Sloth Workshop

December 4-6, 2008

Practicum Topics – A. Judy Avey-Arroyo

In 1972 Luis and Judy Arroyo purchased 320 acres in the coastal lowlands of Limón province in Costa Rica in anticipation of retirement in Liu’s beloved Limon province. The property is situated in the delta of the Estrella River and includes a 120 acre island that is now part of, and protected under, the regimen of the C.R. government’s ‘Privately-owned Protected Wildlife Refuges’

Making twice-a-year treks to their land to oversee construction of their ‘retirement home’ and to ‘recharge their batteries’ from the hectic life in America, the Arroyos decided, in 1986, to move permanently to Costa Rica. They began a business providing bird-watching tours, and worked with birding organizations from the United States. Over 300 bird species have been identified on and around their property whereas over 830 species are found in Costa Rica. They also received tourists from a cruise ship company that visited Limon once per week during the months of October through May. They bought a 17-passenger pontoon boat, and their 3-1/2 hour tour circled the 120 acre island (now known as Sloth Island) that is situated in front of their house.

In 1991, a 7.6 earthquake destroyed their home and changed the course of the Estrella River. It was then impossible to continue their bird-watching tours with the pontoon boat, as the earth rose up 1-1/2 meters in the earthquake, and the river disappeared temporarily. Over the years, it has filled up with enough water so that they now use canoes to do the birders’ tours.

In addition to rebuilding the home that was destroyed in the earthquake, the Arroyo’s decided to build a small hotel. It was during the construction of the hotel that the Arroyos were introduced to the sloth when neighbor girls brought them the first orphaned three-toed sloth (later named Buttercup), whose mother had apparently been hit by a car in front of their house/hotel. When word got out that the Arroyo’s were caring for Buttercup, injured and orphaned sloths of both species began to arrive. Since they were unable to find much literature on sloths, they were left to learn from experience, using observation of wild sloths and a bushel basket full of common sense.
“Before long, the Arroyos became known as authorities on sloth rescue and rearing.... [Insert from the sloth: hardly a deadly sin DVD (Perezoso Productions: Jeri Ledbetter, 2005).]

In 1998, the Arroyos registered the 120-acre island in front of their installations (house, hotel, and rescue center) in a program with the Costa Rican government as a privately-owned and operated Wildlife Refuge. That registration meant that, although they still own the land and it is in their names, it is protected under the “umbrella” of the National Parks System. With their status as Aviarios Wildlife Refuge, the government’s National Parks System takes on the responsibility of removing any and all threats such as people cutting trees, clearing land for crops, or occupying the land illegally.

Presently, 114 sloths reside at Aviarios – Sloth Sanctuary of Costa Rica; and 62 rehabilitated adult sloths have been returned to the wild. Approximately 335 sloths have gone through the center since it opened. That number has included 151 infants and 87 adults of Hoffmann’s; and 61 infants and 36 adults of Bradypus. Of course, these numbers rise weekly!

Aviarios - Sloth Sanctuary of Costa Rica has an on-site veterinarian clinic and hospital. Louis’s cousin, Dr. Francisco Arroyo Murillo, is the Veterinario Regente, which is a Spanish term used to denote the official veterinarian of any rescue center, zoo, veterinarian clinic, etc. By law, Aviarios – Sloth Sanctuary of Costa Rica must have a veterinarian in a capacity to oversee what happens at its institution. Dr. Francisco does not have to be employed full time. He reports to and answers to the government offices that oversee the various institutions. He visits the sanctuary twice per month to check animals, records, etc. He has two clinics, one in San Jose and another on the Pacific side of Costa Rica.

Dr. Francisco is also a professor of veterinary medicine. Each of his students (those that are interested in wildlife medicine) has the opportunity to do a thesis on a specific subject at the sloth sanctuary by completing an internship with Aviarios. One of his graduated students, Dr. Gabriela Varela Brenes, is the on-site veterinarian. She works three days at the sanctuary and three days at a vet clinic for small animals. Another of Dr. Francisco’s graduating students, Diana Barahona Brenes (not related to Dr. Gabriela), fills in the days that Dr. Gabby is not on duty. Diana is writing her thesis on sloths, as well. Update: Dr Diana graduated and has stayed on as a licensed veterinarian at the Sanctuary as well.

Environmental education programs (for three different age groups) are being offered to the local residents so that they can learn an appreciation for the sloths and their forest ecosystem. In addition, the Arroyos provide sloth tours to their on-site hotel visitors, as well as tourists from other local hotels and cruise ships. Funding for the operation of the sloth sanctuary is provided through the operation of the onsite hotel and tourism activities. Additional resources are needed.
There is still a need for local education regarding protection and conservation of the sloths. They also need more capability of on-site lab testing.

**Practicum Topics – B. Francisco Arroyo Murillo, D.V.M.**

Problems: burns and electrocutions from power lines, dog bites. Injuries sometimes are quite old when the sloths are discovered and brought to the sanctuary: maggots in wounds. Skin problems, fractures, amputated limbs. Skin lesions, mange mite (takes over when sloth is under stress). Hair must be shaved in order to treat the skin for mange infestation.

Longevity: Choloepus – 30 to 35 years; Bradypus – unknown scientifically

Necropsy. The sloth is so very different in its anatomy and how it takes on medications. The two genera are different from each other. Choloepus range from 5 – 12kg, Bradypus from 3 to 6 kg and each species has different requirements. Hands and feet of the Choloepus give quick visual information as to the animal’s physical condition: Should be shiny, plump, etc.

Sloths have characteristics of several animals, including primates, bovines, and humans. They have been able to adapt to changes in the environment without physically changing very much.

Choloepus has 5-6 cervical vertebrae, and Bradypus has 9. Choloepus has 23 sets of ribs, and Bradypus has 15. Bradypus arms are twice as long as the legs, Choloepus’ arms and legs are the same length. Unusually shaped vertebrae in the lower back known as xenarthrals (from the Greek word xenikos, meaning strange and arthron, meaning joint) give this order, which includes armadillos and anteaters, it name, Xenarthra, and are found in all members of this order. This adaptation gives support to the sloth’s lumbar area when hanging and making acrobatic moves from branch to branch. The Choloepus has no tail; Bradypus has caudal vertebrae. Bradypus has a tiny flap of skin for the ear, and the Choloepus ear is very human like.

The pelvis is fused so it doesn’t open for the birth process. Babies of both species look like scaled-down adults at birth; they have small heads and narrow shoulders

Ligaments hold everything together, but they can be mistaken for prior injuries or disease. Respiratory tract: Lig. Neumofrenico (lungs to diaphragm), Lig. Neumopericardial (lungs to pericardium), & Lig. Neumomediastinal (lungs to mediasthorax)—(THESE ARE THREE PREVIOUSLY UNKNOWN LIGAMENTS, AND ARE NOT PATHOLOGICAL.) These ligaments hold together the lungs, heart, and diaphragm. (1)
The heart is located in the middle of the torso, between the two lobes of the lungs. The trachea is wider at the beginning and gets narrower in both. The rings on the trachea are incomplete. When palpating the trachea, the cervical section feels ‘harder’ and the thoracic section feels ‘thinner’. Bradypus trachea extends to the diaphragm and forms a loop which allows the Bradypus to turn his head approximately 240 degrees of rotation and 160 degrees extension front to back.

The Spleen is pyramidal-shaped in the Choloepus and in the Bradypus is elongated (tongue-shaped). In both species the spleen is located on the left side between ribs 13 and 15. A Lig. Gastroesplenico joins the spleen to a proventrical. (2) RECOMMENDATION: TRANQUILIZE THE SLOTH BEFORE A BLOOD TEST TO AVOID ELEVATED RED CELLS THAT COULD THROW OFF THE TEST RESULTS.

In both species the liver lies transversal abdominally, is with the larger lobe located on the right, with a right Mesoventral Ligament which allows it to adhere to the ribs on the right side. In the Choloepus the gall bladder is small and has a coledoco that empties into the small intestine. Bradypus does not have a gall bladder. Because Choloepus has 23 sets of ribs, most of the organs are encased by the rib cage.

