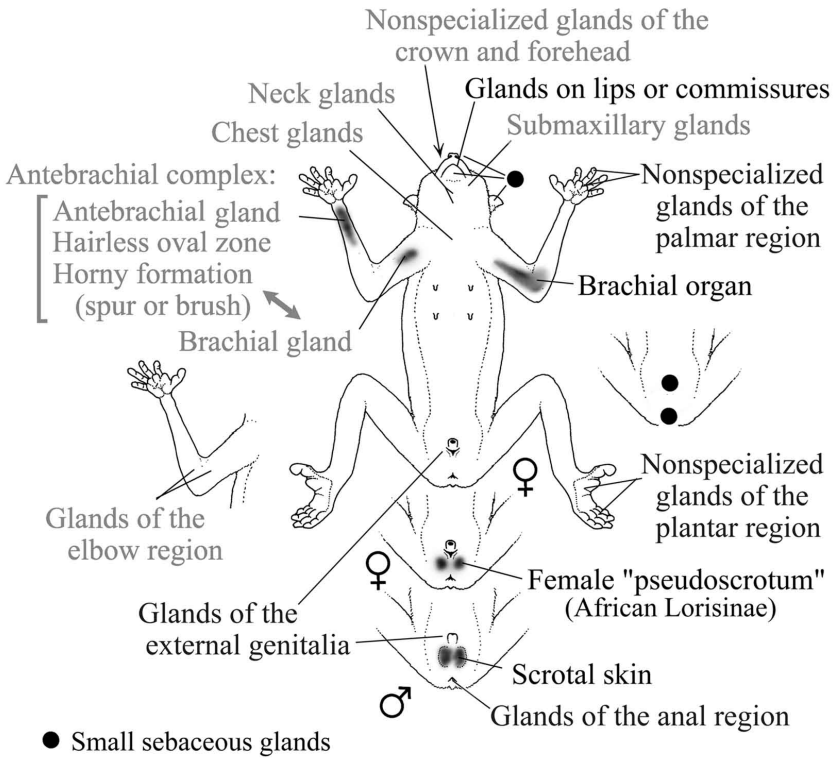
Lemur toothcomb

Ring-tailed lemur Troop

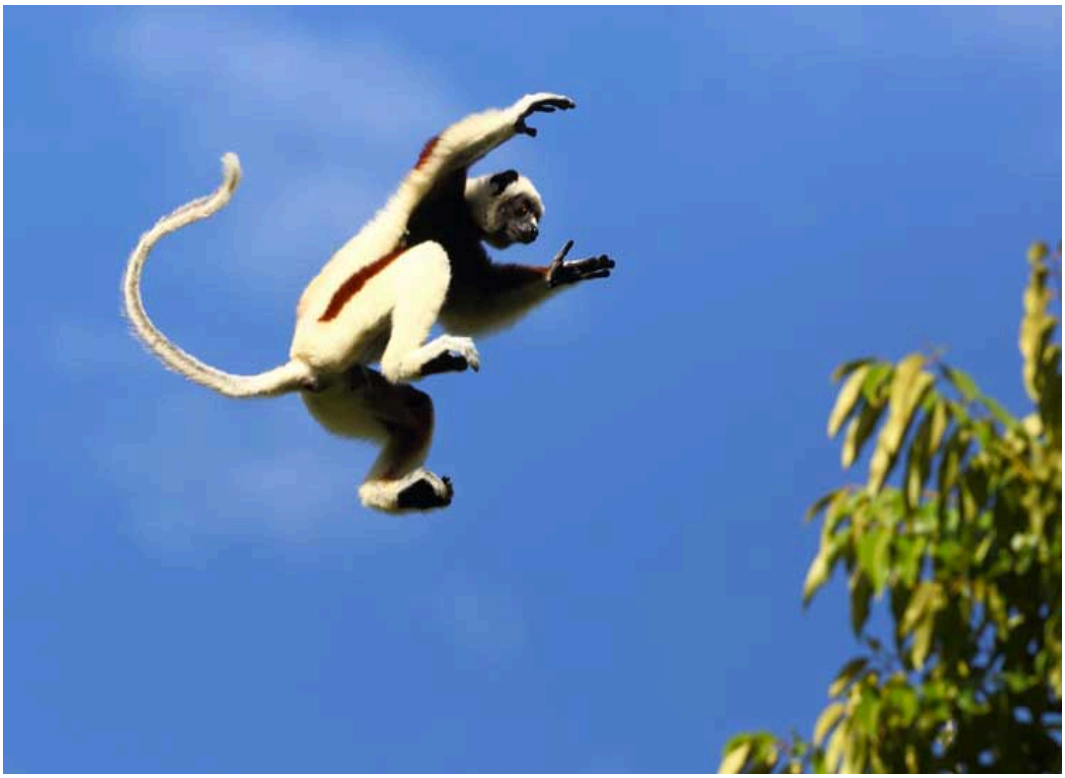
Predator: Fossa

Predator: Madagascar Harrier-hawk

Predator: Madagascar Tree Boa

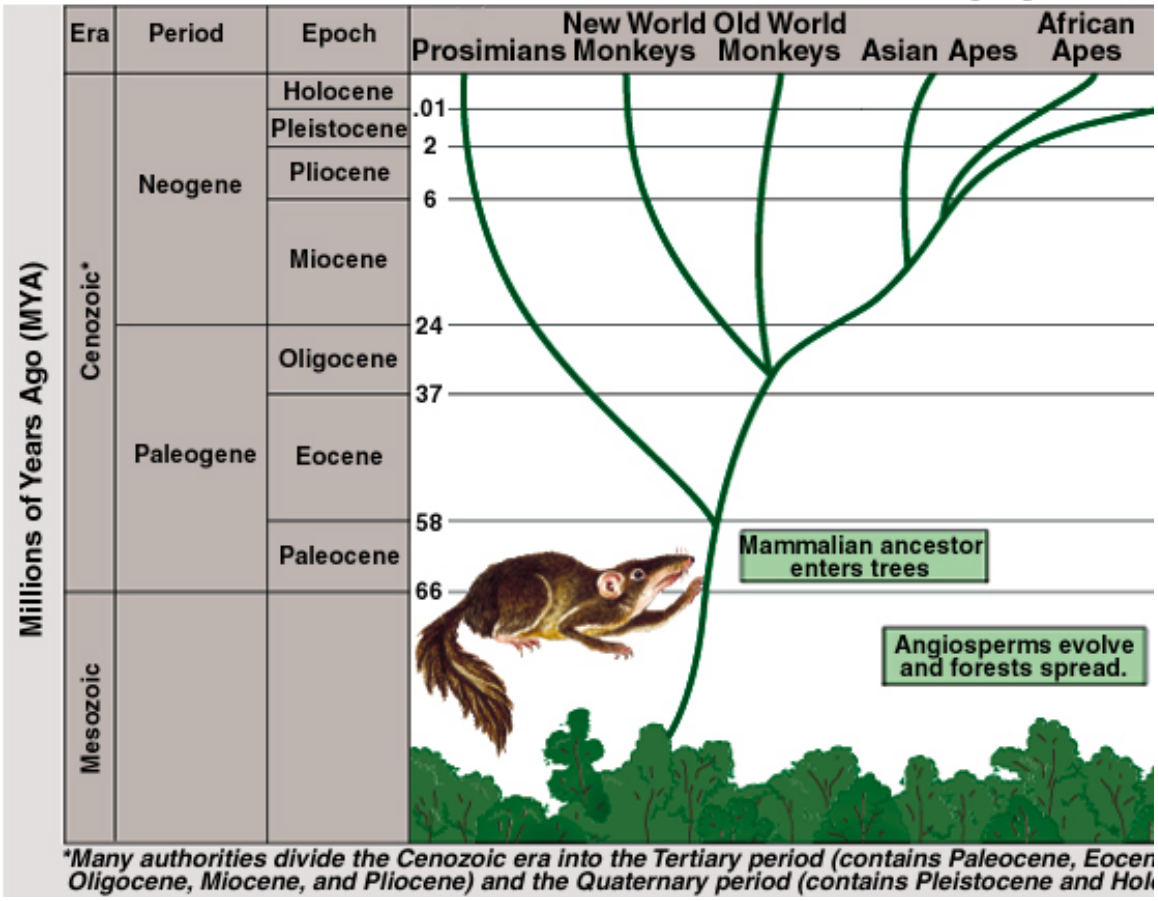


Location of glands on Lemur species



Coquerel Sifaka: top – jumping between trees, left – suspension feeding, bottom right - notice large gap between toe and other digits.

Primate evolution (1)



*Many authorities divide the Cenozoic era into the Tertiary period (contains Paleocene, Eocen
Oligocene, Miocene, and Pliocene) and the Quaternary period (contains Pleistocene and Hol