Population Analysis & Breeding and Transfer Plan

Linne's Two-toed Sloth (*Choloepus didactylus*)
AZA Species Survival Plan®
Signature Program

AZA Species Survival Plan® Coordinator
Debra Dial, National Aquarium (ddial@aqua.org)

AZA Species Survival Plan® Vice Coordinator
Jennifer Hennessy, Roger Williams Park Zoo (jhennessy@rwpzoo.org)

AZA Studbook Keeper
Davi Ann Norsworthy, Lincoln Children's Zoo (dnorsworthy@lincolnzoo.org)

AZA Population Advisor
Adam Winegarden, AZA Population Management Center at Lincoln Park Zoo
(awinegarden@lpzoo.org)

24 February 2026

PMC Population Management Center

LINCOLN PARK ZOO. ASSOCIATION OF ZOOS & AQUARIUMS

Acknowledgments

The Linne's Two-toed Sloth SSP planningmeetingwasheld viaonline conferencing on 20 November 2025 and was attendedbythe following:

Debra Dial,National Aquarium
Jenna Heinze,Philadelphia Zoo
Caroline Schleimer, Zoo Atlanta
Jennifer Hennessy,Roger Williams Park Zoo
Davi Ann Norsworthy,Lincoln Children's Zoo
Lynn Yakubinis, Zoo Atlanta
Dr. Dominique Keller, Los Angeles Zoo and Botanical Gardens
Emily Ryan, National Aquarium
Adam Winegarden, AZA Population Management Center at Lincoln Park Zoo

Cover photo courtesy ofDebra Dial, National Aquarium

This plan was prepared and distributed with the assistanceofPlanning Coordinator, PMCTrack Coordinator, and Program Assistant at the AZA Population Management Center.
(PMC@lpzoo.org andPMCTrack@lpzoo.org)

Species Survival Plan

PMC TRACK

Suggested Citation:

Dial, D., Hennessy, J., Norsworthy, D., Winegarden, A. 2026. Linne's Two-toed Sloth (Choloepus didactylus). AZA Species Survival Plan® Signature Program Population Analysis and Breeding and Transfer Plan. AZA Population Management Center: Chicago, IL, USA.

Description of Population Status

Introduction: The currentLinne's Two-toed Sloth SSP population consists of 183 animals distributed among 92 AZA facilities (Table 1). One additional animal that has been identified as a hybrid is not included in this total population count. Under AZA's current sustainability designations, this Animal Program qualifies as a Signature SSP. The Pangolin, Aardvark, & Xenarthra Taxon Advisory Group in their 2022 Regional Collection Plan (RCP), have designated this population with a target size of 175. An Advised Population Size was calculated for this SSP, demonstrating the number of animals needed for long-term genetic sustainability (Table 3). A target population size of 190 was developed with the Coordinator and Population Advisor to set population goals for this plan.

Acomprehensive introduction to the husbandry, care, and conservation of Choleopus spp. has been provided as anappendix to this Breeding and Transfer Plan. Please see Appendix J for this information.

Analytical Assumptions and Exclusions:

The pedigree of this population is66.8% known (64.8% certain) before assumptions and exclusions (For clarification on known vs. certain, see AppendixF). A total of 55animalshave been excluded from the potentially breeding population (Appendix B). One additional hybrid animal has been excluded from all demographic and genetic analysis. Following assumptions and exclusions, the pedigree is 100% known (96.8% certain). The potentially breeding population consists of 128 animals (Table 1).

Demography: Linne's two-toed sloths first appeared in AZA facilities in 1882 at Philadelphia Zoo. The first recorded birth in the studbook occurred in 1956 at Detroit Zoo but the population was initially sustained by imports until zoo breeding became more wide-spread in the mid-1970s (Figure 1). Zoo-born individuals became more populous than wild-born individuals in 1999. This trend has continued to present day – zoo-born sloths currently comprise 76% of the SSP population. The SSP population has been steadily growing since its inception, and more rapidly since around 2015. The population has increased on average over the past five years by 1.8%.

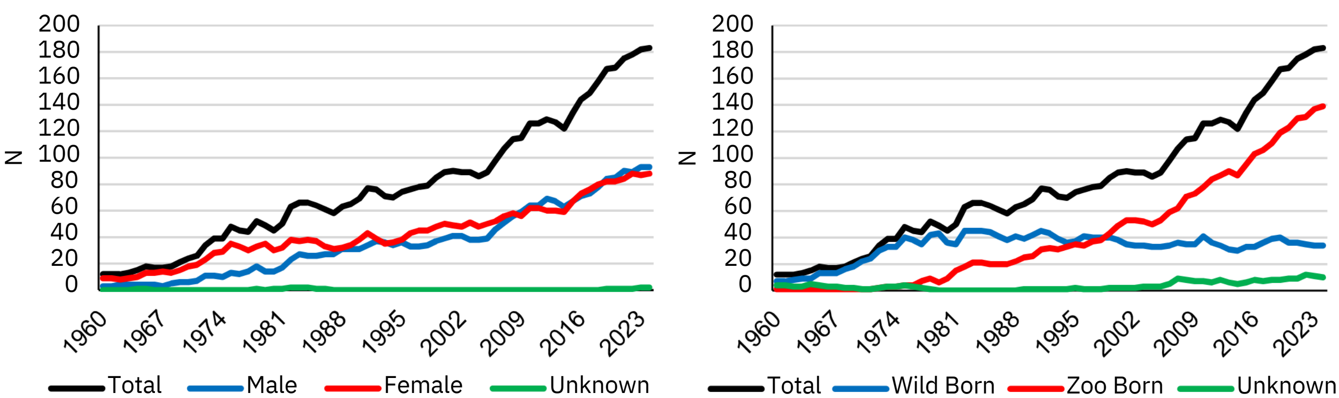


Figure 1: Census of the Linne's Two-Toed Sloth SSP from 1960 to 2024 by sex (left) and birth type (right).

The age structure illustrates the number of males and females in each age class (Figure 2). The Linne's Two-toed Sloth SSP has a balanced sex ratio and a fairly strong pyramidal shape. Typically, with long-lived species, a columnar age structure is observed; however, strong growth rates within the last ten years have given this age structure a wide base of young available for breeding. Note that many of these young animals are excluded from breeding due to unknown pedigree and the shape of the genetically managed animals graph becomes thinner at the base (Figure 2, right). Based on its current age structure and growth rate, if the population continues on its current trajectory, this population has the potential to increase over time (Table 1).

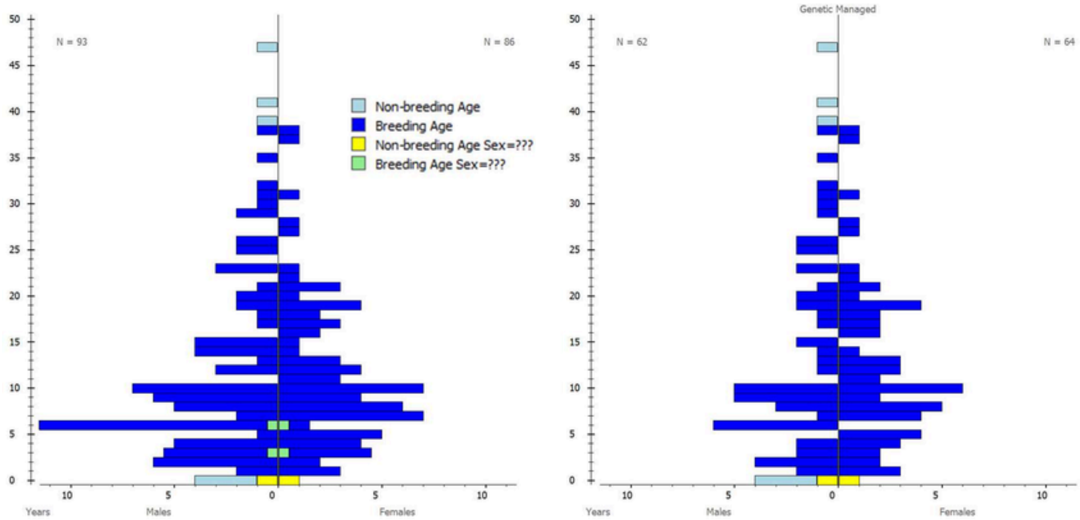


Figure 2: Age distribution of the total (left) and potentially breeding population (right) for the Linne's Two-toed Sloth SSP.

Table 1: Demographic status of the Linne's Two-toed Sloth SSP population according to studbook data.

Demography Summary		
Current size of SSP population (N) – Total (Males.Females.Unknown Sex)	183 (93.86.4)	
Number of individuals excluded from genetic analyses	55 (31.22.2)	
Population size following exclusions	128 (62.64.2)	
Target population size (Kt) derived in planning meeting	190	
Mean generation time (T, years)	16.9	
Population growth rates (λ; lambda)*: Life Table / 5-year / Projected	**0.970 / 1.018 / *0.961 <> 0.973 <> 0.985	
Percentage (%) of living population produced ex situ	76	
Number of participating facilities	92	
Survival/Mortality	**Males**	**Females**
Observed first year mortality rate (Q_x)	0.31	0.34
Median life expectancy (MLE), excluding first year mortalities (years)***	20.7	13.6
Observed maximum longevity (years)	****47 (SB#376)	49 (SB#138)
Reproduction		
Observed reproductive age range	1-37	1-38
Gestation time (days)	270 - 365	
Median litter size born	1	

*Life table (AZA 1 Jan 1980 – 2 Dec 2025); 5-year from studbook census; Projected from PMx stochastic 20-year projections
**Growth rates do not include imported animals, which have historically supported growth in this population.
***Calculated from Descriptive Survival Analysis Report in PopLink. See table in Appendix C for AZA Survival Statistics Library link.
****Oldest living male in studbook is still living and may not represent true longevity of this species.

Genetics: Genetic values are calculated after incorporating pedigree assumptions and removing excluded individuals. Analysis of the studbook indicates that this SSP is descended from 47 founders with 36 potential founders remaining (Figure 3, Table 2). The gene diversity of the population is 97.46%. Based on current founder representations, gene diversity is equivalent to that found in approximately 20 founders.

Population management theory suggests genetic management should strive to maintain thresholds for tolerance of gene diversity loss. The standard goal is 90% gene diversity retention for 100 years. Decreases in gene diversity below 90% of that in the founding population have been associated with increasingly compromised reproduction by, among other factors, lower birth/hatch weights, smaller litter/clutch sizes, and greater neonatal mortality in some species.

Table 2: Genetic status of the Linne's Two-toed Sloth SSP population.

GeneticsSummary*				
	2019	2023	2025**	Potential
Founders	54	45	47	36
Founder genome equivalents (FGE)	21.15	16.68	19.70	70.89
Gene diversity (GD %)	97.6	97.3	97.46	99.29
Population mean kinship (MK)	0.0 236	0.0268	0.0254	--
Mean inbreeding (F)	0.010	0.000	0.000	--
Effective population size relative to population size (N_e/N)	0.1 750	0.1980	0.2273	--
Percentage of pedigree known before / after assumptions and exclusions (%)	78.0 / 98.0	75.0 / 92.8	66.8 / 100	--
Percentage pedigree certain after assumptions and exclusions (%)	98.0	90.6	96.8	--

*Geneticstatisticsmay notbe comparable acrossyears due to changes insoftware and parameters used for projections from year to year.
**Pedigree assumptions were created for this population and may over- orunder-estimate genetic statistics shown in this table.

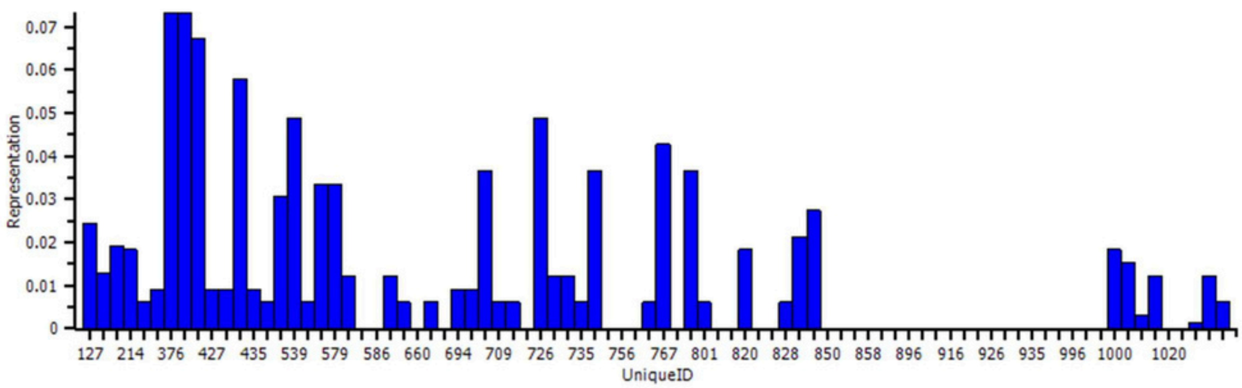


Figure 3: Founder representation distribution of the analytical Linne's Two-toed Sloth SSP population.

Based on current population parameters, gene diversity is projected to decline to 60.5% over the next 100 years if the current population maintains a size of 183 (Table 3, Scenario a), and could maintain 10% gene diversity loss for 57 years (Table 3, Scenario b). Running these same scenarios with a slightly positive growth rate (1% per year, reflective of what this population has achieved with imports) and a larger maximum population size, the population could maintain 90% gene diversity for 115 years (Table 3, Scenario c).

An Advised Population Size of 164 was calculated for this SSP, indicating the population size that would preserve 90% gene diversity for 100 years given current parameters. This population size is just a minimum – since this SSP exceeds the minimum population size, SSP managers should use the capacity of holding facilities and SSP needs to guide breeding recommendations.

Recommendation Outcomes: The website PMCTrack calculates the outcomes for SSP recommendations by comparing breeding and transfer recommendations to births and transfers recorded in the studbook (Figure 4). Use of PMCTrack surveys is now required as of 2023 for SSP Program management. Outcomes are calculated using the most recent recommendation from either the SSP's Breeding and Transfer Plan or interim recommendations as of 2022. There are many reasons that recommendations might not be fulfilled and these reasons can be captured using PMCTrack Outcomes Surveys. Note that starting in 2023, the fulfillment rates of any plan may include attempted fulfillment. Facilities can communicate how they are making progress with their recommendations when they complete the Outcomes Surveys, and this is reflected as attempted fulfillment (patched pattern in outcomes graphs below).

Of the Breeding and Transfer Plan and interim recommendations proposed since the 2023 report, 72% of the breeding recommendations were fulfilled/attempted, and 83% of transfer recommendations were fulfilled/attempted. SSP participants are always encouraged to attempt to fulfill recommendations and communicate successes and challenges to the SSP Coordinator.