The pancreas is very small and diffused, located on the smaller curve of the small intestine.

The digestive system and urinary system are adapted to a life of hanging upside down.

Digestive system. Multi-chambered. Sloths are like ruminants, but don’t ruminate. The cecum in Bradypus and Choloepus are similar. They have three pre-stomachs (proventricles) and one true glandular stomach. The first proventrical is similar to the cow’s rumen. They don’t ruminate or burp or bring up a cud. When a sloth has gastrointestinal disease, the first sign is the accumulation of gas in the proventrical and it is necessary to give specific drugs to stop the continuing formation of gas and correct the underlying problem with drugs and/or diet. Because in cows, the esophagus empties into the Rumen. Food content is at the bottom, with gas at the top that can go out. In sloths, the Rumen opening is 3 centimeters laterally intramurally, the muscle wall acting as a valve keeping food from escaping while eating in an upside down position. This valve prevents excess gas from escaping as well. When babies are given cow’s milk, it ferments and the gas cannot escape, causing serious gastric problems usually resulting in death.

Rumen movements: one complete movement every 30 to 45 seconds with the next movement sometimes overlapping the previous one. Gastric movement is heard through a stethoscope (auscultar) held to the upper left side of the abdominal region and consists of 3 mixing movements with 1 evacuation movement. (The last sound is longer and louder than the other three.) Listen for movements on the upper left side of the abdomen. Rumen sounds: 3 gurgles like a babbling brook and 1 volcano (longer
and louder) rumble. The frequency and intensity of the rumen movements are more subdued while under anesthesia.

The kidneys are located IN THE SUB-LUMBAR REGION and enveloped in a huge layer of fat (about the only fat on their bodies). Bladder, uterus, super-adrenal glands are abnormally large, compared to other species. The cortex and the medulla are well-defined and have papilla and renal pelvis.

Kidney has very little medulla, and the cortex is thick. THAT IS WHY THE PROTEIN LEVEL CAN READ HIGH IN URINE ANALYSIS. THAT THIS IS NORMAL FOR A SLOTH, but not for other animals.

The bladder is uncommonly large and possibly serves as moisture reservoir. When they eventually come down from the trees to eliminate, they urinate large volumes. The interval between evacuations of body waste varies from 3-8 days and at the time of elimination the sloth may lose up to 30% of its body weight due to the passage of urine and feces. [MZG Volunteer Manual regarding Linne’s Two-Toed Sloth.]

...The liver, stomach, spleen and pancreas are rotated to the right, rather than the left as in other mammals. [MZG Volunteer Manual regarding Linne’s Two-Toed Sloth.]

BASIC PARAMETERS  Choloepus only (Bradypus has different parameters):

- Temperature: 92-96 degrees F. 33.4-36.2 degrees C. (Sloths are heterothermic so their temperatures can vary from 75 – 91 degrees F depending on surrounding temperatures)
- Heart rate: 70-130 per min.
- Respiratory rate: 13-14 per min.
- Watch the pupils: Pinpoint pupils – normal for a sloth. ENLARGED PUPILS – THE SLOTH IS IN PAIN OR DEATH IS IMMINENT. It takes several minutes to expand the pupils at night or to adjust to the dark.
  - Anesthesia  Ketamine 50%, Medetomidine, reversal: Atipamazole
  - Blood collection  Brachial vein
  - Ultrasounding As with other animals
  - Nail Trimming – Every 6-8 months. Too long, and the nails will cut into the pads or could get caught and break off in exhibit materials. Cut nails at an angle—45 degrees to form an angled point at the end.
  - Dental care (Choloepus only) – Both genera of sloth are born with teeth; neither have incisors, Choloepus have ‘pseudo-canines’ which are triangular shaped at the base, forming a three-sided pyramid that ends in a very sharp point. Teeth grow throughout life but chewing keeps them worn down to a manageable size. Smaller molars in back with small sharp cusps  SLOTHS CHEW MOVING THE JAW IN A CIRCULAR MOVEMENT WHICH KEEP THE TWO ‘MEETING’ SURFACES FLAT
AND SMOOTH AND THE POINTS VERY SHARP. THEY NEED THE POINT ON THE CANINES FOR BITING INTO FRUITS, TWIGS, ETC. Due to the difference of a captive diet as opposed to a wild diet, teeth can become overgrown. File on both lateral surfaces to keep shape, NOT on the back side of the upper, nor the front side of the lower canines. Don’t clean the teeth. Creamy white at birth, becoming stained with age and diet. Must keep the length manageable. Protect the insides of the cheeks. Put gauze in mouth so that debris doesn’t fall into the throat.

Drawing blood is difficult but not impossible to do on sloths. Shave the area over the vein. Tourniquet is placed almost up in the axillary. DRAW BLOOD FROM THE BRACHIAL VEIN. Previously, it was done in the Sub-clavic vein. That vein passes very close to the carotid artery and a miss could kill the sloth.

HEMATOLOGY CHART. Most other animals: Leukocytes 70% and Lymphocytes 30%. SLOTHS ARE REVERSED; they have Leukocytes 30% and Lymphocytes 70%. Difference in Lymphocytes indicates viral infection. 180,000-200,000 is NORMAL FOR SLOTHS’ PLATELETS.

BLOOD CHEMISTRY CHART. NITROGEN IS VERY LOW FOR SLOTHS. If the numbers are on the high side of normal, you need a relationship between BUN and Creatinine. Divide B.U.N. by the Creatinine value which should equal 10%. Even if within the normal range, IF THE VALUE IS 10 OR GREATER, THEN IT WOULD INDICATE THAT THE SLOTH IS SICK.

HYPOGLYCEMIC WITH RESPECT TO OTHER MAMMALS, WITH LEVELS BETWEEN 10 AND 50 mg/dl

HEMATOLOGY RANGE OF Choloepus hoffmanni

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BLOOD CHEMISTRY OF
Choloepus hoffmanii

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Other members: (MZG) Yeast problems: Used Nystatin orally. (NOTE: Dr. Francisco does not use Nystatin because it is toxic to the liver, especially the young ones. If used on young ones, he also uses a liver protector.) (Himalaya Liv.52)

**ANESTHESIA**

In Costa Rica, we have Ketamine 50; for example, (7kg. times 3) divided by 100 equals 0.21cc. Medetomidine plus 0.21cc. Ketamine to equal 0.42cc. In the U.S., the Ketamine is 100 (double). Therefore, the proportion is half or 0.11cc. Ketamine plus 0.21cc Medetomidine. To reverse the anesthesia, use 0.21cc. Atipamazole (reversal drug). Deep anesthesia lasts 10 minutes. Have to re-administer anesthesia—sometimes 3X, without problems. We use pain protocol before every surgical procedure: AINED’S (Dipirone; Piroxicam; Ketoprophen) In special cases we use corticosteroid drugs.

**DO NOT ADMINISTER ANESTHESIA IF THERE IS NO RUMEN MOVEMENT.** Stimulate the sloth by massaging the palms from the bottom up to the tip.

Under anesthesia, a Choloepus’ breathing slows to around four respirations per minute, and is monitored visually, observing rise and fall of the lower abdomen. If it falls below 4 per minute, open the mouth, grasp the tongue with gauze and pull straight out in tugging movements. This triggers respiration.
Masking down and inter-tracheal tube—Intubate the sloth while it is sitting on its rear end (supported by someone) with the sloth’s neck extended.

(MZG) Hand inject with Ketamine and then intubate or put on face mask. (Memphis) Miloxicam is used.

**Restraint Methods**

Aviarios uses a large stuffed plush toy for the adult sloth to grasp; a large, heavy towel is then wrapped around the sloth and plush to restrain long enough to transport.

Several zoos trained their sloths to accept hand injections (less stressful).

**Physical Exam**

Nose—shiny, clear, dry (Choloepus’ sweat through pores on their noses when stressed or excited. Palms and feet plump. Take measurements, including circumference of the head. In infants it is important to monitor weight gain by daily weigh-ins and taking bimonthly measurements.

TPR

**Recommended Tests**

Feces tests. Collect urine.

Test for coccidia from bird feces. Metronidazole in liquid form (Costa Rica).

Blood draws (CBC) (platelet count) done in Costa Rica, only if animal is sick. (The blood drawn must be transported that day to an offsite lab either in Limon, 26 miles away, or San Jose, 200 miles away, depending on the type of blood work needed.

Check for malocclusion (improper bite). DARK STAINING OF THE TEETH IS NORMAL. SHARP POINTS (CUSPS) ON THE TEETH ARE NORMAL. (Covered on pages 5 & 6)

Fecal test (yeast level) with fungal screen.

There is no rabies in Costa Rica. (The last case in humans was 50 years ago.)

**Common Health Problems**
Sloths have thick, dense skin and the blood circulatory system is deep. Ticks generally cannot get through the tough skin to feed. If the sloth has been lying on the ground, injured, and he has ticks present, the ticks most likely have moved from the ground onto the sloth. At Aviarios, very few sloths have arrived with ticks, and those that we find have generally been unsuccessful in feeding from the sloth’s blood.

Two tapeworms found in Costa Rican sloths had previously only been found in Brazil. There is not enough information to determine where the tapeworms are coming from.

Evaluate dehydration: Open the sloth’s mouth. IF “STRINGS” ARE NOTED BETWEEN THE TEETH, THE SLOTH IS DEHYDRATED. SLIGHT WRINKLES ON THE NOSE WILL INDICATE DEHYDRATION BEFORE THE HANDS SHOW SIGNS. The eyes should be bright and protruding. Hydrate orally and subcutaneously.

A fetus cannot be detected by palpation Ultrasound requires that the hair be shaved over the abdominal area which would be a handicap for the baby. Instead, Costa Rica uses x-rays. Unless a female sloth is exceptionally heavy, the pregnancy does not show.

EXAMINE ABDOMEN FOR WEIGHT INDICATION, NOT ARMS OR LEGS, AS THEY LACK MUSCLE MASS AND FLESH. Round stomach when relaxed—good shape. Concave stomach—problem.

Noisy GI tract. Covered on page 4

Neurological problems: Alertness of animal. PUPILS DILATE OR CONTRACT SLOWLY, uncoordinated movements of limbs.

No way to stimulate urination (Dr. Francisco). (Dr. Volle) has done with catheter

Teeth: Triangular and hour-glass shaped. Difficult to remove.


(San Antonio) Armadillos suffer from a lack of UV light, especially youngsters that are growing. IS IT A POTENTIAL PROBLEM FOR SLOTHS IN ZOOS TO HAVE A LACK OF UV LIGHT? COULD LACK OF UV LIGHT BE CAUSING HEALTH PROBLEMS; I.E. KIDNEY, ETC.? Humidity of 80% is preferred.


Constipation.

Anorexia.

Pneumonia (Buffalo).
Anemia (Memphis and Blank Park). Anemia responds well to Vitamin E and silenium, as well as iron (injectable, but it hurts).

Dry skin. The only incidences we have seen of dry skin is thought to be secondary to a mange infestation (Sarcoptic and Demodex).

Toxoplasmosis (cats or polluted water from pigs). Hemoglobin IGM – has it right now. IGG—has had exposure but has overcome it.

Only parasite that gets into the lungs comes from dogs or cats.

Ascarids. (Memphis-sloth taken home by keeper—dogs and cats.) Worms in feces, comes out nose and ears, in throat.

Canine distemper (Costa Rica). Sloths are healthy generally but not immune to distemper. Aviaros have ‘tentatively’ identified distemper in two infants Choloepuses that were in a home with puppies with distemper)

Lead and zinc toxicosis – caused by eating paint from the wall. Paint chips in the stool. The sloth was vomiting onto its chest (Buffalo). Calcium EDTA given and the sloth survived!!

(Costa Rica) Sloths are burned or electrocuted from power lines. They get hit by cars on the road when the sloths are going to different trees. They have also been tormented by children, who throw rocks at the sloths. In addition, agricultural chemical contamination of banana, pineapple, plantain, etc. fields is now causing problems for the sloths. If sloths are attacked, they often survive due to their tough hides, strong grips, and extraordinary ability to heal from serious wounds. They have been known to withstand 90-ft. falls to the ground, and have also withstood heart arrest for 40 minutes. (Function and Form in the Sloth, M. Goffert, Pergamon Press 1971)

Dr. Tiffany Wolf (MZG) has volunteered to be a vet advisor.

Management of Diseases or Disorders

Problem with Sarcoptic mange (from scabes mite) (Costa Rica) when animals come in stressed.

Ticks. Three different types have been determined: one from cattle –Boophilus, Necator, Sloths in Costa Rica have not had Rocky Mountain Fever or rickettsia but people in the area have had it. People 30 miles away from the sanctuary have died from it.

Fungal infection (from the wild). Suspected ringworm
Canine distemper (runny nose). SLOTHS ARE HETEROTHERMIC, SO THEY WILL DISPLAY A DIFFERENT EFFECT WITH VACCINES

(Florida) Tests for rabies and distemper are required.

(Costa Rica) Killed vaccine can only be used in wildlife. Modified live vaccine cannot be used in wildlife because it could cause a mutation of the disease.

Vitamin E for dry skin (Como) on back during dry season (winter). Topical spray. Also olive oil in diet. Flax seed oil (Costa Rica). When the humidity goes below 70% in Costa Rica, dry skin starts to show: given Cod liver oil, omega 3 & 6. For adults --½ cc. or 1 Tablespoon.

Oily skin (MZG) during dry season (winter).

Preventive Medicine

Vaccines not typically given.

Identification Methods

Pit tags (chips/transponders) between shoulder blades, subcutaneous.

Necropsy (Photos)

Animal History: Paralysis with impaction. The sloth was still eating, but died overnight.

Black circles are parasitic lesions. Mucus lining was separated.

Green stomach content in rumens.

(San Antonio) Dr. Dalen Agnew at Michigan State is doing a research project regarding mineral analysis in bones of exotic species.

(San Antonio) Collect heart blood and keep it frozen for future DNA analysis. Jean ____________ of Brookfield Zoo is no longer employed there. She has all the markers and records.
Nutrition: A. Diet Composition

(Costa Rica) Cook vegetables such as long green beans, sweet potatoes, etc. Give apples or pears, not citrus fruits—cut into long pieces like French fries. Grapes (with the seeds removed) can also be given for a special treat. Dog food is 20% of the sloth’s diet (the actual meat protein content depends on the quality—brand—of dog food) SLOTHS IN THE WILD ALSO EAT DIRT FOR UNKNOWN REASONS.

In zoos, no one has observed sloths eating feces. (It has been observed in the wild.) Over the years at the sloth sanctuary, several babies have eaten feces. It usually ‘outgrows’ the behavior after several months.

(Florida) Fruit is given for training only. Egg is offered only for enrichment. Squash, sweet potatoes, and corn are also given.

(Como) New World primate diet is high in Vitamin D. IN A MIXED-SPECIES EXHIBIT, THERE IS A RISK OF SLOTHS OBTAINING NEW WORLD PRIMATE DIET. Corn is digested – do not see corn in the feces.

(Buffalo) Two sloths aged in 20’s. Weight is 28 and 31 lbs. Zupreem canned primate food. Elevated food dishes. Mixed-species exhibit with possible access to other animals’ food. Large biscuits are crunched up. Defecation: 1x per week.

(Buffalo-2nd group, younger) – 60 biscuits of leaf eater, 200g. sweet potato, 1 leaf romaine, 3 dandelion leaves. (Group came in solely on biscuits.) Weight now: 9 lbs. for male Linne’s. Female – 85 biscuits, 150g. sweet potato, 1 leaf romaine, 3 leaves dandelion. Soft stool while on pellets only, or stress is possibility. 15-30 oz. water for male, 6-16 oz. water for female – daily water consumption. Obtain water from water bottle, so consumption can be tracked.

(Lincoln Children’s Zoo-Nancy) Egg (1/2 hard-boiled) is given every day. (Nancy is under weight.) Male is 40 lbs. Nancy is 17-1/2 lbs. (previously was 20 lbs.). Male defecates 3x per week; Nancy defecates every day (no diarrhea). Nancy bred and gave birth on the PM diet at that time.