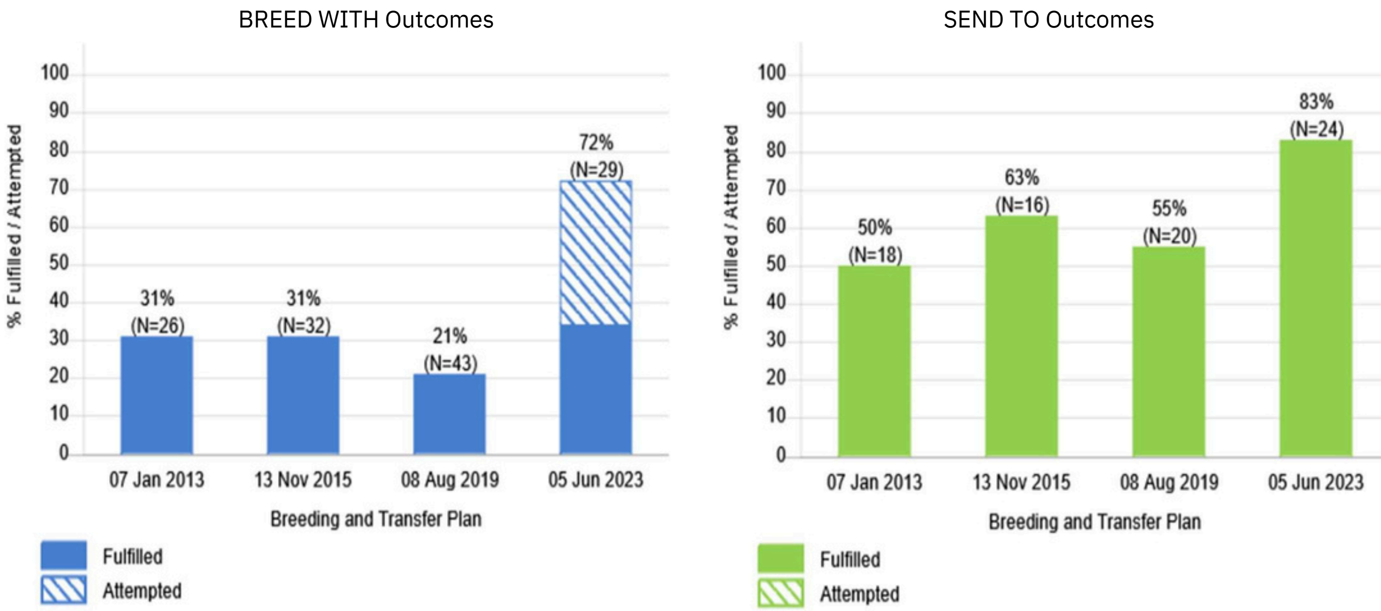


Figure 4: Recommendation outcomes by breeding (left) and transfer (right) for the past Linne's Two-toed Sloth SSP Breeding and Transfer Plans. N represents the number of recommendations scored for each recommendation type that was issued in the plan or during the interim, and the number represents the percent of recommendations fulfilled and attempted. Please visit PMCTrack.org or contact pmctrack@lpzoo.org for more information or with any questions.

F. Definitions

Demographic Terms

Age Distribution – A visual representation of thenumbersorpercentages of individuals in various age and sex classes.

Lambda () or Population Growth Rate – Theproportionalchangeinpopulation size from one year to the next. A lambda of 1.11 means an 11% per year increase;alambdaof0.97meansa3% decline in size per year. The three lambdas highlighted in this BTP are: 1) Life Table,fromthePMxlifetables,thechange in the population based on the demographic regional and date window exported fromthestudbook,thelifetablelambda is the rate at which the population would be expected to grow (in the future) giventhebirthanddeathratesreported in the life tables and assuming a stable age distribution (does NOT factor in importsorexports);2)5-year,fromthestudbook census, the 5-year lambda is calculated from observed changes in populationsizeoverthelast5yearsandincludes births, deaths, imports and exports; and 3) Projected, from the PMx stochastic20-yearprojections(includesconfidence intervals), models how the population is predicted to grow or decline over thenext20yearsgiventhebirthanddeath rates from the life tables and the age structure of the current population.

Lx, Age-Specific Survivorship – The probability that a new individual (e.g., age 0) is alive at the beginning of age x. Alternatively, the proportion of individuals which survive from birth to the beginning of a specific age class.

Mean Generation Time (T) – The average time elapsing from reproduction in one generation to the time the next generation reproduces. Also, the average age at which a female (or male) produces offspring. It is not the age of first reproduction. Males and females often have different generation times.

Median Life Expectancy (MLE) – The ‘typical’ age at which an average animal is expected to live; 50% will die before the median life expectancy and 50% die after. The MLE reported in Breeding and Transfer Plans (BTPs) and Survival Stats Reports, does exclude individuals that did not survive to their first birthday. The MLE obtained from population management software (PM2000, PMx, ZooRisk) or from life tables in BTPs (e.g., where Lx = 0.5) will be lower because they include those individuals that did not survive to their first birthday in order to project the correct number of births needed. A Survival Statistics Library is maintained for most AZA Animal Programs on the AZA website: https://www.aza.org/species-survival-statistics.

Maximum Longevity – The maximum age at which we have observed a species to live. If the oldest observed animal is currently living, we do not yet know the maximum longevity.

Mx, Fecundity – The average number of same-sexed offspring born to animals in that age class. Because studbooks typically have relatively small sample sizes, studbook software calculates Mx as 1/2 the average number of offspring born to animals in that age class. This provides a somewhat less "noisy" estimate of Mx, though it does not allow for unusual sex ratios. The fecundity rates provide information on the age of first, last, and maximum reproduction.

Px, Age-Specific Survival – The probability that an individual of age x survives an age class; is conditional on an individual being alive at the beginning of the age class. Alternatively, the proportion of individuals that survive from the beginning of one age class to the next.

Qx, Mortality – The probability that an individual of age x dies during an age class (Qx = 1-Px). Alternatively, the proportion of individuals that die during an age class. It is calculated from the number of animals that die during an age class divided by the number of animals that were alive at the beginning of the age class (i.e., "at risk").

Risk (Qx or Mx) – The number of individuals that have lived during an age class. The number “at risk” is used to calculate Mx and Qx by dividing the number of births and deaths that occurred during an age class by the number of animals at risk of dying and reproducing during that age class.

Genetic Terms

Effective Population Size (N_e) – The size of a randomly mating population of constant size with equal sex ratio and a Poisson distribution of family sizes that would (a) result in the same mean rate of inbreeding as that observed in the population, or (b) would result in the same rate of random change in allele frequencies (genetic drift) as observed in the

population. These two definitions are identical only if the population is demographically stable (because the rate of inbreeding depends on the distribution of alleles in the parental generation, whereas the rate of allele frequency drift is measured in the current generation). More specifically, PMx software use the definition as the size of the current population that has produced offspring, assuming that there are current breeders, that these current breeders have a Poisson distribution of family sizes, that none of the current breeders are now post-reproductive, and none of the not-yet-breeding adults will breed.

Founder – An individual obtained from a source population (often the wild) that has no known relationship to any individuals in the derived population (except for its own descendants).

Founder Genome Equivalents (FGE) – The number of wild-caught individuals (founders) that represent the same amount of gene diversity as does the population under study. The gene diversity of a population is 1 - 1 / (2 * FGE).

Founder Representation – The proportion of the alleles in the living, descendant population that are derived from that founder.

Gene Diversity (GD) – The probability that two alleles randomly sampled from the same genetic locus across a population are not identical by descent. Gene diversity is calculated relative to a population's founders, which are assumed to be unrelated and not inbred, and is the proportional diversity retained by the current, descendant population.

Inbreeding Coefficient (F) – The probability that the two alleles present at an individual's genetic locus are identical by descent (i.e., both alleles originated from an ancestor common to both the individual's parents).

Mean Kinship (MK) – The mean (or average) kinship coefficient between an animal and all animals (including itself) in the living, zoo/aquarium population. An individual's mean kinship is a measure of how well its alleles are represented within a population. Animals with low mean kinships have few relatives, are from under-represented founder lineages, and have transmitted few of their alleles to the next generation; these individuals should be prioritized for breeding to slow a population's gene diversity loss.

Percent Known – The percentage of an animal's genome that is traceable to known founders. Thus, if an animal has an UNK sire, its % Known = 50. If it has an UNK grandparent, its % Known = 75.

Percent Certain – The percentage of the living individuals' pedigree that can be completely identified as certain: (exact identity of both parents is known) and traceable back to known founders. Individuals that are 100% certain do not have any MULTs or UNKs in their pedigree. Certainty represents a higher degree of knowledge than Known and therefore is always less than or equal to Known.

Management Terms

Signature Species Survival Plan® (SignatureSSP)Program– ASignature SSP Program is a population that is considered to be sustainable using robust measures of viability and sustainability defined by the AZA Animal Population Management Committee. A Signature SSP meets all of the requirements to become an SSP, and scores at least two positives and does not score any negatives in the SSP Assessment process.

Provisional Species Survival Plan® (Provisional SSP) Program – A Provisional SSP Program is a population that is a priority for AZA members but does not currently meet the definitions of viability and sustainability defined by the AZA Animal Population Management Committee. A Provisional SSP Program meets all of the requirements to become an SSP and does not score a negative in more than two categories in the SSP Assessment process.

Sustainability Partners – AZA Animal Population Management (APM) Committee approved wildlife facilities that regularly exchange animals with AZA-accredited facilities and certified related facilities, typically as part of the Species Survival Plan® (SSP) Program Breeding and Transfer Plan or other SSP Program management process.

For more information on Program definitions – visit the AZA Resources Documents Page. https://www.aza.org/resource-documents

Animal Program Engagement – AZA policy stating that all AZA accredited are committed to managing robust animal populations in zoos and aquariums to assure that animals are available to meet individual program goals and fulfill our collective mission. Successful population management relies on highly collaborative, communicative, and engaged

relationships among AZA members and Animal Programs (i.e., Taxon Advisory Groups (TAGs), Species Survival Plans® (SSPs), and AZA Studbooks). Therefore, all AZA member facilities must fully engage with and participate in each SSP that pertains to an animal that the facility own or is part of their collection. Further, each Animal Program Leader (i.e., TAG Chair, SSP Coordinator, and Studbook Keeper) must fully engage with each facility that is part of their Animal Program. Animal Program engagement is defined and explained in the Facility Handbook on Animal Program Engagement and with the SSP and TAG Handbooks (See Appendix G for link to additional AZA Policies pertinent to population management).

Target Population Size (TPS_{DATE}): A short-term target number of animals that is realistic yet aspirational, to be reached by the program by a specified target date. Factors considered when setting TPS may include program goals, the CPS/CPT, logistical constraints, the trajectory and performance of the population, species biology/life history, and/or, where relevant,
a desire to move the population size closer to the APS. The TPS should always be reported with a target date (e.g. TPS_{2029}).

Commitment Population Size (CPS_{DATE}) or Trend (CPT_{DATE}): A number OR trend in number of animals projected to be in a program by a specified short-term date, based solely on realistic participant commitment to holding the species. CPS/CPT should always be reported with a target date (e.g., CPS_{2029}). CPS is a number that represents the size the population would be on that date if all realistic commitment to hold the taxon were filled and requests for acquisition/disposition completed. The unit for CPS may be "individuals" or an alternative unit appropriate to the taxon (e.g., "tanks"). Alternatively, CPT is the direction that the population is projected to shift, based on realistic commitment (growing, declining, remaining stable). CPS/CPT do not include biological/husbandry limitations, which are accounted for when setting TPS. TAGs are responsible for identifying the CPS or CPT and these values should be found in a Regional Collection Plan.

Advised Population Size (APS): a scientifically derived size that, if the population reaches that size and maintains appropriate demographic and genetic characteristics, would result in a high likelihood of the population being robust, viable, healthy, and biologically sound.

G. AZA Animal Population Management (APM) Committee Disclaimers

All Species Survival Plans® are subject to AZA Animal Program Engagement and Sustainability Partner Policies and Accreditation Standards. All participants, including APM Committee-approved Sustainability Partners, are expected to agree and abide by AZA's Code of Professional Ethics, Policy on Animal Program Engagement, Policy on Responsible Population Management, and Accreditation Standards related to animal care and welfare.

Please refer to the definition appendix above for more on how Programs are defined. Lastly, all Board-approved policies mentioned above regarding Animal Program Engagement and population management can be found on the AZA website linked below:

https://www.aza.org/board-approved-policies-and-position-statements?locale=en

I. Contraception and Reproductive Health

Reproductive management is essential to meeting genetic and demographicgoals and supporting long-term sustainability of populations in human care. The AZA Reproductive Management Center (RMC) can provide services related to contraception, and a variety of other reproductive challenges. If contraception is elected for animals designated as "DO NOT BREED", please visit the RMC Website at http://stlzoo.org/contraception and consult the SSP coordinator and the RMC at contraception@stlzoo.org for advice.

When contraception is used, please contribute these contraception data to the AZA RMC Contraception Database at www.zoocontraceptiondata.org. The AZA RMC Contraception Database contains thousands of records that are analyzed to continually update contraception recommendations on efficacy, dosing, frequency of administration, and reversibility for
a wide variety of animals. The RMC relies heavily on institutions to share information about their animals by contributing contraception data for their animals to our contraception database. The data collected include animal information (e.g. taxonomy, age, weight), contraceptive products used, doses, frequency and number of treatments used, implant removals, contraception outcomes (e.g. birth control failures, reversals, etc.), as well as behavioral and physical changes observed during use.

In addition, the Reproductive Health Surveillance Program (RHSP) conducts comprehensive pathologic examinations on reproductive tracts to detect deleterious effects associated with contraception or other reproductive management practices. The results of these analyses are shared with the RMC and provide important information about contraceptives that is incorporated in the Contraception Recommendations. If an animal of any taxa (male or female; contracepted or non- contracepted) dies ~~or is permanently~~ sterilized, please submit the reproductive tract tissues to the RHSP. There are several options for tissue submission. For the most up-to-date tissue submission instructions, please visit the RHSP webpage on the RMC's website at http://stlzoo.org/rhsp.

Population Analysis & Breeding and Transfer Plan

Hoffman's Two-toed Sloth (*Choloepus hoffmanni*)
AZA Species Survival Plan®
Provisional Program

AZA Species Survival Plan® Coordinator
Debra Dial, National Aquarium (ddial@aqua.org)

AZA Species Survival Plan® Vice Coordinator
Jenna Heinze, Philadelphia Zoo (heinze.jenna@phillyzoo.org)

AZA Studbook Keeper
Caroline Schleimer, Zoo Atlanta (cschleimer@zooatlanta.org)

AZA Population Advisor
Adam Winegarden, AZA Population Management Center at Lincoln Park Zoo
(awinegarden@lpzoo.org)

24 February 2026

PMC Population Management Center

LINCOLN PARK ZOO

ASSOCIATION OF ZOOS & AQUARIUMS

Acknowledgments

The Hoffman's Two-toed Sloth SSP planning meeting was held via online conferencing on 20 November 2025 and was attended bythe following:

Debra Dial, National Aquarium
Jenna Heinze, Philadelphia Zoo.
Caroline Schleimer, Zoo Atlanta
Jennifer Hennessy, Roger Williams Park Zoo
Davi Ann Norsworthy, Lincoln Children's Zoo
Lynn Yakubinis, Zoo Atlanta
Dr. Dominique Keller, Los Angeles Zoo and Botanical Gardens
Emily Ryan, National Aquarium
Adam Winegarden, AZA Population Management Center at Lincoln Park Zoo

Cover photo courtesy ofCierra Allen, Philadelphia Zoo

This plan was prepared and distributed with the assistanceofPlanning Coordinator, PMCTrack Coordinator, and Program Assistant at the AZA Population Management Center.
(PMC@lpzoo.org andPMCTrack@lpzoo.org)

Suggested Citation:

Dial, D., Heinze, J., Schleimer, C., Winegarden, A. 2026. Hoffman's Two-toed Sloth (Choloepus hoffmanni). AZA Species Survival Plan® Provisional Program Population Analysis and Breeding and Transfer Plan. AZA Population Management Center: Chicago, IL, USA.

Description of Population Status

Introduction: The current Hoffman's Two-toed Sloth SSP population consists of 77 animals distributed among 35 AZA facilities (Table 1). One animal that has been identified as a hybrid, and not included in the total population count, resides in an additional AZA facility. Under AZA's current sustainability designations, this Animal Program qualifies as a Provisional SSP. The Pangolin, Aardvark, & Xenarthra Taxon Advisory Group, in their 2022 Regional Collection Plan (RCP), have designated this population with a target size of 80. A target population size of 75 by the year 2030 was developed with the Coordinator and Population Advisor to set population goals for this plan.

A comprehensive introduction to the husbandry, care, and conservation of Choleopus spp. has been provided as an appendix to this Breeding and Transfer Plan. Please see Appendix J for this information.

Analytical Assumptions and Exclusions:

The pedigree of this population is 85.1% known (85.1% certain) before assumptions and exclusions (for clarification on known vs. certain, Appendix F). A total of eight animals have been excluded from the potentially breeding population (Appendix B). One additional hybrid animal has been excluded from all demographic and genetic analysis. Following assumptions and exclusions, the pedigree is 100% known (100% certain). The potentially breeding population consists of 69 animals (Table 1).