(Memphis) Check for parasites every 6 months. Physicals every year; fecals every 6 months. (Como) Check every 6 months. (MZG) Check every year for parasites. Check feces.

(Tulsa) Single, elevated food dish. Female gets into the iguana food, eating citrus ficus. Defecate 1x every 4 days. Since going free-range, the sloths are defecating higher; and the keepers can’t always find it. Sloth eats dirt from higher sections (potting soil). PM feedings, so other animals don’t get into the sloths’ food. 16 babies since 1986, all mother-reared. Mother was wild-caught. Bowl of water at bottom of feeding tree, but have NOT seen them drink from the bowl. Not sure if there is a pattern as to the female
(when pregnant) going to the higher levels. Linne’s juvenile is 10 mos. Female has a baby every 14-16 months. (Topeka) Has also seen that with the Hoffmann’s. (Costa Rica) The baby is temporarily removed so male and female can breed again; then female and baby are rejoined. (Tulsa) Breeding occurs with the baby on the mom.

(Memphis) Defecate every other to every 2-3 days. Leave veggies and remove the chow (due to ants). Water is in elevated bowl, which they have been seen to use.

(Riverbanks – Lynn) After the male was misted, he would get active and breed with the female.

(San Antonio) Soak chow with apple juice. (Riverbanks) Soak with Gatorade so the sloths will eat it.

(Memphis) Two bowls elevated for food, but sloths prefer their own bowl. Water bowl—sloths will dip their hands for water. Male is 11.4 kg. Female is 10.8 kg. Reproduced two times, but both infants died after short time. Male will eat egg white (only used for enrichment).

(MZG) Hard-boiled egg is given, to try to bulk up the sloth. Water bowl is elevated, with hanging bowl, and upper level bowl. Nystatin (on it for 3 mos.) has helped with diarrhea. (Liver levels were normal.) (Dr. Francisco) Have you tried Fluconisol (Diflucan) for shorter duration? Defecation daily.

**Nutrition: B. Nutritional Requirements**

See dietary listings from the various institutions.

Bradypus (three fingers) is an absolute herbivore (folivore) and subsists on a variety of leaves. Only the Bradypus feeds on leaves of the trumpet tree (*Cecropia peltata*), because the branches of this tree are too thin (fragile) for the heavier Choloepus; we have never observed a Choloepus in a Cecropia tree, however babies enjoy the tender new leaves and both baby and adult Choloepus love the bean-like seasonal ‘fruit’ of the cecropia. Choloepus (two fingers) is an omnivore, and eats leaves, fruits, slow-moving animals, and bird eggs* This has been reported in research articles, but Aviarios have never seen this behavior in the 16 years they have observed sloths in the wild.

No diet manipulation if the sloth is suspected of pregnancy. Aviarios does not make changes in the diet of a suspected pregnancy, but continues with the regular diet, sometimes adding more of her ‘favorite’ food.

The lips are not horny, and when both genera of sloth eat leaves (or Choloepus, everything else) they extend their tongue out – Choloepus has a long dog-like tongue – and pull the leaf—food- into their mouths where it is crushed by the molars once or twice before swallowing.
**Nutrition: C. Water**

(Como) There is a mister in the exhibit, so the sloth licks water droplets from its fur. There is also a pool of water in the exhibit on the ground, beneath a sturdy branch (so it is possible for the sloth to hang from it also). The sloth will also enjoy additional water when offered by hand. (Also noticed in the wild.)

(Como) At the previous institution, the male killed the female. (Will look up the details.)

(Texas) An infant sloth was killed by a male. In the wild, 6 small babies have been seen with bite marks.

(Florida) There is a pond in the enclosure, but we haven’t observed the sloths drinking from the pond. (The pond is drained every night.) There are also elevated water bowls.

(Buffalo) There is a running stream in the exhibit. Mixed species exhibit with prehensile-tailed porcupines, agoutis, and cotton-top tamarins.

(Aviarios) Does not offer water, most of the cooked and fresh food and the freshly harvested leaves add enough moisture to the diet; our humidity is usually around 80%, and very rarely drops below 70%.

**Nutrition: D. Food Preparation/Presentation**

(Judy – Costa Rica) Beach almond (Terminalia catappa, fam. Combretaceae) leaf (not toxic), a large handful twice a day 230g Ong Choy (Chinese watercress) (half the iron content of spinach). (Red grapes are also high in iron). IT HAS BEEN REPORTED THAT SLOTHS DON’T PROCESS IRON WELL.

(Costa Rica) 150g carrots (steamed), 90g (cooked) sweet potato, 70g dogfood (good quality, Pedigree puppy chow—because it’s always available in our local stores) soaked in water until completely soft, 200g green mango, 65g green beans (‘yard-long green beans - not cooked, or regular green beans are cooked), 230g of beach almond leaves. There is a high water content in the diet and high humidity—so don’t see the sloths drinking additional water. Chayote (pear squash from Latin market) (high water content, but not full of nutrients). In the wild, have seen sloths eating mango (but not sweet mango), and other seasonal fruits. Have not seen high glucose readings, renal problems, etc. The diet has been used for 16 years. In Nancy’s (Lincoln Children Zoo female) readings, the glucose readings were elevated. It would be interesting to see if
Costa Rica’s levels are low because they are not giving the sloths as much fruit as in other institutions. Bananas and oranges have high sugar levels.

(Buffalo) sloths were received from other locations or providers that had only been on biscuits and sweet potato) 33 glucose level (similar level as in Costa Rica). What are the sloth sugar levels of zoo animals? Sloths are fasted for 12 hrs. prior to anesthesia, so they are already glycemic, artificially lower level of glucose. Nancy’s (Lincoln Children Zoo female) level may be low because of the stress from traveling all day to get to the workshop.

(Costa Rica) Sloths were anesthetized, but without fasting prior to blood draw, glucose level was normal. WHEN THE GLUCOSE LEVEL IS LOW, THE KETAMINE (ANESTHESIA) CAN CAUSE REACTIONS (SEIZURES) IN OTHER MAMMALS. Need to capture wild sloths and do blood studies to determine the glucose level. Is more fruit needed to raise the glucose level? (Ask your vets about the glucose levels in the group of 46 (?) sloths that she presented at the workshop that had high levels and are sick; only one had low levels as do ours, and it was healthy)

Hibiscus flowers, mulberry, grape vine – favorites for sloths. Wax myrtle, drake elm, banana leaves (Como’s sloths don’t like it), new leaves from sweetgum, bamboo every once in a while, convoluted willow, black willow (won’t eat as readily), (Tulsa) citrus ficus from tropics exhibit. (MZG) Sloth won’t eat greens.

(Costa Rica) Bamboo is used for sleep or traveling from one food tree to another, but is not eaten.

(MZG, Como, and Costa Rica) SLOTHS EAT DIRT. Hypothesis: Most of the leaves in the wild are toxic. The sloths may change trees to vary the toxins. Could they be eating dirt (high clay content and low nutrient value) to neutralize the toxins? Is soil-eating a requirement for the young to build up bacteria in the stomach for future digesting of foods? In zoos-dirt infected with fungus and mushrooms can cause problems. Do we need to provide a different source of dirt with better quality and controlled? After diatomaceous earth was ingested, it seemed to clear up diarrhea. Powder on food?

**Nutrition: E. Browse/Enrichment**

(Como) New furniture and scents (cinnamon). Paper bags to crawl inside. Likes towels (curled inside, not covered). Anything from the female sloth given to the male sloth will get him too aroused and more aggressive. No shredding or destructive behavior. Won’t touch pepper (vegetable)—any color.

(Buffalo) Pumpkin seeds were found internally in the sloth after arrival at the facility.
PUMPKINS SHOULD NOT BE USED, AS THE SLOTH’S DIGESTIVE SYSTEM WILL NOT PASS PUMPKIN SEEDS. The sloth will eat canned pumpkin. THERE ARE PROBLEMS WITH GRAPE SEEDS AND APPLE SEEDS, TOO.

Physical Environment: A. Humidity

Zoo humidity is 60-70%. Costa Rica has humidity of 75-80% or above.

Physical Environment: B. Light

It is okay to exhibit sloths in either diurnal or nocturnal setting. Diurnal is more common in zoos. A 12-HOUR PHOTO PERIOD IS REQUIRED FOR THE ANIMALS.

(Costa Rica) – our ‘resident’ wild sloths that live in trees surrounding the sanctuary are as active in daylight hours as during the night, eating, grooming, and moving from branch to branch or tree to tree.

Physical Environment: C. Temperature

Sloths have a variable body temperature: Choloepus range from 95ºF to 96ºF and Bradypus range from 84ºF to 92ºF. The process of adjusting the body temperature is not well understood, but depends on the ambient temperature, and sloths must bask in the morning sun in the upper canopy, or after periods of rainy weather depending on the surrounding temperature.

It has been reported that on average, sloths spend 15 hours a day sleeping (although a recent [2008], very short-term study seems to be trying to disprove this); they drop their head onto their chest and, sitting on a branch, grasp an upright branch with one foot, tuck the other foot and both arms into the body, thus protecting themselves from loss of body heat. It has been reported that they cannot shiver to keep warm. However, Aviaros have observed many Choloepus’ shiver in response to cold, pain, and what we presumed was fear (of the unknown?) We have also observed several Bradypus shiver for presumably the same reasons.

(Aviarios Sloth sanctuary – Costa Rica)

(Costa Rica) 78-82 degrees F. during the day, and 5 degrees F. lower at night. There was one instance when the outside temperature dropped to 68ºF with continuous strong winds, that a ‘resident’ Bradypus whose body temperature dropped so low (didn’t register on the rectal or ear thermometer) was physically unable to release his claws from the caging.

(Florida – Choloepus) Temperature has been 40 degrees F. overnight and 70’s during the day. The sloths still did well if there was another companion or if the sloth was in a
small box—to generate additional heat. Choloepus can tolerate lower temperatures
(than the Bradypus)—as long as it was for a short duration and the sloth is able to get
heated up again during the day.

**Physical Environment: D. Furniture**

Nestboxes –3’ x 2’ with branches about 18” over the top to hang onto. If there is a top
the sloth will tend to go to the deepest, darkest part. If it is open they tend to spread
out on it

Shelf should be 3’ off the floor

Branches should have a rough texture and varied widths to help with nail growth. If it is
too smooth the nails tend to splay to the side

Chainlink is not good as the nails get stuck and tear off

(Como) Cut branches. Sloths don’t use hammocks. Black rubber tubs for sleeping
(Tulsa). (Lincoln Park) Sloths curl up on the floor! Want to rest on some type of fixed
surface, not up high. (Costa Rica) also need a fixed surface for sleeping—curl up in the
crook of a tree up high. (Lincoln Park) Milk cartons behind the scenes. Sleep on its back
inside a crate, but sloth needs to grab onto something to hold. (Lynn) Sleep on a bench.
Hoffmann’s prefers to be in an enclosed place—small size. In the corner when the sides
are up. When the sides are down, it will hang over the ledge.

(Costa Rica) The sloths use towels to cover themselves up when sleeping. Decks are 3-4
feet (1.5 meter) above the ground. The branch (bamboo is too slippery) above the deck
should be about 18 inches above the sleeping surface, so the animals can grab onto it.
Need varying circumferences of branches so that the sloth nails don’t malform by
splaying out from the wrong size branch. Wild males come into the center when the
females are in heat. The cyclone fencing is very open, so there are fighting problems.
Our housing is meant to house the sloths adequately and comfortably rather than in a
spacious, ‘natural-appearing’ exhibit so that the public will view the animal in a more
animal-friendly setting, as we must consider the number of sloths that we are, and will
be caring for into the future.

**AT AVIARIOS SLOTH SANCTUARY BRADYPUS SLOTHS HAVE LEARNED TO DEFECATE AND
URINATE IN PLASTIC WATER-FILLED TUBS, AND THE BEHAVIOR HAS SPREAD FROM ONE
GROUP OF SEVEN SLOTHS TOGETHER IN ONE ENCLOSURE TO ANOTHER GROUP OF SIX
BRADYPUS’ IN A SEPARATE ENCLOSURE OUT OF SIGHT OF THE OTHER, AND 20 FEET
AWAY. We have also observed Choloepus’ sitting in a tub of water placed four feet off
the ground, on very hot days. Occasionally, some have defecated and urinated in the
tub. SLOTHS GO DOWN TO THE GROUND TO DEFECATE IN WATER. Are they stimulated
to do so by the water? Sloths are regular about their toilet spots. Would a tub of water be preferred to a litter box in zoos?

**Physical Environment: E. Air Quality**

At Aviarios S.S. the adult enclosures are located under a common roof, and are open to the air; the individual cages are separated by cyclone fencing (not ideal as nails can get caught), and our particular problem is that wild sloths can easily climb the wire and have, on occasion, bitten our captive sloths. We also suspect two pregnancies were from ‘wild’ sloths mating through the cyclone fencing. (A Choloepus and a Bradypus.)

[Was not addressed.]

**Enclosure Design and Containment**

SUBMIT ENCLOSURE AND HOLDING DIMENSIONS.

9ftx10ftx13ft winter holding. Florida Fish & Wildlife mandates sizes for all animals.

(Buffalo) Two holding cages 5ft x7ft x7ft high and 6ft x8ft x8ft high.

Exhibit 48ft x30ft x20ft high—800 sq. ft. (2 sloths) and 20’ x 20’ x 10’high—400sq ft

**Mixed Species Exhibits**

(Florida) *Didactylus* with 1.2 Yellow footed tortoises. Tortoises eat what the sloth drops. 1.1 cotton-top tamarin. Male tamarin wanted the baby sloth. *Aracaris*.

Hoffmann’s with 1.1 green-winged macaws. Sloth got close, the bird tried to bite, and the sloth went the other direction. Otherwise, no problems. 1.1 toucans. 2 blue-winged teal, no problem. The Hoffmann’s only get browse biscuits at night, so the sloths can eat food by themselves.

(Memphis) The sloths are exhibited with armadillos, agoutis, 1.1 kinkajous, and 1.1 owl monkeys. Prehensile-tailed porcupines are no longer there—harassment. Sloths don’t take any other animals’ food. The kinkajous are old and have been with the sloths since they came into the zoo. The exhibit is 20ft.x20ft. deep with sloping ceiling (15-10ft), glass, and real trees with silk. Hammocks are made out of canvas. The male sleeps low, and the female sleeps high in the hammocks.
(Atlanta) The sloths are exhibited with golden-lion tamarin, 1.1 titi monkeys, and 1.1 saki monkeys. A titi tried to grab the sloth’s tongue, but nothing came of it. Acouchis are brought into holding at night, since one was discovered with a bite (believed to be from the male sloth).

(Kansas) Squirrel monkeys had to be separated at night to keep them from fighting. One squirrel monkey was killed from a bite wound (believed to be by the sloth). No other problems with squirrel monkeys.

(San Antonio) There have been no injuries with (10) squirrel monkeys. The owl monkey will curl up with the sloths. The exhibit also includes three-banded armadillos, a nine-banded armadillo, and pacarana (rodent).

(Lincoln Park) Ten cotton-tops, ring teal, green basilisk lizard, yellow-spotted Amazon River turtles. No negatives.

(Como) 4.2 white-faced sakis, tamarins. No problems with the tamarins. Possible one bite on the sloth tail from sakis. No problems with old sakis. Young sakis go after the sloth.

(Buffalo) 2 cotton-top tamarins, 4+ agoutis, and 4 prehensile-tailed porcupines.

(MZG) Golden lion tamarin. One male was aggressive against the sloth. Current pair does not bother the sloth. Sloth is hand fed, because the tamarins will steal its food. Presently unable to take tamarins off exhibit.