Demography: Hoffman's two-toed sloths first appeared in AZA facilities in 1946 at San Diego Zoo. The first recorded birth in the studbook occurred in 1958 at Fort Worth Zoo, but the population was initially sustained by imports until zoo breeding became more wide-spread in the mid-1970s (Figure 1). Zoo-born individuals became more populous than wild-born individuals in 1991. This trend has continued to present day – zoo-born sloths currently comprise 78% of the SSP population. The SSP has maintained a population of between 70-90 sloths consistently for the last 40 years. While 2024 was a year of growth ($\lambda = 1.013$), the population has declined on average over the past five years by 1.0% ($\lambda = 0.990$).

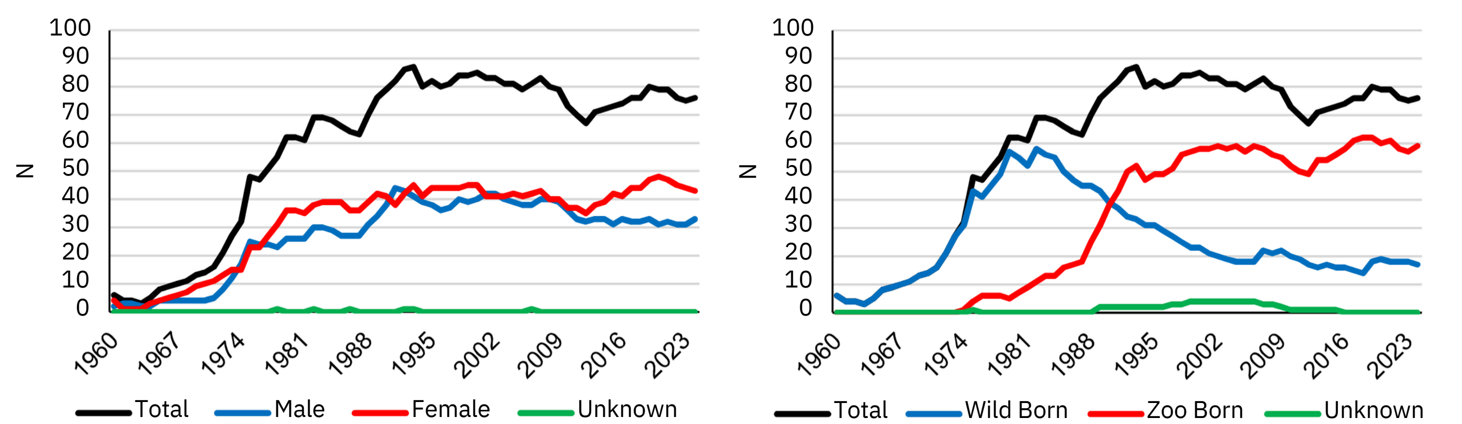


Figure 1: Census of the Hoffman's Two-toed Sloth SSP from 1960 to 2024 by sex (left) and birth type (right).

The age structure illustrates the number of males and females in each age class (Figure 2). This SSP population has a columnar age structure, a shape to be expected from species with longer lifespans. Consistent breeding has occurred within the last 15 years, as is apparent from the lack of empty age classes. To achieve more growth in the population, these basal age classes should ideally be slightly wider. The sex ratio of this population is nearly equal. Based on its current age structure and growth rate, if the population continues on its current trajectory, this population will decrease gradually over time (Table 1). Note that growth rates in Table 1 do not incorporate any imports to the population.

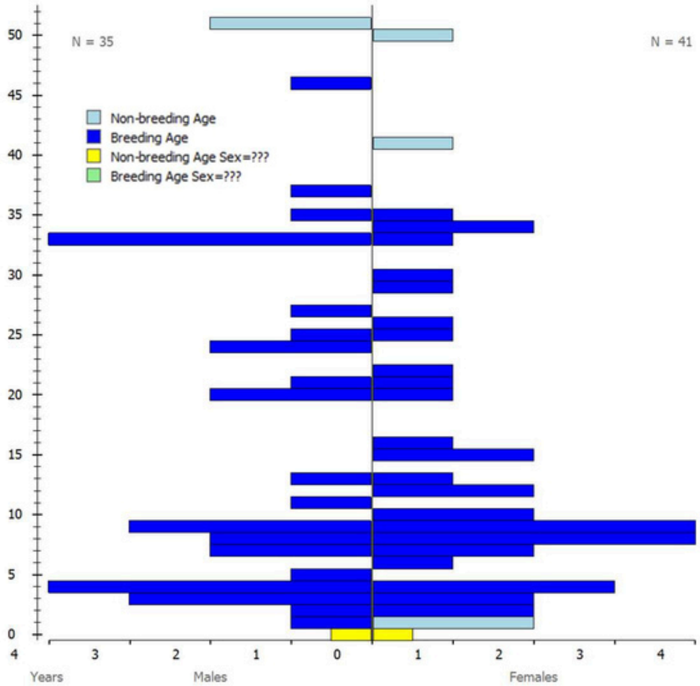


Figure 2: Age distribution of the total population for the Hoffman's Two-toed Sloth SSP.

Table 1: Demographic status of the Hoffman's Two-toed Sloth SSP population according to studbook data.

Demography Summary		
Current size of SSP population (N) – Total (Males.Females.Unknown Sex)	77 (35.41.1)	
Number of individuals excluded from genetic analyses	8 (2.6.0)	
Population size following exclusions	69 (33.35.1)	
Target population size (Kt) derived in planning meeting	80	
Mean generation time (T, years)	16.6	
Population growth rates (λ; lambda)*: Life Table / 5-year / Projected	**0.979 / 0.990 / *0.961 <> 0.978 <> 0.995	
Percentage (%) of living population produced ex situ	78	
Number of participating facilities	35	
Survival/Mortality	**Males**	**Females**
Observed first year mortality rate (Q_x)	0.40	0.37
Median life expectancy (MLE), excluding first year mortalities (years)***	16.5	
Observed maximum longevity (years)****	51 (SB#233)	50 (SB#244)
Reproduction		
Observed reproductive age range	1-46	2-37
Gestation time (days)	345	
Median litter size born	1	

*Life table (AZA 1 Jan 1980 – 19 Nov 2025); 5-year from studbook census; Projected from PMx stochastic 20-year projections.
**Growth rates do not include imported animals, which have historically supported growth in this population.
***Calculated from Descriptive Survival Analysis Report in PopLink. See table in Appendix C for AZA Survival Statistics Library link.
****Oldest living male and female in studbook are still living and may not represent true longevity of this species.

Genetics: Genetic values are calculated after incorporating pedigree assumptions and removing excluded individuals. Analysis of the studbook indicates that this SSP is descended from 17 founders with 15 potential founders remaining (Figure
3, Table 2). The gene diversity of the population is 92.68%. Based on current founder representations, gene diversity is equivalent to that found in approximately seven founders.

Population management theory suggests genetic management should strive to maintain thresholds for tolerance of gene diversity loss. The standard goal is 90% gene diversity retention for 100 years. Decreases in gene diversity below 90% of that in the founding population have been associated with increasingly compromised reproduction by, among other factors, lower birth/hatch weights, smaller litter/clutch sizes, and greater neonatal mortality in some species.

Table 2: Genetic status of the Hoffman's Two-toed Sloth SSP population.

GeneticsSummary*				
Founders	2019	2023	2025**	Potential
Founder genome equivalents (FGE)	20	22	17	22
Gene diversity (GD %)	7.5	7.67	6.82	33.74
Population mean kinship (MK)	9	93.5	92.67	98.52
Mean inbreeding (F)	0.093. 659	0.0652	0.0733	--
Effective population size relative to population size (N_e/N)	0.04197	0.0236	0.0238	--
Percentage of pedigree known before / after assumptions and exclusions (%)	0.3 445	0.3262	0.3478	--
Percentage pedigree certain after assumptions and exclusions (%)	84.0 / 95.3	82.0 / 93.6	85.1 / 100	--
	95.3	93.6	100	--

*Geneticstatisticsmay notbe comparable acrossyears due to changes insoftware and parameters used for projections from year to year.
**Pedigree assumptions were created for this population and may over- orunder-estimate genetic statistics shown in this table.

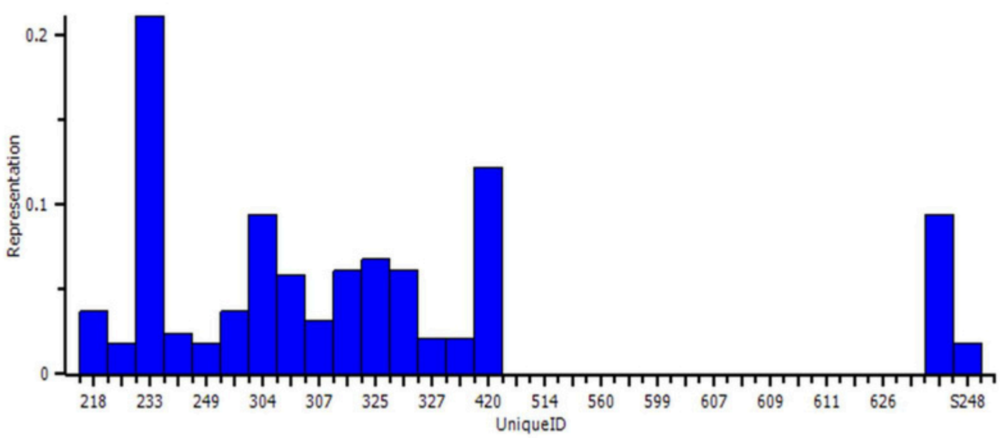


Figure 3 :Founder representation distribution of the analytical Hoffman's Two-toed Sloth SSP population.

Based current population parameters, gene diversity is projected to decline to 63.6% over the next 100 years if the population maintains at the size of 77 (Table 3, Scenario a), and could maintain 10% gene diversity loss for 54 years (Table 3, Scenario b). Running these same scenarios with a slightly positive growth rate (1% per year) and a marginally larger target size (80), the population could maintain 90% gene diversity for 26 years and 10% gene diversity loss for 104 years (Table 3, Scenarios c and d). Scenario e shows that combining a positive growth rate, higher Ne/N, and reaching the 2022 RCP target size of 80 could help preserve 84.3% gene diversity after 100 years (Table 3, Scenario e). The import of new founders is also a way to generate new gene diversity, but does not align with the current sustainability goals of the SSP.

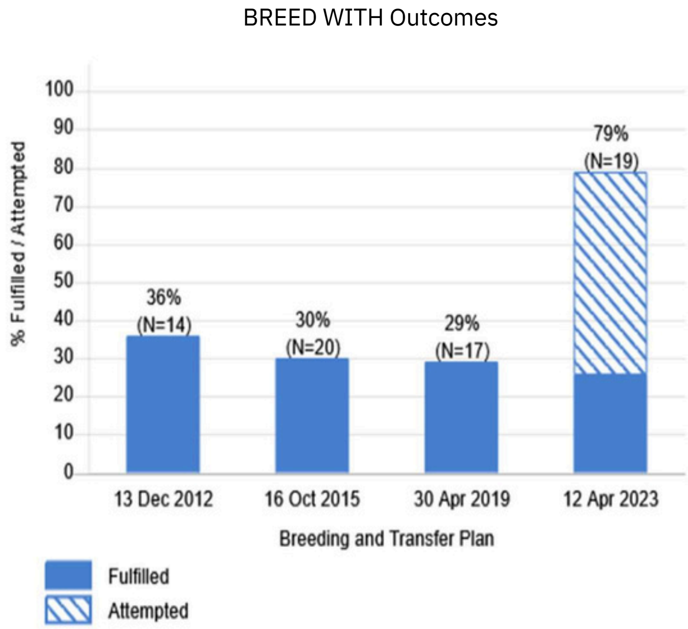
Table 3: Long term gene diversity scenarios from PMx. Scenarios a-b are standard minimum projections run for every report and reflect projections based on current parameters*.

Scenario Descriptions	Lambda	Ne/N	Max Allowable Population Size	Years to Reach Genetic Goal	GD Maintained (%)
a. Maintain 90% GD for 100 years	0.98	0.3478	77	20	63.6
b. Maintain 10% GD loss (82.67%) for 100 years	0.98	0.3478	77	54	63.6
c. Maintain 90% GD for 100 years with a slightly positive growth rate	1.01	0.3478	80	26	83.1
d. Maintain 10% GD loss (82.68%) for 100 years with a slightly positive growth rate	1.01	0.3605	80	104	83.1
e. Maintain 90% GD for 100 years with a slightly positive growth rate, higher Ne/N, and reaching the target size from the 2022 RCP.	1.01	0.4000	80	30	84.3

*Startingpopulation(N)=77;Generationtime (T) = 16.6; current GD = 92.67.

Recommendation Outcomes: The website PMCTrack calculates the outcomes for SSP recommendations by comparing breeding and transfer recommendations to births and transfers recorded in the studbook (Figure 4). Use of PMCTrack surveys is now required as of 2023 for SSP Program management. Outcomes are calculated using the most recent recommendation from either the SSP's Breeding and Transfer Plan or interim recommendations as of 2022. There are many reasons that recommendations might not be fulfilled and these reasons can be captured using PMCTrack Outcomes Surveys. Note that starting in 2023, the fulfillment rates of any plan may include attempted fulfillment. Facilities can communicate how they are making progress with their recommendations when they complete the Outcomes Surveys, and this is reflected as attempted fulfillment (patched pattern in outcomes graphs below).

Of the Breeding and Transfer Plan and interim recommendations proposed since the 2023 report, 79% of the breeding recommendations were fulfilled/attempted, and 100% of transfer recommendations were fulfilled/attempted. SSP participants are always encouraged to attempt to fulfill recommendations and communicate successes and challenges to the SSP Coordinator.



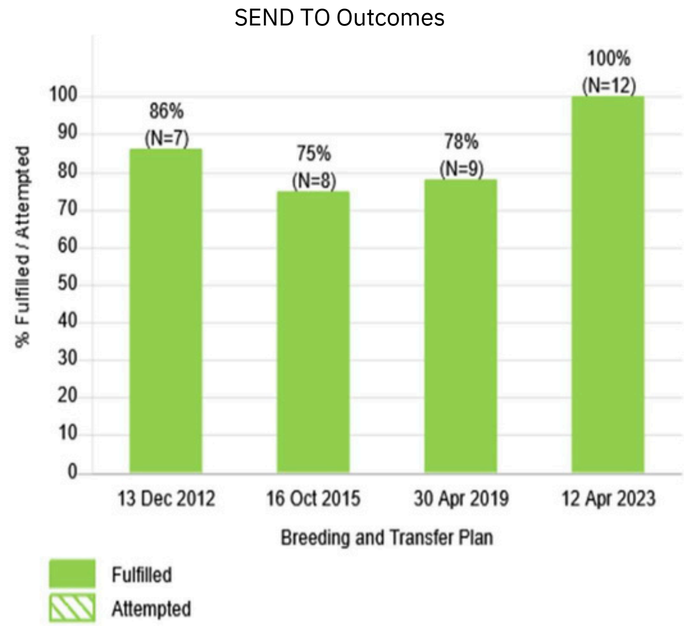


Figure 4: Recommendation outcomes by breeding (left) and transfer (right) for the past Hoffman's Two-toed Sloth SSP Breeding and Transfer Plans. N represents the number of recommendations scored for each recommendation type that was issued in the plan or during the interim, and the number represents the percent of recommendations fulfilled and attempted. Please visit PMCTrack.org or contact pmctrack@lpzoo.org for more information or with any questions.

Management Strategies

This is a 2-year plan (2025 – 2027).Interimrecommendations will continue to be made as needed until another full set of recommendations are produced. Recommendations contained in this plan supersede all previous recommendations.

The Hoffman's Two-toed Sloth SSP will pursue the scenario of growing to a target size of 80 by 2030 for this Breeding and Transfer Plan (Table 4, scenario b). The SSP saw a year of positive growth in 2024 and hopes to continue to achieve a pattern of gradual population increase as new breeding pairs are established and facilities gain experience.

Table 4: Reproduction plan and history for the Hoffman's Two-toed Sloth SSP population.