(Tulsa) 5.1 Golden lion tamarins, 1.1 common marmosets, many fruit bats, 1.0 acouchi, many yellow footed tortoises, 5 iguanas, 1.1 scarlet macaw (off exhibit at night), 3 scarlet ibises, 1.0 sun bittern, 8 sun conure, 6 guira cuckoo, 2 heron, 1 arapaima, 0.2 wood rail, 0.1 bare-faced currasaw, and 0.1 orapendula. Since the sloths are fed at night, there are no problems with the birds. (Oropendulas peck at the sloth’s eye but THE SLOTH’S EYES MOVE BACK IN ITS HEAD.)

(Blank Park) Marmosets. They (sloth & marmosets) each will steal the other’s food. Will be adding golden lion tamarins. Large exhibit 25’ x 15’ x 12’high – so primates can get away from the sloth.

(Topeka) Sloths free range as high as 35 ft. and all over the building. No issue with the sloths. Tamarins were free ranging, and now are contained. Lots of different birds, iguanas, tortoises, and large fruit-eating bats. The sloths can also go to other open exhibits—There have been no issues. Sloths have swum across the stream in the exhibit. Sloth food is hanging in the tree, late in the day (to keep tamarins out of their food). No problems from the sloth. Tamandua with sloths free ranging and in the exhibit.
(Which zoo? Topeka?) Sloths mixed with reptiles. Only one bacteria issue noted.

RECOMMENDATION: DON’T MIX SLOTHS WITH REPTILES.

RECOMMENDATION: SPECIAL ACCOMMODATIONS MAY HAVE TO BE MADE IN ORDER TO ASSURE PROPER FOOD DELIVERY TO THE SLOTHS.

USDA likes to have a buffer to ensure there is no interaction between free-ranging animals and the public.

Social Grouping

Sloths are essentially non-social animals that live in isolation. In the zoo world, however, social groupings are possible. Sloths can be trained to remain in a social grouping. EXCEPTION: YOU ARE NOT LIKELY TO HAVE ANY BREEDING IF SLOTHS WERE RAISED TOGETHER. THERE IS REASON TO BELIEVE THAT SIBLING RELATIONSHIPS CAN DEVELOP BETWEEN YOUNG SLOTHS THAT WOULD PRECLUDE ANY FUTURE BREEDING.

Four to five years of age for sexual maturity. (Costa Rica - It has been reported that both kinds of female sloths reach sexual maturity between 3 to 3 ½ years, and males around four years, but we do not have a breeding program so cannot agree or disagree)

(Costa Rica) 6ft.x6ft.x12ft.high enclosures. Pairs that grew up together have not reproduced even though they are of mating age. (Suspect that the image of a sibling suppresses reproduction.) One hand-raised female grew up to be a competent mother after an unexpected pregnancy. Without a DNA test we do not know if the father is a two and a half year-old male that was placed with her when he was two years old, an eight year-old male in the adjoining cage, or a wild sloth mating through the cyclone fencing.

(Como) Very aggressive male against the female, and he had to be removed from the exhibit. He came in with aggressive background.

A pair of sloths can be kept together at all times, even through infant rearing. Multiple females can be kept in the same group. Multiple males kept together is generally NOT recommended. (Costa Rica) One group: Two adult males that had been together since infancy fought and had to be separated. A second group of two males are still together, with no problems. Advised to not have more than 1 male if it is exhibited with a group of females.

Is there a window of time when it is no longer advisable to keep an infant with its parents? (In the wild, the young will stay with the mother up to 14 months.)

(Kansas) May have had a miscarriage, but uncertain as to the specifics. Have not seen any inbreeding between young and adults.
**Introduction of New Animals (Sloth to Sloth)**

Mesh-to-mesh introduction

Removable pathways so pathways can be scentmarked.

Howdy cage method.

Successfully put together without any prior introductions

Hissing, puffing up, but no problem.

(Florida) Howdy was not an option, problem with one introduction, but no problem with the other one.

(Costa Rica) Have not had good luck because only small enclosures. There was pursuit into a corner.

(Florida) Hoffmann’s – not successful with introduction.

**Reproduction: A. Breeding Season**

The studbook indicates births all year long.

There is no fixed mating season with births recorded in all months except April, September and November. [MZG Volunteer Manual regarding Linne’s Two-Toed Sloth.]

(Costa Rica) We have not noticed any breeding season. Infants of both genera are brought to the sanctuary every month of the year.

(Costa Rica) For the Hoffmann’s, delivery occurs 11 months and around one week after breeding takes place.

(Tulsa) We have consistently seen 12 months between breeding and delivery. Linne’s female has a baby every 14-16 months. (Topeka) Has also seen that with the Hoffmann’s.) (Costa Rica) The baby is temporarily removed at around nine months of age so male and female can breed again; then female and baby are rejoined. (Tulsa) Breeding occurs with the previous baby on the mom.
Reproduction: B. Breeding Behavior

(Costa Rica) During breeding, a white discharge appears in males and females coming from the nose and eyes. The discharge will reabsorb and disappear. Observed also in one male while in quarantine (excitement), no female was near. We have also seen this white substance in females.

No visible outward sign of estrus

Only Bradypus will vocalize during estrus. Prior to the vocalization, the female's pheromones will also bring in the males (700 meters). (Tulsa) Choloepus makes no vocalizations.

Males and females can be exhibited far away from each other and then put together for breeding. When the male gets closer to the female this is indicative of breeding interest. Is mating more successful within a larger area, so escape is possible? (Tulsa and San Antonio) Breeding has also occurred within a small area enclosure. NEED TO STUDY. (In Costa Rica, breeding occurred four times (with four successful pregnancies and births, between the same pair, in an enclosure 10 x12 x12 feet.)

Breeding done at night, no human observation. Male was erect and started thrusting motions—don’t know if it was breeding. The female Bradypus squeals to advise the males where she is. Front to front, very quick (30 seconds) between first and second times.

(Lynn) Female was pursuing male, chuffing. She would sit on his belly, deep sniffing and chuffing. (This behavior was not observed at any other location.)

Reproduction: C. Birth

(Costa Rica) You can detect fetal movement on the mother’s side. A baby is born fully furred, with its eyes open. The ears are open and well formed (Hoffmann’s). A baby with closed eyes is an indicator that the baby is premature. Their teeth are in place; they don’t have two sets of teeth like most mammals. The mom eats the afterbirth. The baby will start to nurse almost immediately.

Didactylus Birth weight: 260g. – very low. Hoffman’s birth wt 400-500g. Didactylus is larger and longer than Hoffmanni. (Florida) Drastically different between hand-reared and mother-reared.

(Kansas) Birth video: Female was resting on a ledge. Female’s arms and legs got much darker before birth. Contractions followed by constant belly licking. Stopped licking, perfectly still, and baby’s head emerged. More licking by female—of her belly or of the baby’s head? (Could not see because the female was curled forward.) Another contraction by the female, and the baby’s body emerged. Eventually, the baby started
squawking. Female turned over onto her back, with the baby lying prone on her chest. Born at 1:12 p.m., the umbilical cord was still intact at 2:00 p.m., at 6:00 p.m. the cord was missing. The old male (1970 or 1972, wild-caught) died two weeks previous to the birth. Day birth.

(Costa Rica) A wild female rescued and reintroduced on sanctuary grounds came down the tree, across a gully, and hung from her arms and legs in a six-foot high bush without support for her back. When the baby was half way emerged, mother leaned over her abdomen and baby grasped mother’s arms and mother pulled the baby up onto her. From the time the mother situated herself in the bush and contractions began and the baby was suckling and all traces of the birth were cleaned, forty minutes had gone by. Forty minutes duration for birth. Believed that the constant licking is what breaks open the sac because the babies are always born exposed. Day and night births.

(Florida) Baby born with one foot first, hand and butt, then head—sideways!!

(Memphis) Female did use the birthing platform for 7 days prior to the birth. Delivery only at night.

No other observations of darker coloring prior to birth.

The birth canal is very short, so there is not a need for very many contractions.

(Tulsa) Babies are usually dark colored at birth.

**Reproduction: D. Estrus Cycle**

(Costa Rica) Only Bradypus will vocalize during estrus. The female will give a shrill scream to attract males. Prior to the vocalization, the female’s pheromones will also bring in the males (700 meters).

(Costa Rica) PROPOSE TO DO A STUDY ON THE BREEDING CYCLES, ETC. FIRST STUDY: WHAT IS THE CYCLE? (Is the cycle similar to humans?) UTERUS IS SIMPLE (similar to a human’s so is it like a human estrus cycle?) FURTHER WORK IS NEEDED TO DETERMINE CYCLICITY IN SLOTH (are they like dogs or like primates?)

SECOND STUDY: MEASURE THE LEVELS OF ESTROGEN AND PROGESTERONE. DEFINE A MODEL TO TEST FOR THOSE LEVELS. There are ovulation tests for humans. Testing every day will give a graph of the progesterone and estrogen levels. When estrogen elevates, what is the behavior of the female at that point? If she is like other mammals, she will seek a male. If it is like primates, they behave differently from other mammals. The cycle in cats/dogs/rabbits is Proestrus (bleed), Estrous, Metestrus, Diestrus. Female estrogen levels will rise. If she accepts the male when estrogen levels are high, then it is an Estrogen cycle like cats/dogs. If she accepts the male when progesterone levels are
high during Metestrus, then it is a Progesterone cycle like humans. DETERMINE WHICH KIND OF CYCLE IS IN A SLOTH: ESTROGEN OR PROGESTERONE.

(San Antonio) There is an ongoing research project of armadillos, wherein there is testing of fecal samples to determine estrogen levels. Can that study be incorporated with sloths?

Reproduction:  E. Housing for Breeding

The larger the area the better. Need space for males and females to be separated from each other for a period of time for successful reproduction, so that they can come together naturally. (Costa Rica) We can separate several pairs to determine if that makes a difference.

YOU ARE NOT LIKELY TO HAVE ANY BREEDING IF THE SLOTHS WERE RAISED TOGETHER. THERE IS REASON TO BELIEVE THAT SIBLING RELATIONSHIPS CAN DEVELOP BETWEEN YOUNG SLOTHS THAT WOULD PRECLUDE ANY FUTURE BREEDING (either with each other or any other sloth).

Reproduction:  E. Pregnancy Indicators


(San Antonio) Taughtness to the belly shows on lean animals, no belly protrusion.  
(Tulsa) Plumpness shows, births every 14-15 months; but sloths may be on the heavier side—more information to be submitted.

(Costa Rica) Before birth, female carries the baby along the left pelvic area, could not find it on an ultrasound. Should look more towards the female’s back.

(Tulsa) Female shows widening out the sides, not in the front. Performed ultrasound, shaved front, nothing showed. (Florida) also did an ultrasound. (Florida) Did ultrasound from the front and side, but could not see anything, due to gut movement.

Not a lot of mammary development, so not an indicator.

(Florida) Prior to birth, noticed diarrhea from the mother. Previous evening, female was noted to be more active, agitated.
Prior to birth, what is the appearance of the genitalia area? Example: Puffiness followed by swelling (like armadillo) 24 hrs. prior to birth? (Florida) More open vagina noticed prior to birth. Will check records and follow-up with specifics.

**Reproduction: F. How to Sex Sloths**

(Costa Rica) You can visually determine the sex immediately after birth. A male protuberance is clearly visible.

Genitalia: Male (Hoffmann’s) – When relaxed, there is a protuberance with a hole in the center. When excited, a small penis can be seen externally. Female has a labial slit.

**Reproduction: G. Mother-Infant Relationships**

(Florida) Infant did not nurse at all, couldn’t find the nipple (even with keeper assistance). Not much milk is expressed by squeezing the female’s mammarys in an attempt to stimulate the baby.

(Costa Rica) There is a deep relationship between mother/baby. The baby will lick the female’s face. The mother will fold her arms over the baby to protect it. Sloths do not produce and store milk; it is produced ‘on demand’ from stimulation by the infant’s suckling.

(MZG) In other animals, Oxytocin makes females more maternal and increases relationship with the baby.

(Memphis) A mother sloth threw the baby to the floor. The baby lived for 10 months, but it had constant health issues. Is that why the mother rejected the baby?

(Costa Rica) Moms manipulate the baby with front claws. We have never seen moms mouthing the baby in a normal situation.—is that an indicator of a problem with the baby? We have witnessed injured mothers biting their babies, and it is usually associated with pain from terrible injuries or extreme fear. We have also received infants that have been found on the ground, with injuries corresponding to the ‘tell-tale’ triangular tooth mark of a Choloepus bite.

(Tulsa) After 1-2 months, mom/baby will change trees. Baby will sniff leaves, mom will give to baby. Will follow-up to narrow down the time frame.

(Costa Rica) At 1-1/2 wks., the infant will begin to sample leaves. By 2-1/2 wks, the baby is taking bites of beans and carrots. We have NEVER witnessed a mother sloth of either genera chewing leaves and giving it to baby. Baby eats from the same leaf (food) that the mother is ‘actively’ eating, sometimes even ‘stealing’ food from her grasp.
WHAT IS THE FREQUENCY/DURATION OF NATURAL NURSING? Is it not very long?  
(Costa Rica) Mammary tissue is orange underneath the skin, very small, and flat, lateral and very high up. Chest is very narrow. Could not express any milk; minimum 2cc. needed for milk study.

(San Antonio) has seen two adult males nursing from nursing moms.

Should the male be left with mom/baby or should the male be separated out?  (Florida) had male take baby and hug together, after death of the mother.

Can females be made to lactate with stimulation?  (Tulsa—it works with howler monkeys.)

(San Antonio) The baby climbed on the father without any problem. The male has been in the enclosure since the beginning. The same male was implicated in an infant death previously.

(Tulsa) The baby differentiates and prefers to be on the mom, but sometimes gets confused and finds itself on the male but then goes to the mom.

NO VOCALIZATIONS FROM THE ADULTS. BABIES WILL SQUEAL. Female will leave the 6mos. old baby and take off, then come back to the baby when the baby cries. The cry will trigger the mother’s response. For weaning, at about 1yr. the mother will move completely away where she cannot hear the baby, and the baby becomes independent. (Costa Rica) Mom/12 month old baby were separated for 2 mos., brought back together, and the baby did not try to get back onto the mom. They recognized each other, with kissing.

The personality of the sloth determines whether or not it can be handled. Reaction: puffed hair, bites. BABIES DO NOT NEED TO BE PULLED EARLY, AS THEY CAN BE GROOMED AS AN EDUCATION ANIMAL AT A LATER (NATURAL) TIME WHEN THEY WOULD ORDINARILY BE SEPARATED FROM THE MOTHERS.

If the mom is not raising the baby, then she does not want the baby there.

Education sloth: What is the enclosure space? Doesn’t matter; determine a standard. Both females and males have been used as education animals. Too many people can cause the sloth stress and biting. People were trying to touch the animal, and it reacted. Sloths are unpredictable. While some have been used not all are successful. Need to be prepared to do something with the sloth if it doesn’t work out. It is okay for a pregnant sloth to still be used as an education animal, depending on the animal.
(Costa Rica) With rescued babies, goat’s milk is administered with a syringe, 7-grain wholewheat bread (start at 1 mo. age), cut into cubes and moistened with goat milk.

With infants, GI problems from ingestion of cow’s milk—most common problem. One hypothesis is that it stays so long in the digestive system, fermenting and producing toxins, killing off the intestinal flora. Another hypothesis is that the fat molecule is much larger that Mother’s milk or goat milk, making it harder to break down, causing difficulties in the gastric system, diarrhea, and death is often the result.