Reproductive Goals				
	Growth Rate (λ)	Year to Reach Goal	Number of Offspring Needed per Year	To Reach Target Population SizeOf
a.Maintain current population size	1.000	2026	6-7	77
b.Growsizeto therecommended target population size (TPS) in five years	1.008	2030	6-8	80
ReproductiveGoalsSummary from the Last BTP (2023)				
Number of females recommended to breed	21			
Number of births since publication date of last report	9			
AverageNumberofEventsintheSSP Population per Year over theLast Five Years*				
Average number of births per year	2.6			
Average number of deaths per year	3.6			
Average number of imports per year	0.2			
Average number of exports per year	0			

*Changes to numbersofimports or exports betweenreports may be due to changes in accreditationthrough time. These numbers pertain to the AZA Population at the time of analysis/publication.

Summary Recommendations:

1. The SSP recommends 14 females to breed at 14 facilities.
2. The SSP recommends five transfers to establish new pairs and meet facility requests.
3. Please contact the SSP Coordinator if you have any questions about determining the sex or species of sloths in your care. Methods vary and the SSP can provide you with guidance for methods that have been most reliable.
4. Facilities wishing to receive (or place animals) should contact the SSP Coordinator for guidance before making arrangements. The SSP can recommend sources for acquiring sloths. Animals should not be transferred before first discussing it with the SSP Coordinator. It must be ensured that the best moves and pairings are carried out in order to achieve demographic stability and genetic health for the population in the future.
5. Any facilities wishing to import unrelated, young animals should contact the SSP coordinator first—this includes sloths intended for educational purposes.
6. If considering acquiring a slot for education, please contact the SSP coordinator first. All two-toed sloths in AZA facilities are managed by the SSP coordinator. All sloths are valuable to the population and are needed for the demographic stability and genetic health of the population. The SSP recommends that educational sloths are housed in natural exhibits with the opportunity for them to exhibit natural behaviors. They should never be held or carried for programs – theyshouldbetrainedtovoluntarilyenteracrateorclimbonaperch.
7. Please consult AZA Reproductive Management Center (See Appendix I) for questions related to limiting or promoting fertility as well as reproductive health. Direct inquiries to contraception@stlzoo.org

population. These two definitions are identical only if the population is demographically stable (because the rate of inbreeding depends on the distribution of alleles in the parental generation, whereas the rate of allele frequency drift is measured in the current generation). More specifically, PMx software use the definition as the size of the current population that has produced offspring, assuming that there are current breeders, that these current breeders have a Poisson distribution of family sizes, that none of the current breeders are now post-reproductive, and none of the not-yet-breeding adults will breed.

Founder – An individual obtained from a source population (often the wild) that has no known relationship to any individuals in the derived population (except for its own descendants).

Founder Genome Equivalents (FGE) – The number of wild-caught individuals (founders) that represent the same amount of gene diversity as does the population under study. The gene diversity of a population is 1 - 1 / (2 * FGE).

Founder Representation – The proportion of the alleles in the living, descendant population that are derived from that founder.
Gene Diversity (GD) – The probability that two alleles randomly sampled from the same genetic locus across a population are not identical by descent. Gene diversity is calculated relative to a population's founders, which are assumed to be unrelated and not inbred, and is the proportional diversity retained by the current, descendant population.

Inbreeding Coefficient (F) – The probability that the two alleles present at an individual's genetic locus are identical by descent (i.e., both alleles originated from an ancestor common to both the individual's parents).

Mean Kinship (MK) – The mean (or average) kinship coefficient between an animal and all animals (including itself) in the living, zoo/aquarium population. An individual's mean kinship is a measure of how well its alleles are represented within a population. Animals with low mean kinships have few relatives, are from under-represented founder lineages, and have transmitted few of their alleles to the next generation; these individuals should be prioritized for breeding to slow a population's gene diversity loss.

Percent Known – The percentage of an animal's genome that is traceable to known founders. Thus, if an animal has an UNK sire, its % Known = 50. If it has an UNK grandparent, its % Known = 75.

Percent Certain – The percentage of the living individuals' pedigree that can be completely identified as certain: (exact identity of both parents is known) and traceable back to known founders. Individuals that are 100% certain do not have any MULTs or UNKs in their pedigree. Certainty represents a higher degree of knowledge than Known and therefore is always less than or equal to Known.

Management Terms

Signature Species Survival Plan® (SignatureSSP)Program–A Signature SSP Program is a population that is considered to be sustainable using robust measures of viability and sustainability defined by the AZA Animal Population Management Committee. A Signature SSP meets all of the requirements to become an SSP, and scores at least two positives and does not score any negatives in the SSP Assessment process.

Provisional Species Survival Plan® (Provisional SSP) Program – A Provisional SSP Program is a population that is a priority for AZA members but does not currently meet the definitions of viability and sustainability defined by the AZA Animal Population Management Committee. A Provisional SSP Program meets all of the requirements to become an SSP and does not score a negative in more than two categories in the SSP Assessment process.

Sustainability Partners – AZA Animal Population Management (APM) Committee approved wildlife facilities that regularly exchange animals with AZA-accredited facilities and certified related facilities, typically as part of the Species Survival Plan® (SSP) Program Breeding and Transfer Plan or other SSP Program management process.

For more information on Program definitions – visit the AZA Resources Documents Page. https://www.aza.org/resource-documents

Animal Program Engagement – AZA policy stating that all AZA accredited are committed to managing robust animal populations in zoos and aquariums to assure that animals are available to meet individual program goals and fulfill our collective mission. Successful population management relies on highly collaborative, communicative, and engaged

relationships among AZA members and Animal Programs (i.e., Taxon Advisory Groups (TAGs), Species Survival Plans® (SSPs), and AZA Studbooks). Therefore, all AZA member facilities must fully engage with and participate in each SSP that pertains to an animal that the facility own or is part of their collection. Further, each Animal Program Leader (i.e., TAG Chair, SSP Coordinator, and Studbook Keeper) must fully engage with each facility that is part of their Animal Program. Animal Program engagement is defined and explained in the Facility Handbook on Animal Program Engagement and with the SSP and TAG Handbooks (See Appendix G for link to additional AZA Policies pertinent to population management).

Target Population Size (TPS_{DATE}): A short-term target number of animals that is realistic yet aspirational, to be reached by the program by a specified target date. Factors considered when setting TPS may include program goals, the CPS/CPT, logistical constraints, the trajectory and performance of the population, species biology/life history, and/or, where relevant,
a desire to move the population size closer to the APS. The TPS should always be reported with a target date (e.g. TPS_{2029}).

Commitment Population Size (CPS_{DATE}) or Trend (CPT_{DATE}): A number OR trend in number of animals projected to be
in a program by a specified short-term date, based solely on realistic participant commitment to holding the species. CPS/CPT should always be reported with a target date (e.g., CPS_{2029}). CPS is a number that represents the size the population would be on that date if all realistic commitment to hold the taxon were filled and requests for acquisition/disposition completed. The unit for CPS may be "individuals" or an alternative unit appropriate to the taxon (e.g., "tanks"). Alternatively, CPT is the direction that the population is projected to shift, based on realistic commitment (growing, declining, remaining stable). CPS/CPT do not include biological/husbandry limitations, which are accounted for when setting TPS. TAGs are responsible for identifying the CPS or CPT and these values should be found in a Regional Collection Plan.

Advised Population Size (APS): a scientifically derived size that, if the population reaches that size and maintains appropriate demographic and genetic characteristics, would result in a high likelihood of the population being robust, viable, healthy, and biologically sound.

G. AZA Animal Population Management (APM) Committee Disclaimers

All Species Survival Plans® are subject to AZA Animal Program Engagement and Sustainability Partner Policies and Accreditation Standards. All participants, including APM Committee-approved Sustainability Partners, are expected to agree and abide by AZA's Code of Professional Ethics, Policy on Animal Program Engagement, Policy on Responsible Population Management, and Accreditation Standards related to animal care and welfare.

Please refer to the definition appendix above for more on how Programs are defined. Lastly, all Board-approved policies mentioned above regarding Animal Program Engagement and population management can be found on the AZA website linked below:

https://www.aza.org/board-approved-policies-and-position-statements?locale=en

I. Contraception and Reproductive Health

Reproductive management is essential to meeting genetic and demographicgoals and supporting long-term sustainability of populations in human care. The AZA Reproductive Management Center (RMC) can provide services related to contraception, and a variety of other reproductive challenges. If contraception is elected for animals designated as "DO NOT BREED", please visit the RMC Website at http://stlzoo.org/contraception and consult the SSP coordinator and the RMC at contraception@stlzoo.org for advice.

When contraception is used, please contribute these contraception data to the AZA RMC Contraception Database at www.zoocontraceptiondata.org. The AZA RMC Contraception Database contains thousands of records that are analyzed to continually update contraception recommendations on efficacy, dosing, frequency of administration, and reversibility for
a wide variety of animals. The RMC relies heavily on institutions to share information about their animals by contributing contraception data for their animals to our contraception database. The data collected include animal information (e.g. taxonomy, age, weight), contraceptive products used, doses, frequency and number of treatments used, implant removals, contraception outcomes (e.g. birth control failures, reversals, etc.), as well as behavioral and physical changes observed during use.

In addition, the Reproductive Health Surveillance Program (RHSP) conducts comprehensive pathologic examinations on reproductive tracts to detect deleterious effects associated with contraception or other reproductive management practices. The results of these analyses are shared with the RMC and provide important information about contraceptives that is incorporated in the Contraception Recommendations. If an animal of any taxa (male or female; contracepted or non-contracepted) dies or is permanently sterilized, please submit the reproductive tract tissues to the RHSP. There are several options for tissue submission. For the most up-to-date tissue submission instructions, please visit the RHSP webpage on the RMC's website at http://stlzoo.org/rhsp.

F. Definitions

Demographic Terms

Age Distribution – A visual representation of the numbers or percentages of individuals in various age and sex classes.

Lambda () or Population Growth Rate – The proportional change in population size from one year to the next. A lambda
A lambda of 1.11 means an 11% per year increase; a lambda of 0.97 means a 3% decline in size per year. The three lambdas highlighted in this BTP are: 1) Life Table,fromthePMxlifetables,thechange in the population based on the demographic, regional, and date window exported studbook. The life table lambda is the rate at which the population would be expected to grow (in the future) reported in the life tables and assuming a stable age distribution (does NOT factor in exports); 2) A 5-year lambda, from the studbook census, the 5-year lambda is calculated from observed changes in population size over the last 5 years and includes births, deaths, imports and exports; and 3) Projected, from the PMx stochastic 20-year projections (includes confidence intervals), models how the population is predicted to grow or decline over the next 20 years given the birth and death rates from the life tables and the age structure.
of the current population.

Lx, Age-Specific Survivorship—The probability that a new individual (e.g., age 0) is alive at the beginning of age x. Alternatively, the proportion of individuals who survive from birth to the beginning of a specific age class.

Mean Generation Time (T) – The average time elapsing from reproduction in one generation to the time the next generation reproduces. Also, the average age at which a female (or male) produces offspring. It is not the age of first reproduction. Males and females often have different generation times.

Median Life Expectancy (MLE) – The 'typical' age at which an average animal is expected to live; 50% will die before the median life expectancy and 50% die after. The MLE reported in Breeding and Transfer Plans (BTPs) and Survival Stats Reports does exclude individuals that did not survive to their first birthday. The MLE obtained from population management software (PM2000, PMx, ZooRisk) or from life tables in BTPs (e.g., where Lx = 0.5) will be lower because they include those individuals that did not survive to their first birthday in order to project the correct number of births needed. A Survival Statistics Library is maintained for most AZA Animal Programs on the AZA website: https://www.aza.org/species-survival-statistics.

Maximum Longevity—The maximum age at which we have observed a species to live. If the oldest observed animal is currently living, we do not yet know the maximum longevity.

Mx, Fecundity—The average number of same-sexed offspring born to animals in that age class. Because studbooks typically have relatively small sample sizes, studbook software calculates Mx as 1/2 the average number of offspring born
to animals in that age class. This provides a somewhat less "noisy" estimate of Mx, though it does not allow for unusual sex ratios. The fecundity rates provide information on the age of first, last, and maximum reproduction.

Px, Age-Specific Survival – The probability that an individual of age x survives an age class is conditional on an individual being alive at the beginning of the age class. Alternatively, the proportion of individuals that survive from the beginning of one age class to the next.

Qx, Mortality—The probability that an individual of age x dies during an age class (Qx = 1-Px). Alternatively, the proportion
of individuals that die during an age class. It is calculated from the number of animals that die during an age class divided by the number of animals that were alive at the beginning of the age class (i.e., "at risk").

Risk (Qx or Mx) – The number of individuals that have lived during an age class. The number "at risk" is used to calculate Mx and Qx by dividing the number of births and deaths that occurred during an age class by the number of animals at risk
of dying and reproducing during that age class.

Genetic Terms

Effective Population Size (N_e) – The size of a randomly mating population of constant size with equal sex ratio and a Poisson distribution of family sizes that would (a) result in the same mean rate of inbreeding as that observed in the population, or (b) would result in the same rate of random change in allele frequencies (genetic drift) as observed in the

population. These two definitions are identical only if the population is demographically stable (because the rate of inbreeding depends on the distribution of alleles in the parental generation, whereas the rate of allele frequency drift is measured in the current generation). More specifically, PMx software use the definition as the size of the current population that has produced offspring, assuming that there are current breeders, that these current breeders have a Poisson distribution of family sizes, that none of the current breeders are now post-reproductive, and none of the not-yet-breeding adults will breed.

Founder – An individual obtained from a source population (often the wild) that has no known relationship to any individuals in the derived population (except for its own descendants).

Founder Genome Equivalents (FGE) – The number of wild-caught individuals (founders) that represent the same amount of gene diversity as does the population under study. The gene diversity of a population is 1 - 1 / (2 * FGE).

Founder Representation – The proportion of the alleles in the living, descendant population that are derived from that founder.

Gene Diversity (GD) – The probability that two alleles randomly sampled from the same genetic locus across a population are not identical by descent. Gene diversity is calculated relative to a population's founders, which are assumed to be unrelated and not inbred, and is the proportional diversity retained by the current, descendant population.

Inbreeding Coefficient (F) – The probability that the two alleles present at an individual's genetic locus are identical by descent (i.e., both alleles originated from an ancestor common to both the individual's parents).

Mean Kinship (MK) – The mean (or average) kinship coefficient between an animal and all animals (including itself) in the living, zoo/aquarium population. An individual's mean kinship is a measure of how well its alleles are represented within a population. Animals with low mean kinships have few relatives, are from under-represented founder lineages, and have transmitted few of their alleles to the next generation; these individuals should be prioritized for breeding to slow a population's gene diversity loss.

Percent Known – The percentage of an animal's genome that is traceable to known founders. Thus, if an animal has an UNK sire, its % Known = 50. If it has an UNK grandparent, its % Known = 75.

Percent Certain – The percentage of the living individuals' pedigree that can be completely identified as certain: (exact identity of both parents is known) and traceable back to known founders. Individuals that are 100% certain do not have any MULTs or UNKs in their pedigree. Certainty represents a higher degree of knowledge than Known and therefore is always less than or equal to Known.

Management Terms

Signature Species Survival Plan® (SignatureSSP)Program– ASignature SSP Program is a population that is considered to be sustainable using robust measures of viability and sustainability defined by the AZA Animal Population Management Committee. A Signature SSP meets all of the requirements to become an SSP, and scores at least two positives and does not score any negatives in the SSP Assessment process.

Provisional Species Survival Plan® (Provisional SSP) Program – A Provisional SSP Program is a population that is a priority for AZA members but does not currently meet the definitions of viability and sustainability defined by the AZA Animal Population Management Committee. A Provisional SSP Program meets all of the requirements to become an SSP and does not score a negative in more than two categories in the SSP Assessment process.

Sustainability Partners – AZA Animal Population Management (APM) Committee approved wildlife facilities that regularly exchange animals with AZA-accredited facilities and certified related facilities, typically as part of the Species Survival Plan® (SSP) Program Breeding and Transfer Plan or other SSP Program management process.

For more information on Program definitions – visit the AZA Resources Documents Page. https://www.aza.org/resource-documents

Animal Program Engagement – AZA policy stating that all AZA accredited are committed to managing robust animal populations in zoos and aquariums to assure that animals are available to meet individual program goals and fulfill our collective mission. Successful population management relies on highly collaborative, communicative, and engaged

relationships among AZA members and Animal Programs (i.e., Taxon Advisory Groups (TAGs), Species Survival Plans® (SSPs), and AZA Studbooks). Therefore, all AZA member facilities must fully engage with and participate in each SSP that pertains to an animal that the facility own or is part of their collection. Further, each Animal Program Leader (i.e., TAG Chair, SSP Coordinator, and Studbook Keeper) must fully engage with each facility that is part of their Animal Program. Animal Program engagement is defined and explained in the Facility Handbook on Animal Program Engagement and with the SSP and TAG Handbooks (See Appendix G for link to additional AZA Policies pertinent to population management).

Target Population Size (TPS_{DATE}): A short-term target number of animals that is realistic yet aspirational, to be reached by the program by a specified target date. Factors considered when setting TPS may include program goals, the CPS/CPT, logistical constraints, the trajectory and performance of the population, species biology/life history, and/or, where relevant, a desire to move the population size closer to the APS. The TPS should always be reported with a target date (e.g. TPS_{2029}).

Commitment Population Size (CPS_{DATE}) or Trend (CPT_{DATE}): A number OR trend in number of animals projected to be in a program by a specified short-term date, based solely on realistic participant commitment to holding the species. CPS/CPT should always be reported with a target date (e.g., CPS_{2029}). CPS is a number that represents the size the population would be on that date if all realistic commitment to hold the taxon were filled and requests for acquisition/disposition completed. The unit for CPS may be "individuals" or an alternative unit appropriate to the taxon (e.g., "tanks"). Alternatively, CPT is the direction that the population is projected to shift, based on realistic commitment (growing, declining, remaining stable). CPS/CPT do not include biological/husbandry limitations, which are accounted for when setting TPS. TAGs are responsible for identifying the CPS or CPT and these values should be found in a Regional Collection Plan.

Advised Population Size (APS): a scientifically derived size that, if the population reaches that size and maintains appropriate demographic and genetic characteristics, would result in a high likelihood of the population being robust, viable, healthy, and biologically sound.

G. AZA Animal Population Management (APM) Committee Disclaimers

All Species Survival Plans® are subject to AZA Animal Program Engagement and Sustainability Partner Policies and Accreditation Standards. All participants, including APM Committee-approved Sustainability Partners, are expected to agree and abide by AZA's Code of Professional Ethics, Policy on Animal Program Engagement, Policy on Responsible Population Management, and Accreditation Standards related to animal care and welfare.

Please refer to the definition appendix above for more on how Programs are defined. Lastly, all Board-approved policies mentioned above regarding Animal Program Engagement and population management can be found on the AZA website linked below:

https://www.aza.org/board-approved-policies-and-position-statements?locale=en

I. Contraception and Reproductive Health

Reproductive management is essential to meeting genetic and demographicgoals and supporting long-term sustainability of populations in human care. The AZA Reproductive Management Center (RMC) can provide services related to contraception, and a variety of other reproductive challenges. If contraception is elected for animals designated as "DO NOT BREED", please visit the RMC Website at http://stlzoo.org/contraception and consult the SSP coordinator and the RMC at contraception@stlzoo.org for advice.

When contraception is used, please contribute these contraception data to the AZA RMC Contraception Database at www.zoocontraceptiondata.org. The AZA RMC Contraception Database contains thousands of records that are analyzed to continually update contraception recommendations on efficacy, dosing, frequency of administration, and reversibility for
a wide variety of animals. The RMC relies heavily on institutions to share information about their animals by contributing contraception data for their animals to our contraception database. The data collected include animal information (e.g. taxonomy, age, weight), contraceptive products used, doses, frequency and number of treatments used, implant removals, contraception outcomes (e.g. birth control failures, reversals, etc.), as well as behavioral and physical changes observed during use.

In addition, the Reproductive Health Surveillance Program (RHSP) conducts comprehensive pathologic examinations on reproductive tracts to detect deleterious effects associated with contraception or other reproductive management practices. The results of these analyses are shared with the RMC and provide important information about contraceptives that is incorporated in the Contraception Recommendations. If an animal of any taxa (male or female; contracepted or non-contracepted) dies or is permanently sterilized, please submit the reproductive tract tissues to the RHSP. There are several options for tissue submission. For the most up-to-date tissue submission instructions, please visit the RHSP webpage on the RMC's website at http://stlzoo.org/rhsp.

J. Introduction to Choloepus spp. Care

Sloth Species Survival Plan®

Foundational Guidance for Husbandry and Management of Choloepus spp. Sloths in Human Care

Deb Dial, Program Coordinator, Choloepus didactylus and Choloepus hoffmanni
with review, contributions and support from AZA sloth program leadership

Jenna Heinze CVT, Vice Coordinator, Hoffman's Two-toed Sloths (Choloepus hoffmanni)
Caroline Schleifer, Studbook Keeper, Hoffman's Two-toed Sloths (Choloepus hoffmanni)
Jennifer Hennessy, Vice Coordinator, Linne's Two-toed Sloths (Choloepus didactylus)
Davi Ann Norsworthy, Studbook Keeper, Linne's Two-toed Sloths (Choloepus didactylus)
Dr. Dominique Keller, DVM, Veterinarian Advisor for Choloepus didactylus & Choloepus hoffmanni
Adam Winegarden, Population Biologist for Choloepus didactylus & Choloepus hoffmanni

Introduction

Seven extant species of sloths from two genera—Bradypus (three-toed sloths) and Choloepus (two-toed sloths)—represent diphyletic lineages and differ substantially in anatomy, physiology, and husbandry needs. The genus Bradypus includes B. variegatus, B. tridactylus, B. torquatus, B. pygmaeus, and B. crinitus, while Choloepus comprises C. hoffmanni and C. didactylus. Molecular and paleontological evidence indicates that Bradypus and Choloepus diverged roughly 25–30 million years ago (estimates vary by published method, dataset, and fossil calibration). Traits shared by both genera like suspensory arboreality and slow movements reflect convergent evolution rather than a close relationship [1, 2].

Despite profound differences in evolutionary history, anatomy, physiology, behavior, and ecology, two- and three-toed sloths are often incorrectly generalized as the single term "sloths," resulting in assumptions that can negatively influence husbandry, veterinary care, and public perception. Recognizing information may be delivered overly generalized and incorrectly is essential for deciphering and promoting evidence-based husbandry and welfare-aligned management of Choloepus species.

This document synthesizes natural history, peer-reviewed literature, population-level experience, and husbandry considerations to support accurate, modern guidance for two-toed sloths (Choloepus didactylus and Choloepus hoffmanni) in AZA-accredited facilities.

Navigating Sloth Information

To ensure accuracy and avoid perpetuating outdated or generalized claims, it is essential to critically evaluate sloth-related information.

- Resources that do not explicitly identify the genus/species (and, when relevant, wild vs. managed care) should not be assumed to apply across both living sloth genera (Bradypus and Choloepus).

- When taxonomy is not specified, the information should be treated as indeterminate and not reliably attributable to either genus by default.
- Much of the publicly available information either refers primarily to three-toed sloths, blends both genera without distinction, or presents generalized statements that are not supported by current evidence.
- Reliable guidance should therefore prioritize sources that clearly define the species, population, and biological relevance of the claim.
- Unless otherwise stated, in this document, “sloths” refers specifically to two-toed sloths (*Choloepus* spp.).

Myths That Compromise Care

Myth 1: Sloths sleep 18–24 hours a day.

Truth: Published research demonstrates substantially shorter sleep durations. Choloepus spp. in managed care typically sleep 10–14 hours per day, with patterns influenced by temperature, activity levels, and diet [3, 4].

Impact: The misconception that sloths are motionless, inactive, and sleep all day can lead to undersized habitats and environments that fail to support natural movement, exploration, and behavioral expression.

Myth 2: Sloths defecate once a week.

Truth: Wild Choloepus typically defecate every 3–7 days, while intervals in managed care vary with diet, environment, hydration, and activity. In human care, reports of intervals can range from 2 to 7 days. Appropriate fecal scoring and confirmed animal health status by an experienced sloth veterinarian and an appropriate diet should always be considered [3].

Impact: Misinterpreting normal defecation intervals may lead to unnecessary diagnostics and even treatments based on the mistaken belief that typical patterns are abnormal.

Myth 3: Sloths do not bite.

Truth: Choloepus sloths possess powerful jaw musculature and sharp caniniform teeth capable of causing serious injury [2]. Although quantitative bite-force values have not been published, anatomical studies demonstrate jaw structures capable of rapid, forceful closure. Experienced sloth professionals consistently report significant defensive bites when animals are stressed, restrained, or improperly handled in case reports from zoological and rehabilitation settings.

Impact: Assuming sloths are harmless can lead to improper handling, increased risk for human safety, putting wild sloth counterparts in harm's way, and inappropriate animal–visitor interactions.

Myth 4: Sloth infants do not require prolonged maternal care.

Truth: Sloths exhibit an extended period of maternal dependency. Offspring typically remain with the mother for approximately 11–12 months, maintaining near-constant contact while nursing, thermoregulating, and acquiring essential skills. Sloths should NEVER be removed from mom unless a risk exists to the mother or baby that impacts overall welfare; they should stay together until natural separation.

Impact: Early maternal separation is not natural for either Choloepus or Bradypus and has been associated with compromised development, increased stress behaviors, poor weight gain, and reduced survival in both wild and managed care settings. Hand-reared individuals may exhibit altered behavioral repertoires, difficulty transitioning to appropriate food, missed developmental milestones, and long-term deficits in species-typical behaviors (rehabilitation records; clinical observations).

Taxonomy & Phylogeny

Choloepus spp. are managed by the Sloth Species Survival Plan® (SSP) within AZA facilities.

- Hoffmann’s two-toed sloth, Choloepus hoffmanni
- Linne’s two-toed sloth, Choloepus didactylus

Both species belong to Pilosa, suborder Folivora, within Xenarthra. Comparative studies confirm they are phylogenetically distinct from Bradypus, with shared traits resulting from convergent evolution [1, 2].

The lineage leading to modern two-toed sloths originated from extinct ground-dwelling forms prior to the evolution of their arboreal lifestyle. Molecular evidence indicates that C. didactylus and C. hoffmanni diverged approximately 6–7 million years ago.[1]

In the United States, populations in AZA-accredited facilities are currently skewed toward C. didactylus, largely due to significant imports from northern South America during the past decade [5].

Current husbandry guidance is generally applied across both Choloepus species, and no consistently demonstrated species-level differences are known to alter daily care recommendations at this time. However, species-specific differences remain under-studied; therefore, management should remain individualized and guided by behavioral, nutritional, and clinical monitoring.

Geographic Distribution & Habitat

Both species are primarily arboreal, relying on connected canopy and subcanopy structure for travel and access to resources. Two-toed sloths exhibit cathemeral activity, with short bouts distributed across the 24- hour cycle and substantial individual variation; activity patterns can shift with environmental conditions.

Sloths move for multiple functional reasons, including foraging, mate searching, thermoregulation, and accessing preferred canopy structures or resources. [8, 9].

Conservation Status

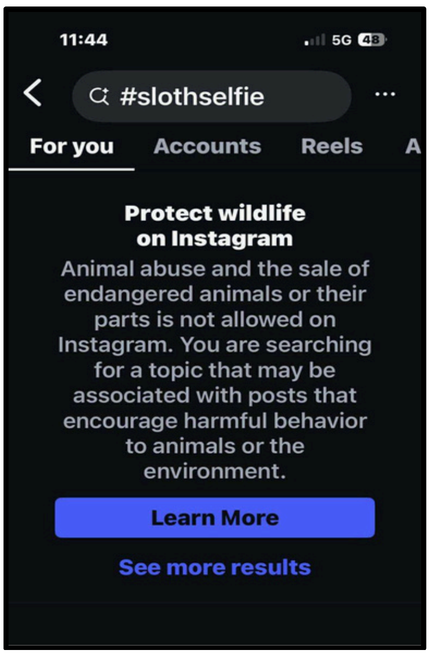
Sloths face threats from habitat loss, electrocution, road mortality, tourism, and pet-trade exploitation [1].

Until December 2025, both Choloepus species were listed by the International Union for Conservation of

Nature (IUCN) as Least Concern, a distinction reserved for species that are widespread with few threats to wild populations. At the end of 2025, both Choloepus species were granted CITES Appendix II status. This update provides a level of permitted oversight that ensures trade is monitored.

Between 2011 and 2021, >98% of live sloth imports into the United States were C. didactylus, approximately 97% sourced from Guyana [5]. Over this same ten-year period, 1,146 live sloths were imported into the United States.

Exploitation of sloths for wildlife selfie tourism has been documented as a wildlife-trafficking driver [10]. Efforts span over multiple countries to bring the spotlight to these exploitative practices and include well- known media campaigns and awareness initiatives like #StopSlothSelfies and the Wildlife Selfie Code.



Wildlife selfie tourism drives the exploitation and trafficking of sloths [10]. To combat these exploitative practices and raise awareness, efforts are underway across multiple countries. These initiatives include high-profile media campaigns and awareness drives, such as the #StopSlothSelfies campaign and the Wildlife Selfie Code. In 2017, social media giant Instagram® joined the large-scale effort by arming search engine results with responses to keywords like "sloth selfie" with an announcement that links those acts as harmful for wildlife.

Sloth Populations in Care

The Sloth SSP plays a key role in sloth welfare, public perception, and global sloth conservation. AZA facilities acquiring sloths are strongly encouraged to consult and coordinate with the Sloth Species Survival Plan® (SSP) prior to acquisition or transfer to ensure alignment with AZA standards, ethical sourcing, and population management goals.

Sloths entering AZA-accredited institutions should be acquired and transferred in coordination with the Sloth SSP and must meet the following criteria:

AZA Compliance

- Transfers must meet all applicable AZA standards and are expected to be supported by the Sloth SSP whenever possible.

Legal and Ethical Acquisition

- Animals must be obtained legally, ethically, and humanely.
- Animals must be transported safely and in accordance with all applicable welfare and transport regulations.
- Recipients of animals must be regulated to care for CITES Appendix II species.
- Exporting stations in home country must have ethical collection practices, be in good-standing with local and international governing agencies, and practice modern care focused on best welfare.

Age and Demographic Considerations

- Animals should be no younger than 12 months of age at the time of transfer.
- Infants and juveniles should not be separated from their dams for the purpose of transfer.
- Females should be confirmed as not pregnant by methods considered reasonable, like ultrasound, xray orlabwork, before shipping. Pregnant females should not be exported out of their home country.
- Ifan animal enters an AZA facility prior to 12 months of age, documentation must clearly demonstrate avalid, welfare-based reason for separation from the dam.