Respiratory problems in the infants: THE POSITION IN WHICH YOU ARE FEEDING THE BABY IS VERY CRITICAL, DUE TO THE LOCATION OF THE GOTERA ESOFAGO (Spanish term) FEED THE BABY WITH IT LYING ON ITS STOMACH, PLACED ON TOP OF A FOLDED TOWEL OR OTHER SOFT OBJECT WHICH THE BABY CAN GRASP ONTO WITH ALL FOURS, WITH THE HEAD AT AN ANGLE AND SLIGHTLY HIGHER THAN THE REAR TO HELP PREVENT ASPIRATION OF THE MILK. Hypothesis: aspiration pneumonia could be the result of a feeding position other than a normal mother-to baby, the resulting aspiration could be due to

(Costa Rica) Joy (mother reared) gained 40 g. in 4 days and 115 g. in 1 month. Raja (sickly baby) gained 195 g. in 4 months. When learning to eat solid foods, some hand-reared babies work their tongues to the front, rather than the back—hard to get them to actually swallow the food. Pet nurser for tiny babies is hard for them to get their tongues around. (Florida) uses a pipette—worked well, almost the same size as a nipple. Catac (from England) nipple, longer and more pliable, attached to a 10cc syringe with a canula is used in Costa Rica. Take care to make a tiny hole in nipple so baby doesn’t take in too much and aspirate. (Memphis) used marsupial nipples—looks similar. Feed babies food at 45 degree angle for 7-10 minutes amount per feeding depends on age/size of infant. (Judy will forward the proportion of milk/food given.) Feed at 7am, 11am, 2:30pm, and between 7:00 and 10:30pm. After 1 month, none of the babies are waking in the middle of the night to eat; they are housed together in incubators when possible. Prior to that, one nighttime feeding at 2 am. Single babies are kept on a stuffed animal and our experience is that they will wake up because of loneliness rather than hunger during the night. Babies that are kept together do not wake up for 2 am feedings after 1 month of age. Babies “suckle” on ears of their ‘incubator-mates’, their own fingers or heel. Once suckling is started, it is usually continued for life. They are not actually suckling, but simply holding the ear, fingers, or heel in the mouth for oral comfort. There is no ear damage. However, the lower mandible bone can be deformed by the heel bone held in the mouth during the time that the sloth is very young and his bones are malleable and growing. Pacifier is not effective.
(Costa Rica) Benebac + Pedialyte to restore bacterial flora and for rehydration.

(Costa Rica) Change feeding syringe after a couple uses because they get stuck after sterilizing, making it impossible to maintain an even flow of milk to the baby.

(Costa Rica) IF FED ARTIFICIALLY, AND CARE IS NOT TAKEN (FEEDING TOO QUICKLY FORCING THE INFANT TO SWALLOW RATHER THAN SUCKLE) BABIES CAN SOMETIMES LOSE THEIR SUCKLING ABILITY, MAKING IT VERY DIFFICULT TO FEED WITHOUT THE DANGER OF ASPIRATION.. ORPHANED BABIES DO BETTER IF THEY ARE REARED TOGETHER. A mother-raised baby grows larger, faster, more robust, than a hand-raised baby.

Reproduction: I. Infant Development

At approximately 6 months of age the infants are taken to an outdoor tree for a few minutes for fresh air, exercise and to stimulate physical evacuation. In the wild-when infant is about 1 yr the dam leaves the infant in her home territory and moves to another area of her home range to allow the juvenile to learn to be independent. This can be a problem in small enclosures and cause aggression between dam and juvenile. When infant reaches 12-14 months of age and not removed aggression could result, or the juvenile never learns independence and continues to ask to be carried by the mother.

The following is from the MZG Volunteer Manual for Linne’s Two-Toed Sloth: The infant is born fully furred, eyes open and dentition complete. Birth weight is 11-14oz. (300-400g.). The female giving birth will hang by her arms. The fully developed young is born head first and clings to the mother with its claws. The infant remains hidden in the fur of the mother’s belly for 4 weeks. Then it starts to show interest in its surroundings and will start to grab at nearby branches. At 10 weeks it starts to eat part of the mother’s meals. At 9 months it starts hanging independently from the mother. Adult size and weight is reached at 2-1/2 years; its life span is up to 40 years. (30-35 years was indicated at the workshop.)
**Transportation**

IOTA regulations.

Insert DWA photos

(Florida) Water Oak branches to hang onto, but the branches add weight to the crate. A roughed-up broom handle can also be used. Wiring above the floor, so defecation falls through the floor below—don’t ship with straw.

(Memphis & MZG) Use shavings.

Upright “T” and horizontal bench within the crate.

(Costa Rica) Pretreatment with Benebac and the Himalayan Ansiocare (anti-anxiety substance)---prior to shipping the sloth. Ship with towels as bedding to absorb urine.

Quarantine problems when coming into an institution: Constipation. Few days not eating and eating a little bit before more normal food consumption. Sloths drop their food intake just before they defecate.

**Training**

(Como) Stephano has been handled as an education animal since the beginning. Animal puts legs around keeper’s body. Then keeper places sloth’s arms onto keeper’s shoulders.

Chloe trained with target (touch tip of nose, bridged with piece of fruit) to come down from tree. (3-4 months to learn.) Later, she reverted and did not want to do the target. Cue command to come down the tree. All four keepers are women, okay with men too. Clicker trained for immediate reinforcement. Chloe holds onto keeper’s side. RECOMMENDATION: INSTEAD OF THE FRONT, TRAIN THE SLOTH TO HOLD ONTO THE KEEPER’S SIDE (in case the keeper becomes pregnant or if the keeper’s arm is in a sling).

(Como) Used for 15 min. keeper talk. Stantions are used so the public cannot get near the animal.

(Florida) Target trained immediately after first session.

Trained to use a crate. (Tulsa) trained to use a bucket.

Hoffmann’s: With 2 people: 1 to hold feet and 1 to hold arms to transport.

The sloth experience of the keepers attending the workshop ranged from 2-37 yrs. [If needed, John Gramieri made notes of the specific length of time per keeper.]
Both animals were wild-caught. At first, the male would chuff & hiss. 1st-keeper would stand by him. When can get close to sloth’s food, then use the bridge. Start touching the limbs and use the bridge and reward. Then just bridge and not reward every time. There was a lot of resistance to pick sloth up—6 mos. additional training. Sloth is not responsive to other staff as yet. Female was target trained by accident (honey on target, then bridged). All 5 keepers can now pick her up. She will be used for keeper talks within the building. (Memphis does not have a Training Coordinator.) (Grapes, apples used for male for reward.)

A jungle gym is used from which the sloth can hang, and the sloth is then more visible to the public.

Used broom handle to carry a sloth by using 2 people. Sloth remains relaxed and away from the keepers’ faces.

After training, sloth will take injections.

Sloth is trained to accept an ultrasound.

Sloths will accept the keeper moving the sloths’ one finger at a time for nail trimming. Not trained to come down from the trees.

**Future**

WHAT CAN WE ALL DO FOR THE UNRELEASABLE HAND-REARED SLOTHS THAT LIVE AT THE SLOTH SANCTUARY? Start the process of bringing them to North American exhibits. Adult sloths are rescued and brought to the sanctuary for medical care as a result of power lines injuries, or are hit by motor vehicles, or some are attacked by dogs or humans. Due to their injuries (particularly amputations), some of them cannot always be released back into the wild. These sloths remain at the sanctuary as permanent residents, well cared for for the rest of their lives. The sloths that are rescued from certain death and brought to the sanctuary as infants and hand-reared cannot be introduced to the wild as they do not have the critical survival skills that baby sloths must learn from their mothers. The sanctuary will continue to receive injured and orphaned sloths. Something must be done to ease the burden of the sanctuary. There is a need for hand-reared sloths in zoos and aquariums, and there are no ‘sanctioned’ breeding programs for sloths to provide these needs. Sloths are taken from the wild to provide zoos and aquariums. By placing our adapted, hand-reared sloths in zoos and aquariums, we could help ease the burden of taking healthy sloths from the wild.

Equipment is desperately needed to perform important research projects. There is still a need for local education regarding protection and conservation of the sloths. Funding is needed for the education program. More capability of onsite lab testing is also needed.
MZG keepers gave $400 from their AAZK chapter funds to Aviarios – Sloth Sanctuary of Costa Rica. The Sloth Sanctuary of Costa Rica is grateful for the donation and thanks everyone in the AAZK chapter for their generosity!

Use Tulsa or Topeka to show AZA that the American facilities know how to take care of sloths.

(1) (2) From graduation thesis of Dra. Gabriela Varela Brenes, Universidad Veritas, Escuela de Medicina y Cirugía Veterinaria San Francisco de Asis, Coronado, Costa Rica; Professor Dr. Francisco Arroyo Murillo; 01 Octubre del 2007.