Documentation and Transparency

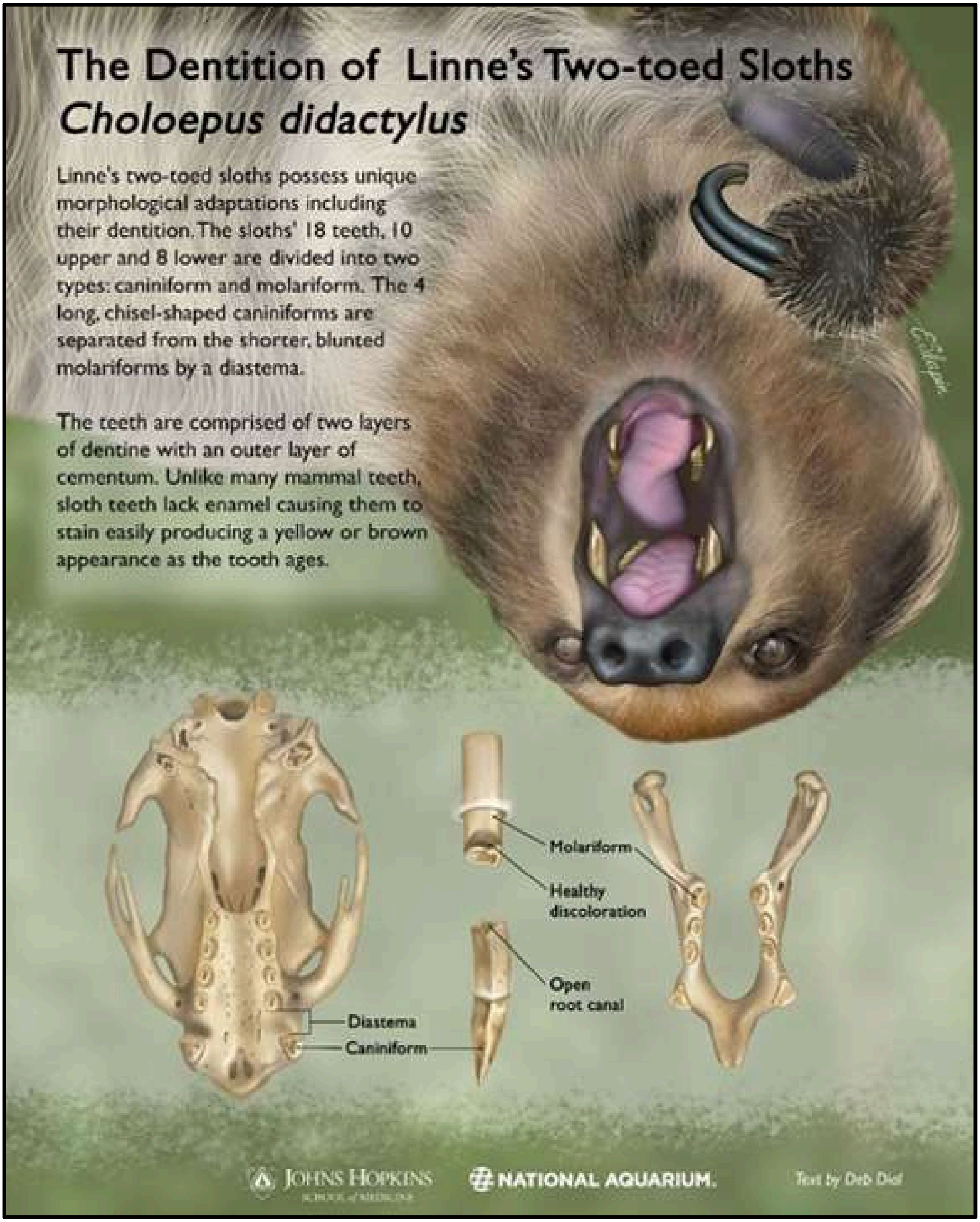
Complete records should accompany each animal, including:

- Country and facility of origin.
- Location/region of collection.
- Circumstances of care within the home-country institution.
- Rationale for international transfer.

Both Choloepus species are CITES APPENDIX II as of December 2025

SSP Engagement

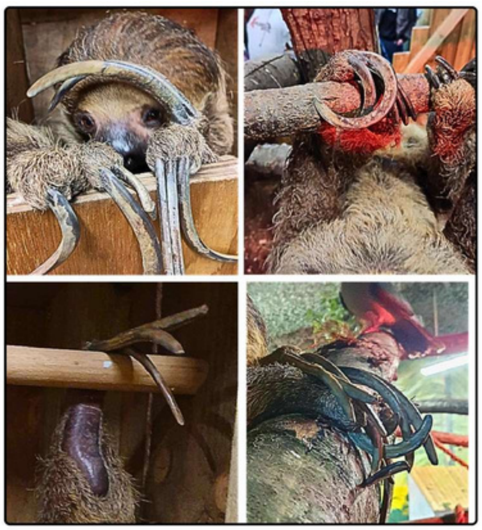
AZA facilities are strongly encouraged to engage the Sloth SSP early when considering acquisition, as the SSP team can assist in identifying appropriate, ethical sources that align with the greater population-management goals and responsible global stewardship.


The Dentition of Linne's Two-toed Sloths
Choloepus didactylus
Linne's two-toed sloths possess unique morphological adaptations including their dentition. The sloths' 18 teeth, 10 upper and 8 lower are divided into two types: caniniform and molariform. The 4 long, chisel-shaped caniniforms are separated from the shorter, blunted molariforms by a diastema.
The teeth are comprised of two layers of dentine with an outer layer of cementum. Unlike many mammal teeth, sloth teeth lack enamel causing them to stain easily producing a yellow or brown appearance as the tooth ages.
Molariform
Healthy discoloration
Open root canal
Diastema
Caniniform
JOHNS HOPKINS
NATIONAL AQUARIUM.

Dentition

Sloths have specialized dentition that reflects their unique evolutionary history. They have 18 hypsodont teeth—10 upper and 8 lower—divided into two functional types: chisel-shaped caniniforms and shorter, blunted molariforms. A distinct diastema separates the caniniforms from the molariform and the teeth grow continuously, sharpening against their opposing surfaces during mastication. Unlike Bradypus spp., Choloepus sloths are capable of delivering very effective bites. Both males and females also use their caniniforms to defend during courtship interactions, territory setting, or with predators.

Unlike most mammals, sloth teeth lack enamel entirely, consisting instead of dentin covered by cementum. This composition causes the teeth to stain naturally, giving them yellow to dark brown coloration that represents normal wear rather than disease.



Nail and Foot Health

Illustration by Emily Slapin Lufkin,ScientificContentbyDebDial

Photo credit: Sloth Browse Guide

Although nail and pad care is not unique in concept—many species require routine assessment of foot health—it is uniquely important in sloths because of their specialized suspensory anatomy and the constant reliance on their claws for support and locomotion. Overgrown nails can curl into the footpads and create wounds or snag on exhibit furniture. Recommended nail care tools include plier-style large canine nail clippers, which are effective for safe, controlled trimming in two-toed sloths. If using a rotary tool, consider the individual to determine if it is appropriate for the animal, as many sloths are averse to vibration.

Nails that are fractured or broken may not regrow or may regrow at odd angles. Proper habitat design and nail care can help prevent breaks from occurring. Sloth nails are more than “just a nail.” Each “finger” and “toe” is a phalanx bone. The phalanges are covered with a keratin sheath that extends further than the bone and creates the curve.

Healthy footpads should be shiny, without cracks or sores. This may serve as an external indicator of proper hydration, humidity, normal weight-bearing, and health.

Well-designed habitats with variable textures and natural perches of a proper diameter and humidity to encourage normal wear and health of nails and footpads.

- Support the limb and avoid excessive extension of joints.

Claw Management

- Evaluate each nail individually to assess nail length and curvature.
- Identify the natural arc and thickness of the nail.
- Note wear patterns and abnormalities if present.
- Trim incrementally, removing small amounts each time.
- If radiographs are unavailable to confirm the position of the distal phalanx:
  - Proceed conservatively.
  - Leave a generous safety margin to prevent exposure or trauma.
- Preserve the nail's original curvature and taper.
- Do not alter the functional hook shape required for climbing and suspension.

CHOLOEPUS NAIL CARE

NAIL CARE IS NOT UNIQUE FOR ANIMALS IN HUMAN CARE, AND MANY SPECIES REQUIRE ROUTINE ASSESSMENT OF NAIL, TOE, AND FOOTPAD HEALTH—BUT IT IS UNIQUELY IMPORTANT FOR SLOTHS.

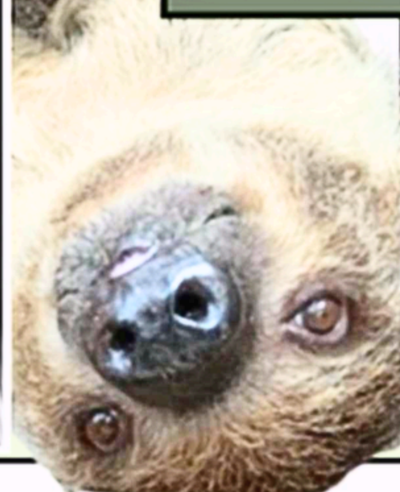
SLOTHS ARE BUILT TO HANG AND MOVE USING THEIR CLAWS, WHICH SUPPORT THEIR BODY WEIGHT DURING CLIMBING AND RESTING. HEALTHY CLAWS ALLOW THE TOES TO REMAIN PROPERLY ALIGNED AND PREVENT PRESSURE ON THE FOOTPADS.

CLAWS SHOULD BE MONITORED REGULARLY AND TRIMMED IF THEY BEGIN TO CURVE INWARD TOWARD THE FOOTPAD. OVERCURVED CLAWS CAN CATCH ON ENCLOSURE FURNISHINGS, COMPROMISE GRIP, OR INCREASE THE RISK OF FOOT INJURY DURING CLIMBING.

NAILS SHOULD WRAP AROUND NATURAL PERCHING, AND THE FOOTPAD SHOULD REST ON THE BRANCH. PERCHING SHOULD BE NO SMALLER THAN 3" IN DIAMETER TO PREVENT NAILS FROM PUNCTURING THEIR FOOTPADS.

EXCESSIVE CURVATURE OR ABNORMAL WEAR PATTERNS REQUIRE INTERVENTION. NAILS THAT ARE NOT MONITORED CLOSELY ARE VULNERABLE TO ENTANGLEMENT OR TRAUMA.

SOME NAILS ALLOW VISUAL IDENTIFICATION OF THE BONE DUE TO COLOR VARIATION.
THE AREA OVERLYING THE DISTAL PHALANX MAY APPEAR DARKER OR MORE OPAQUE, WHILE THE DISTAL KERATIN TIP IS OFTEN LIGHTER OR MORE TRANSLUCENT.



Anatomy & Physiology Quick Reference

- Choloepus have a basal metabolic rate (BMR) that is 40–60% of what is expected for similarly sized mammals [3]
- Behaviorally poikilothermic with body temperature dependent on environmental conditions [3]
- Sloths are non-ruminant, foregut fermenters with digestive rates dependent on several factors. Transit time may depend on temperature, fiber type, and diet [3, 11].

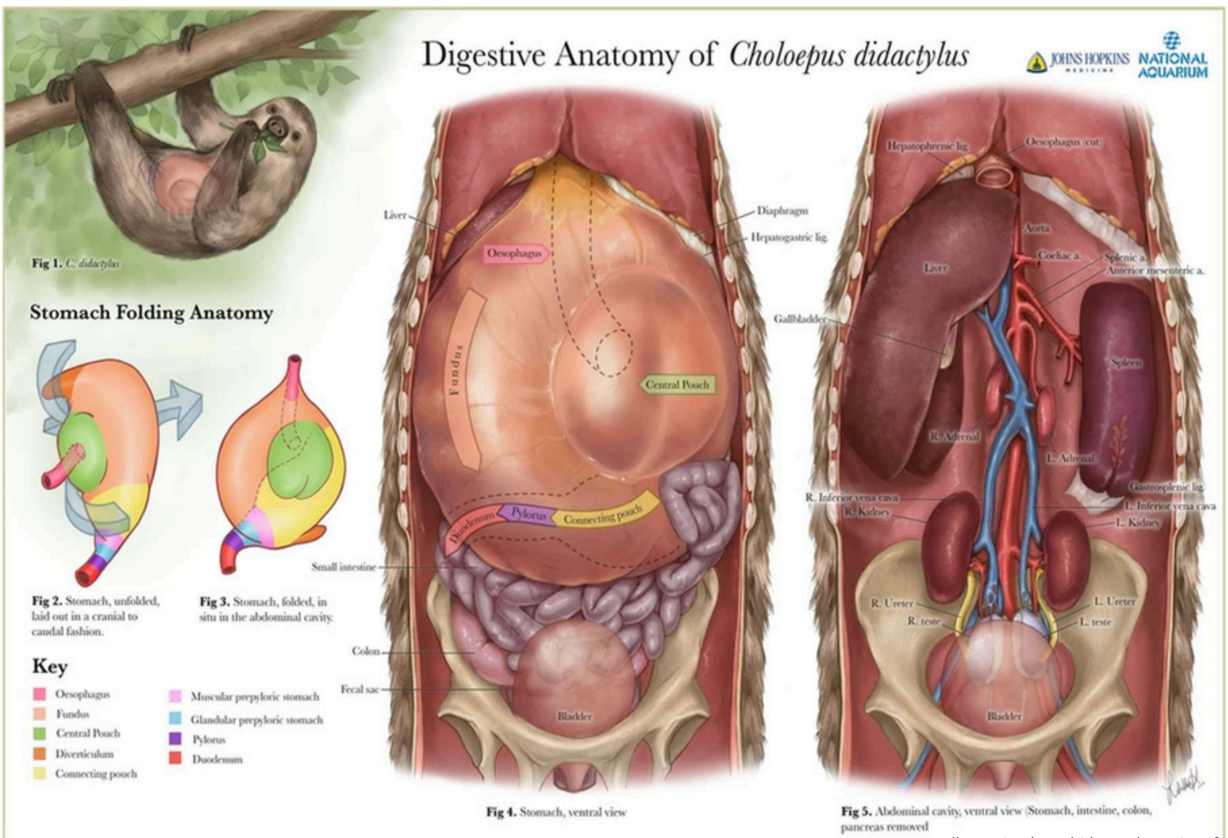


Illustration by Lohitha Kethu, Scientific Content by Deb Dial

Behavior & Social Structure

Choloepus are cathemeral. They are solitary except during maternal care or breeding [4]. In the wild, sloths spend most of the time suspended but in managed settings they move on the ground often.
Typical defecation intervals are 2–7 days, with significant mass loss each event [3]. Frequency alone is not diagnostic—stool quality and urine parameters are more meaningful.

Social compatibility varies. Females with adequate space may cohabit, while males must never be housed together. Harems (1.2) or same-sex female group, may be acceptable if each animal has ≥350 sq ft of traversable space [4]. Habitats should be perched so there are no dead ends and plenty of travel routes to avoid altercations.

Reproductive Biology

Sexual maturity may occur by 2–3 years. Gestation averages ~10 months (range 9–12) [3, 4]. Births occur year- round. Neonates cling effectively from birth.

Pregnancy is challenging to detect visually; ultrasound is required for confident assessment. Conception typically occurs 9.5–10.5 months before parturition [3].

Interbirth intervals vary from 17 to 28+ months, influenced by maternal care duration and estrus resumption [4].

Sexing: Males exhibit a raised perineal mound; females have slotted labial folds. Sex can be confirmed via visual exam or ultrasound [13]. Males have intraabdominal testes. You can also expose the penis by gently pushing back on the preputial skin.

Photo credit, contributions, and adaptations from Dr. Andres Brautigam, Deb Dial & Manual de Manejo, and Medicina y Rehabilitacion de Perezosos.

Health & Diet Considerations: Metastatic mineralization and sloths?

Mineralization with Choloepus is likely multifactorial, but there is evidence that at least one contributing factor can be addressed with proper nutrition. Ongoing research, published literature, and reviews of both historical and active medical cases in managed care consistently demonstrate that two-toed sloths (Choloepus spp.) have exceptionally low requirements for vitamin D, calcium, and phosphorus relative to most mammals. Within their natural range, Choloepus are primarily folivorous, consuming diets composed almost entirely of leaves and other plant material, with minimal exposure to calorie-dense or highly fortified foods such as fruit or animal matter.

Importantly, Choloepus are not inherently predisposed to metabolic or mineralization disorders. Rather, the medical conditions frequently observed in managed populations largely reflect mismatches between sloth physiology and human-constructed husbandry practices. When diets contain levels of vitamin D, calcium, phosphorus, protein, or carbohydrates that exceed their physiology can accommodate, sloths are placed at risk for preventable disease processes.

Vitamin D, calcium, and phosphorus are especially elevated in commercial primate diets, dog foods, eggs, dairy products, and other fortified prepared feeds. Chronic overexposure to these nutrients can result in abnormal mineral deposition within soft tissues, disruption of normal organ architecture and metabolic function, and progression to organ failure. Renal disease, cardiovascular pathology, and gastrointestinal complications are among the most frequently documented sequelae associated with excess vitamin D, calcium, and phosphorus intake. Additionally, diets high in carbohydrates can adversely alter normal gastrointestinal microflora, impairing digestion and nutrient absorption.

Thermal and environmental management further intersect with nutrition and metabolism. Sloths exhibit poikilothermic tendencies, relying on external temperature and humidity to regulate metabolic processes. Housing conditions that fall outside species-appropriate thermal and humidity ranges can further impair digestion, nutrient utilization, and overall physiologic stability.

Taken together, these characteristics are best understood not as abnormalities, but as evolutionarily appropriate adaptations to a low-energy, folivorous lifestyle. In this context, sloths may be conceptually compared to species with highly specialized metabolic strategies—such as reptiles and ruminants—where deviations from biologically aligned husbandry, rather than intrinsic fragility, are the primary drivers of disease.

Recommended Actions for Proper Sloth Nutrition

1. Review diets to identify components that are:
   a. High in vitamin D, calcium and phosphorus b. High in carbohydrates and protein
2. Review husbandry parameters and aim to provide parameters within the USDA and SoS recommendations hoffmans for temperature and humidity. (https://usbiotechnologyregulation.mrp.usda.gov/sites/default/files/housing-two-toed-sloths.pdf)
3. Consider anesthetized exams of sloths to collect blood and perform diagnostic imaging to evaluate current medical status.
4. Always provide water, ideally running water.

Nutrition

Early diet recommendations borrowed from primates and dogs are now obsolete. Wild-born animals, especially those from highly trafficked countries like Guyana, may have already received foods like rice in a mash to keep the animals "full" until they are exported. These animals have traditionally had poor health outcomes long-term.

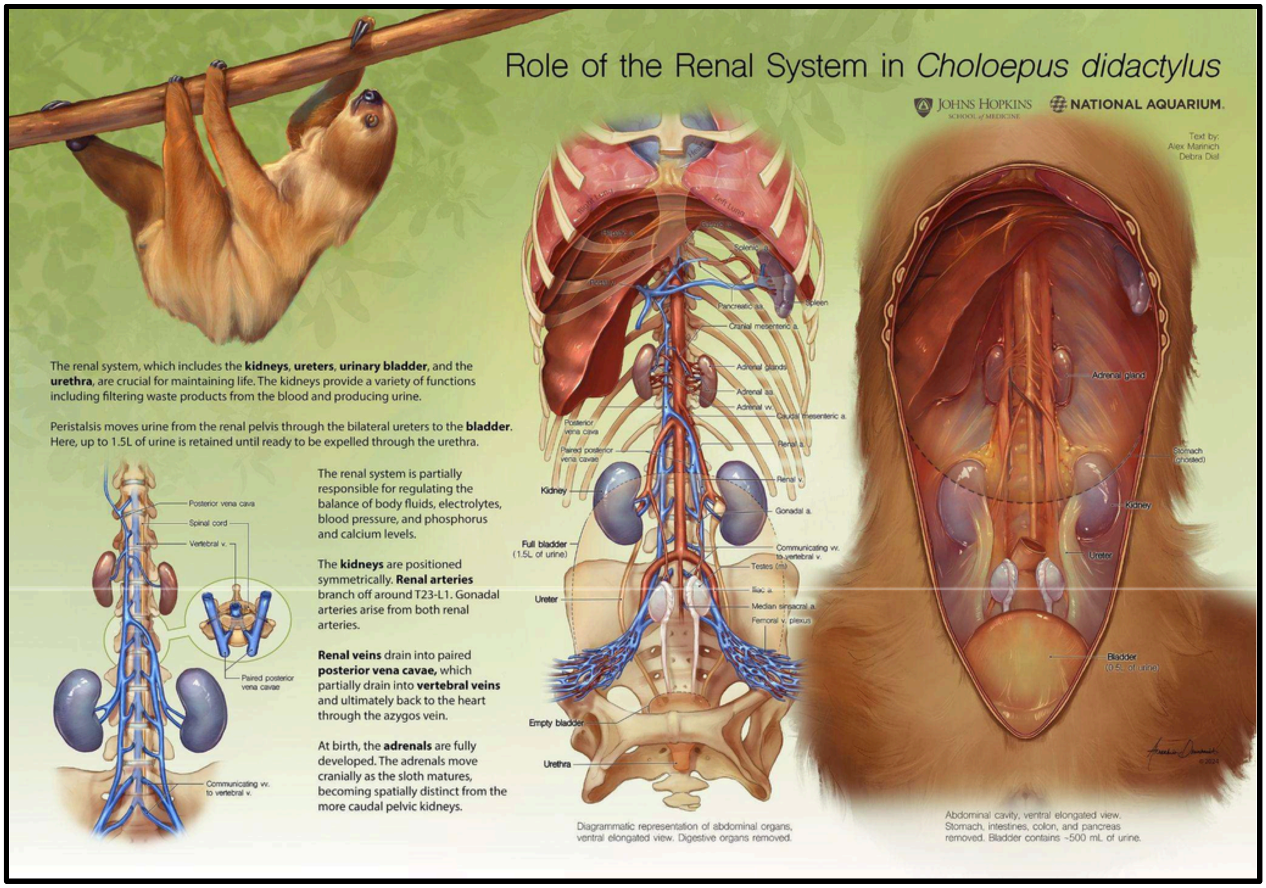
Modern evidence supports excluding:

- All primate diets (leaf-eater biscuits, canned diets, gels)
- Dog/cat food
- Eggs, dairy
- Starches and grains (rice, oats)
- Fruits (including "low-sugar" fruits)
- Sweet potatoes and other high-carbohydrate items

Choloepus have low requirements for vitamin D, calcium, and phosphorus. Oversupply predisposes to:

- Renal compromise
- Cardiovascular mineralization
- GI disruption
- Foregut dysbiosis [3, 11]

Illustration by Alexandria Dannhardt, Scientific Content by Alex Marinch and Deb Dial



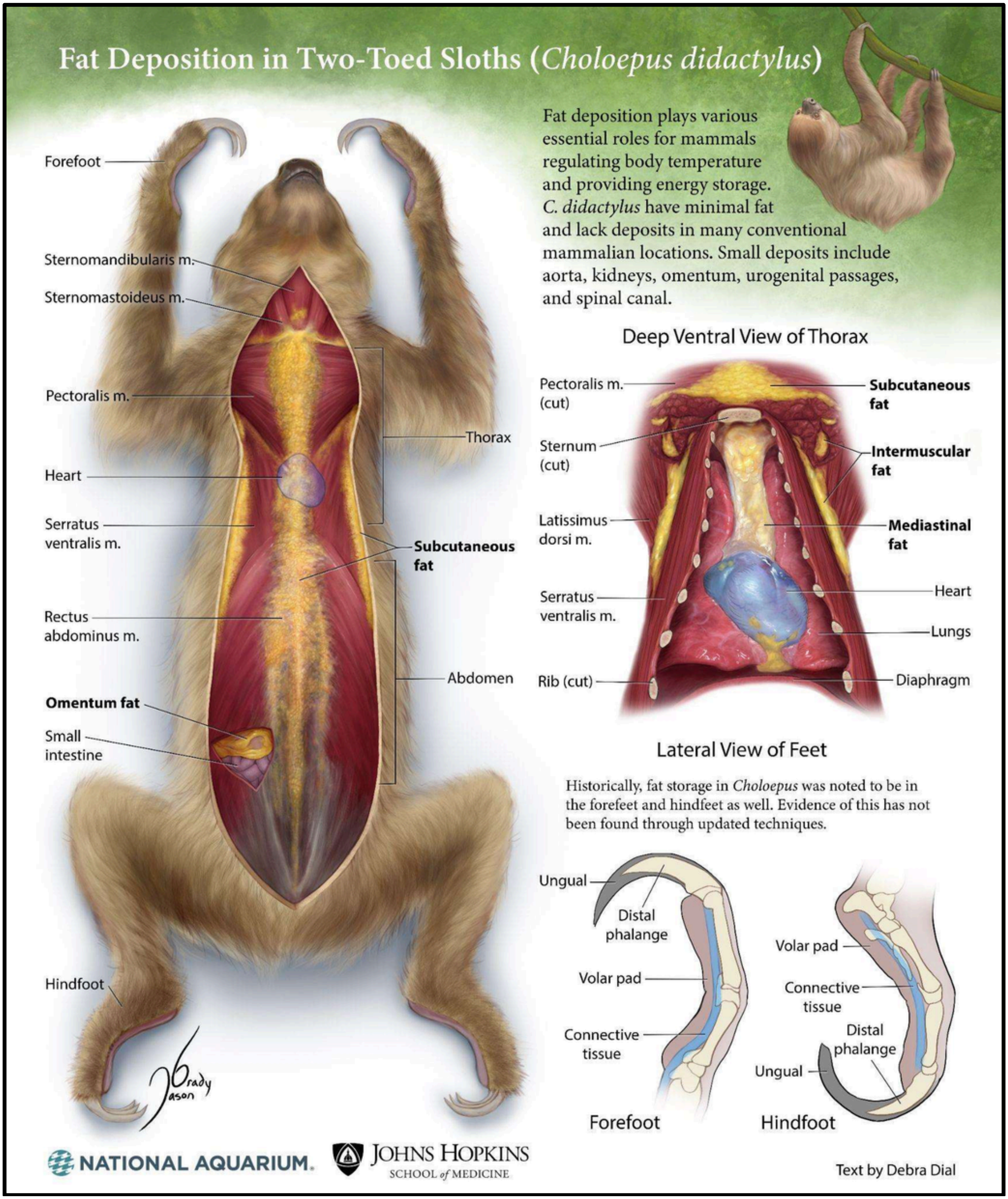


Illustration by Jason Brady, Scientific Content by Deb Dial

Body Condition & Weight

Choloepus have minimal fat deposition; traditional mammalian body condition scores are inappropriate.

Weight must be interpreted as part of long-term trends and taken post-urination/defecation and pre-feeding. Large changes in weight may represent muscle wasting. Muscle wasting is associated with many processes but it is not uncommon to be the first noticeable symptom in renal disease or metabolic imbalance, both conditions common for sloths in human care.

Habitat & Environmental Management

Habitat design profoundly influences welfare. Key requirements include:

- Sloths require no less than 350 sq. ft. of traversable space per adult.
- Sloths prefer running or dripping water whenever possible but at minimum always provide clean, drinkable water.
- Natural and varied perching ≥3 inches diameter allowing for easy travel at various levels of the habitat from ceiling to floor.
- Use only minimal amounts of rope (<10% of total; never <3 in diameter).
- 75–84°F thermal gradient with distinct warm/cool zones. Animals must be able to rest appropriately in each zone to support self-regulation of processes like digestion with environmental temperatures.
- 60–80% humidity – misters are a good addition to help achieve appropriate humidity levels.
- Areas offering shade from sun or overhead lights, as well as an area to move out of public view should they choose.
- Elevated rest areas, natural substrates such as cypress mulch or clean soil without additives like vermiculite are good choices, and live plants.
- Never use artificial plants in a sloths reach or unstable props. Sloths have suffered obstructions from eating artificial plants or eating pieces of props not secured.
- Avoid sensory conditions such as heavy vibrations, flashy lights or overly loud areas.
- Fabrics or towels should only be used in specific scenarios like when raising young or in medical cases. Sloths have suffered obstructions and complications from eating fabric, towel threads and stuffed animals.

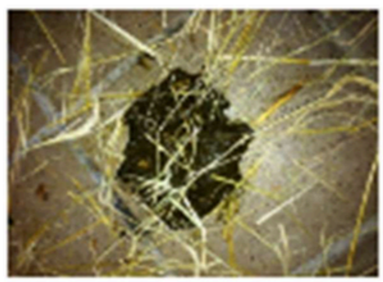
These elements support digestion, thermal stability and potentially provide stress reduction.

Sloth Fecal Microbiota Transfaunation (FMT)

Fecal Microbiota Transfaunation (FMT) is a tool for managing gastrointestinal dysbiosis and is used in some zoological species as well as domestic species. While widely studied in other applications like humans and domestics, its application in sloths is preliminary.

In sloths, dysbiosis may present as altered fecal frequency, consistency and dehydration often linked to diet, illness, stress, or human-care-associated microbiome shifts. FMT may be considered when structural or infectious causes are ruled out, but optimal dosing, donor criteria, and long-term outcomes remain unknown.

FMT should be undertaken only under veterinary supervision with appropriate welfare and biosafety protocols. Donor fecal evaluation should be rigorous to ensure the donor candidate's feces is appropriate. Continued data collection is needed to develop species-specific guidelines.

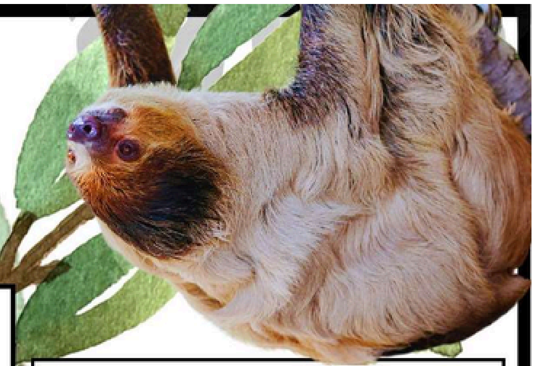
Sloth Fecal Condition Scoring Guide	
Score 1 – deer pellets 	Score 2 – formed, but less pelleted 
Score 3 – Some parts not pelleted 	Score 4 – Formed, minimal pelleting 
Score 5 – Unformed, minimal pelleting 	Score 6 – Unformed, soft 
Score 7 – Diarrhea, no texture 	

Fecal scoring by Heidi Bissell

CHOLOEPUS SLOTH QUICK CARE GUIDE

TRANSFAUNATION

EXAMPLE FMT SOP



Standard Operating Procedure: Fecal Microbiota Transplant for Choloepus Sloths (example)

SOP No.: FMT-ChDid-001
Version: 1.0
Effective Date: [Insert Date]
Prepared by: [Insert Name]
Reviewed by:
[Veterinary Services/Nutrition Science]
Approved by: [
Curator / Animal Health Manager]

Fecal microbiota transplantation (FMT) is an emerging tool in veterinary and zoological medicine that aims to restore or rebalance the gastrointestinal microbiome by transferring fecal material from a healthy donor to a recipient. While FMT has been extensively studied in humans and select domestic species, its application in exotic taxa, particularly in Choloepus sloths, remains largely experimental and not yet well researched.

In sloths, gastrointestinal dysbiosis may manifest as changes in fecal frequency, consistency, or microbial diversity, potentially linked to diet, stress, or human care-related microbiome shifts. FMT offers a promising, low-risk intervention when conventional diagnostics reveal no structural or infectious cause for gut disturbance. However, the procedure's efficacy, optimal dosing, and long-term impacts in Choloepus remain to be systematically evaluated.

The use of FMT in this context should therefore be considered an experimental supportive therapy, guided by veterinary oversight and performed in accordance with established welfare and biosafety standards used with other species. Continued data collection and microbiome analysis from such cases are essential to develop species-specific guidelines for Choloepus sloths and other folivorous mammals under professional care

Authorship Statement

This standard operating procedure was developed and formatted by SoS through the synthesis of current literature on fecal microbiota transplantation (FMT) in wildlife, companion, and exotic species.

The protocol integrates and summarizes findings from multiple peer-reviewed sources, including Thacher et al. (2023), Blyton et al. (2019), and related comparative studies to guide husbandry-level application of FMT in Choloepus.

This document does not/should not replace care from an experienced and licensed animal health professional.

6.5 Criteria for Success

A. Return to normal stool frequency and form.

B. Improved microbial diversity.

C. Stable health indicators.

7. Safety & Welfare

Only use in clinically stable individuals. Handle samples under biosafety level 2 precautions. Avoid cross-contmination

8. Recordkeeping

Maintain records for donor ID, prep dates, treatment schedule, fecal monitoring, and long-term outcomes

9. Troubleshooting

GI upset
Recipient rejects FMT diet
No improvement
Recurrence

1/3. WWW.SCIENCEOFSLOTHS.ORG EDUCATED ZOOKEEPER LLC CONNECT WITH US

Deb Dial

Standard Operating Procedure (SOP): Example
Fecal Microbiota Transplant (FMT) in Choloepus Sloths

1. Purpose

To describe standardized procedures for the collection, preparation, administration, and monitoring of fecal microbiota transplants (FMTs) for the treatment of gastrointestinal dysbiosis or abnormal fecal consistency in Choloepus didactylus under managed care, following the methodology of Thacher et al. (2023).

2. Scope

This SOP applies to all staff involved in the animal care, veterinary, or nutrition programs for sloths undergoing FMT. It is intended for non-invasive, prophylactic, or therapeutic use in clinically stable animals presenting with altered stool frequency, consistency, or suspected gut microbiome imbalance.

3. Definitions

FMT: Transfer of processed fecal matter from a healthy donor to a recipient's gastrointestinal tract to restore normal microbiota.
Donor: Clinically healthy conspecific sloth.
Recipient: Sloth exhibiting gastrointestinal dysbiosis or abnormal stooling.

4. Responsibilities

Role	Responsibility
Veterinarian	Approves donor selection, oversees screening, and authorizes FMT treatment.
Nutrition Staff	Prepares FMT material and creates gel or capsules for delivery.
Animal Care Team	Collects fecal samples, administers FMTs, and monitors behavior and fecal output.
Curator	Ensures compliance with welfare and research policies, and manages the process

5. Materials & Equipment

PPE, sterile containers, -80°C freezer, grinder or blender, gelatin capsules, gel diet base, freeze-dryer, desiccator, analytical balance, sterile tools, and recordkeeping forms.

6. Procedure

Includes donor selection, sample preparation, FMT administration schedule, and monitoring.

6.1 Donor Selection

Select healthy donor with normal stool, perform fecal screening for parasites, and confirm no antibiotic

6.2 Sample Collection and Preparation

Collect fresh feces, freeze at -80°C, freeze-dry and grind for capsule prep, or mix in gel diet for slurry

6.3 Administration Schedule

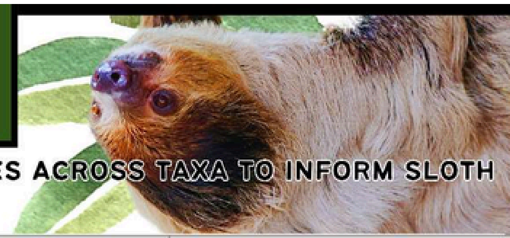
Administer orally via gel diet or capsule.

Administration should be planned in multiple rounds of consecutive days. Exact duration must be determined on an individual basis with veterinary and husbandry teams. Transfaunation is a process which is lengthy and after the initial rounds, it is likely to continue for months following, while a healthy microbiome is established.

6.4 Monitoring and Data Collection

Track fecal frequency, consistency, and behavior. Collect samples pre-, during, and post-FMT for fecal analysis if possible.

Fecal Microbiota Transplant (FMT) Dosage Rationale for Choloepus Sloths



The rationale below compares typical dose ranges across taxa to inform sloth applications.

Species/Context	Typical Dose Range	Delivery Route	Key Reference
Canine/Feline (oral capsules)	250–500 mg freeze-dried feces per capsule	10–13 oral capsules/day 5–10 days)	Sayusn et al., 2022, Front Vet Sci
Equine/large mammal (slurry)	0.5–1 g feces/kg BW suspended in saline	Rectal	Schoster et al., 2018, Vet Microbiol
Koala (folivorous marsupial)	~1–2 g wet feces/day	Rectal Oral	Blyton et al., 2019, Animal Microbiome
Lemur (primate transfaunation)	0.5–1 g feces/kg BW suspended in saline	Inoculation Oral	Bombusch et al., 2021, Animal Microbiome
Two-Toed Sloth (Choloepus didactylus)	~1–2 g wet feces/day 0.5–1 g freeze-dried feces per treatment	Oral gel cube or capsule	Inferred + Thacher et al., 2023

Potential starting dose Range for Sloth FMT:

For Choloepus (average adult 4–8 kg), start with 0.5 g freeze-dried donor feces (~5 g wet weight) daily for multi-day courses (4–14 days as per Thacher et al. 2023). Increase gradually only under veterinary oversight. Given the sloth's slow metabolism and gut transit time, conservative Dosing supports microbial engraftment while minimizing digestive stress.

The dose recommendations in this document are meant as a starting point, & all protocols must be created and maintained by experienced veterinary staff & husbandry teams.

Authorship Statement

This standard operating procedure was developed and formatted by SoS through the synthesis of current literature on fecal microbiota transplantation (FMT) in wildlife, companion, and exotic species.

The protocol integrates and summarizes findings from multiple peer-reviewed sources, including Thacher et al. (2023), Blyton et al. (2019), and related comparative studies to guide husbandry-level application of FMT in Choloepus.

This document does not/should not replace care from an experienced and licensed animal health professional.

Thacher, P.R., Kendrick, E.L., Maslanka, M., Muletz-Wolz, C.R., & Bornbusch, S.L. (2023). Fecal microbiota transplants modulate the gut microbiome of a two-toed sloth (Choloepus didactylus). Zoo Biology, 1–6. https://doi.org/10.1002/zoo.21751

Blyton, M.D.J. et al. (2019). Faecal inoculations the gastrointestinal microbiome and allow dietary expansion in a wild specialist herbivore, the koala. Animal Microbiome, 1(1), 6.

Bornbusch, S.L. et al. (2021). Antibiotics and fecal transfaunation differentially affect microbiota recovery in lemur guts. Animal Microbiome, 3(1), 65.

differentially affect microbiota recovery in lemur guts. Animal Microbiome, 3(1), 65.

Sung, J.Y. et al. (2022). Canine fecal microbiota transplantation: Current application and future prospects. Frontiers in Veterinary Science, 9:941325.

Schoster, A. et al. (2018). Fecal microbiota transplantation in horses: Current evidence and future perspectives. Veterinary Microbiology, 223, 6–12.

Illustration by Ann Siegler, Scientific content by Ellie Yaunke and Deb Dial

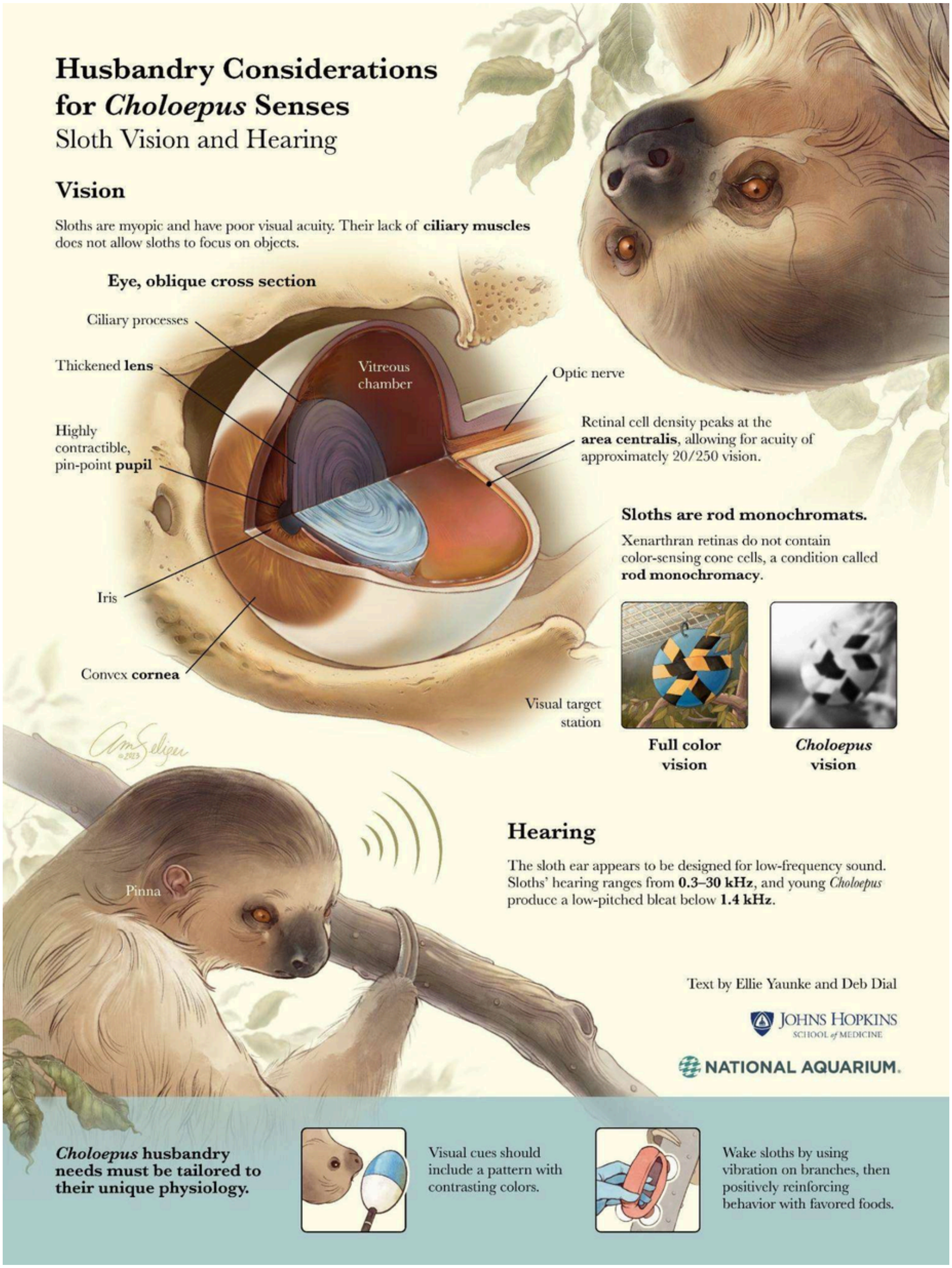


Illustration by Monal Chang, Scientific Content by Dr Aimee Berliner and Deb Dial

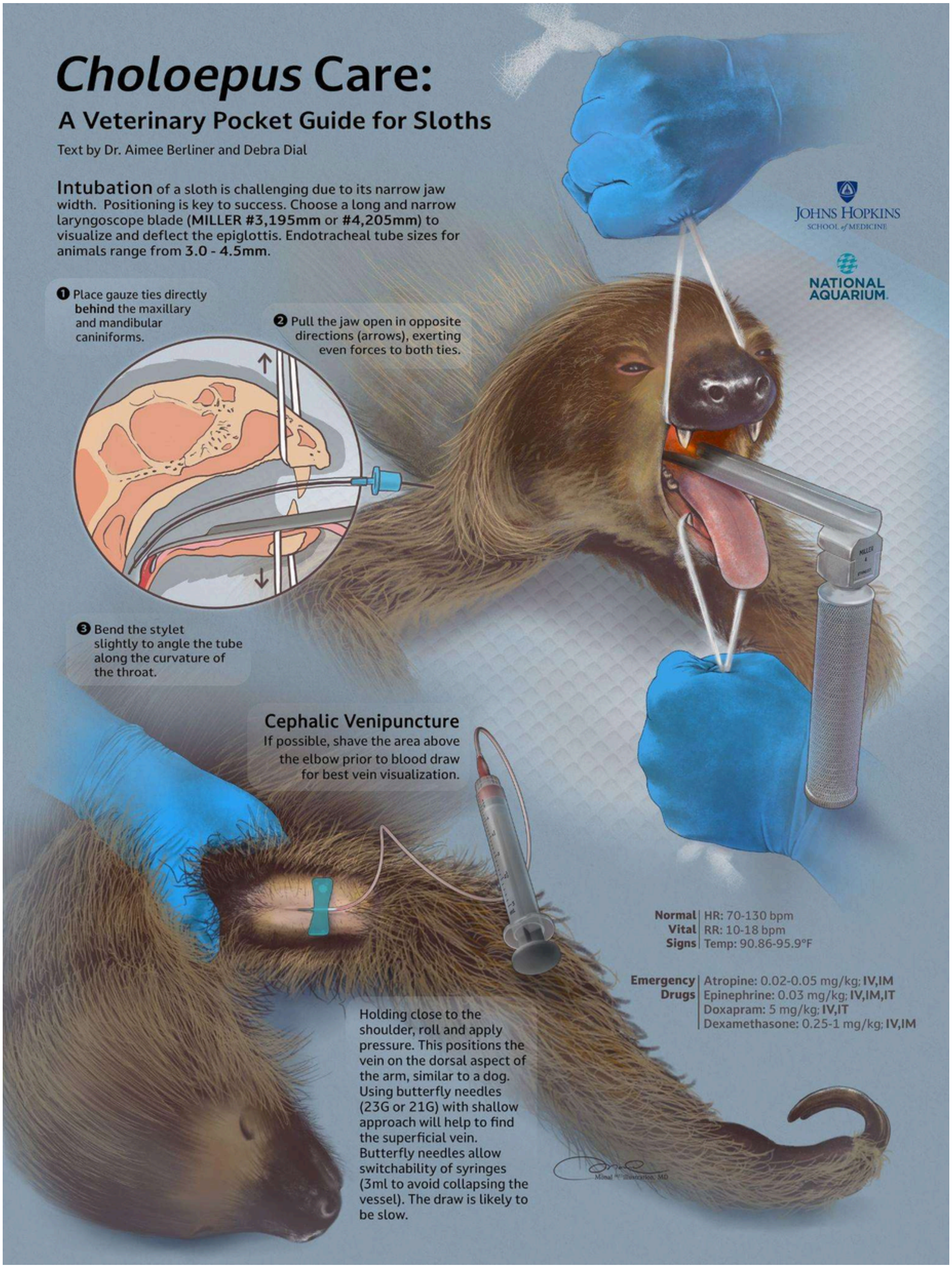


Illustration by Rose Perry, Scientific Content by Deb Dial

Find updated AZA Sloth information at https://www.scienceofsloths.org/azaslothprograms.

Scientific Illustrations

Choloepus Dentition,illustration by Emily Slapin Lufkin, scientific content by Deb Dial

Role of the Renal system, illustrated by Alexandra Dannhardt, scientific content and text by Alex Marinich and Deb Dial

Fat Deposition, illustrated by Jason Brady, Scientific content and text by Deb Dial

Husbandry Considerations or Choloepus Senses: Sloth Vision and Hearing, Illustrated by Ann Siegler, Scientific content by
Ellie Yaunke and Deb Dial

A Veterinary Pocket Guide for Sloths, illustrated by Monal Chang, Scientific Content by Dr Aimee Berliner and Deb Dial

The First Year of Development in Choloepus didactylus, illustrated by Rose Perry, scientific content and text by Deb Dial

References

[1] Hautier,L., Rodrigues, H., Billet, G., & Asher, R. J. (2016). The hidden teeth: Sloths' evolutionary strategies and dental simplification. Scientific Reports, 6, 27763.

[2] Naples, V. (1986). Morphology and function of the hyoid region in tree sloths. Journal of Morphology, 187, 91–104.

[3] Gilmore, D., Da-Costa, C., & Duarte, D. (2008). Sloth biology overview. In Vizcaíno & Loughry (Eds.), The Biology of the Xenarthra.

4] Taube, E., Keravec, J., Vié, J-C., & Duplantier, J-M. (2008). Reproduction and neonatal development in Choloepus. In The Biology of the Xenarthra.

[5] USFWS Import Data (2011–2021). Live Sloth Import Records.

[6] Hayssen, V. (2009). Choloepus hoffmanni. Mammalian Species, 827, 1–7.

[7] Moraes-Barros, N. & Arteaga, M. (2015). Distribution & phylogeography of sloths. In Handbook of Mammals of the World, Vol. 2.

[8] Pauli, T., Barmes, L., & Duarte, M. (2023). Behavior and activity budgets of two sympatric sloths. Journal of Zoology, 320(2), 108–118.

[9] Montgomery, G. & Sunquist, M. (1978). Habitat selection and use by two- and three-toed sloths. In Ecology of Arboreal Folivores. Smithsonian Press.

[10] Mongabay (2025). Sloth-selfie tourism and trafficking trends in South America.

[11] Wendt, E. et al. (2015). Gastrointestinal transit and digestive performance in two-toed sloths.

[12] Hayssen, V. (2010). Choloepus didactylus. Mammalian Species, 42(868), 77–86.

[13] Dial, D. (2019). Two-toed Sloths: Ten Years of Husbandry & Management. Animal Keepers' Forum, 46(6), 148–157.

[14] Dial, D. (2023–2025). Science of Sloths: Comprehensive Husbandry Guidance. The Educated Zookeeper LLC.