Population Analysis & Breeding and Transfer Plan

Pygmy Slow Loris (*Nycticebus pygmaeus*) AZA Species Survival Plan® Provisional Program

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19 February 2025

PMC Population Management Center

LINCOLN PARK ZOO

ASSOCIATION OF ZOOS & AQUARIUMS

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Acknowledgments

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Cover photo courtesy of David Haring, Duke Lemur Center

This plan was prepared and distributed with the assistance of Planning Coordinator, PMCTrack Coordinator, and Program Assistant at the AZA Population Management Center.
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Species Survival Plan

PMC TRACK

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Description of Population Status

Introduction: The pygmy slow loris (*Nycticebus pygmaeus*) is a nocturnal, arboreal species of slow loris endemic to Vietnam, Laos, eastern Cambodia, and China. In the wild, pygmy slow loris are largely threatened by habitat loss and the species has been afforded the highest level of protection by CITES (Appendix I) to combat overexploitation. The current SSP population consists of 46 animals distributed among 19 AZA facilities (Table 1). Under AZA's current sustainability designations, this Animal Program qualifies as a Provisional SSP. The Prosimian Taxon Advisory Group in their 2024 Regional Collection Plan (RCP) have designated this population with a commitment population trend of increasing. A target population size of 55 was developed with the Coordinator and Population Advisor to set population goals for this plan.

Analytical Assumptions and Exclusions: The pedigree of this population is 96.9% known before assumptions and exclusions (For clarification on known vs. certain, see Appendix F). A total of five animals have been excluded from the potentially breeding population (Appendix B). Following assumptions and exclusions, the pedigree is 100% known (100% certain). The potentially breeding population consists of 41 animals (Table 1).

Demography: This SSP species first appeared in AZA facilities in 1968 when a single male was confiscated and transferred to the Honolulu Zoo. From 1968 – 1986, the population size remained low, never exceeding four individuals, and the Honolulu Zoo remained the only holding institution. The current SSP population was founded in 1987 when the San Diego Zoo, Duke Lemur Center, and Cincinnati Zoo imported 29 individuals from Sweden. The first recorded births occurred in 1988 at all three facilities that worked to import animals. The population steadily grew to a peak of 76 individuals by 2011 (Figure 1). This growth can largely be attributed to successful breeding and secondly to a small number of continued imports. Since 2012, the population has experienced a notable decline in size primarily due to insufficient reproduction. The reasons for this low, inconsistent reproduction in recent years are currently unclear, but may be associated with husbandry, particularly diet. However, the population has shown growth over the last five years again and there are enough births to offset deaths in the population. The population has increased on average over the past five years by 1.8%

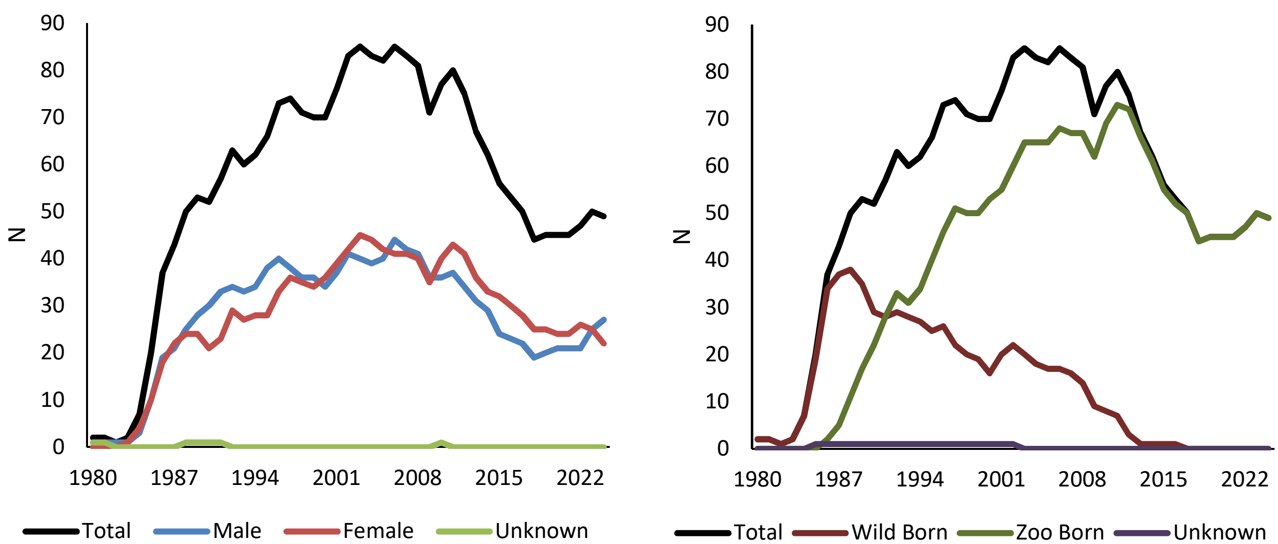


Figure 1: Census of Pygmy Slow Loris SSP from 1980 to 2024 by sex (left) and birth type (right).

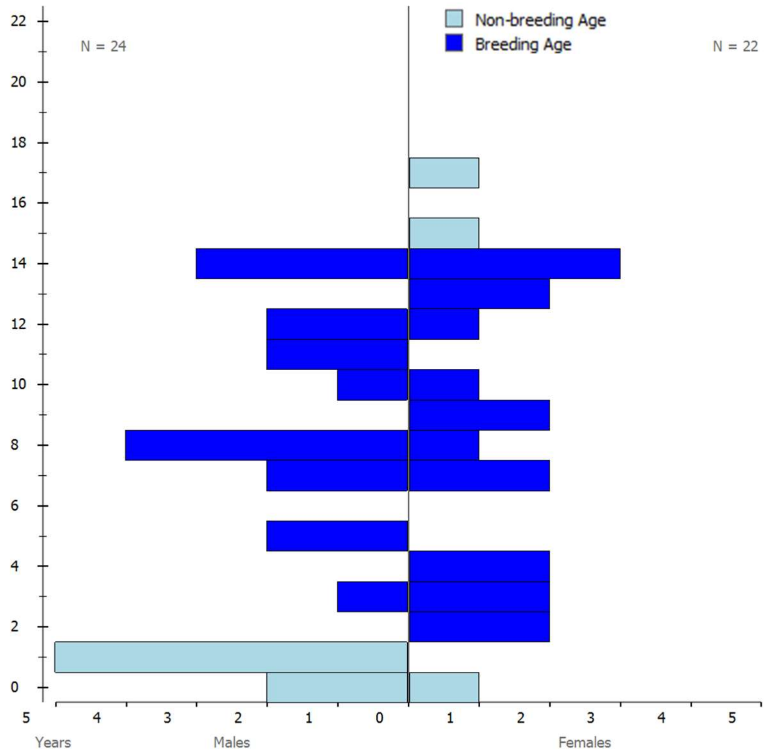


Figure 2: Age distribution of the total population of the Pygmy Slow Loris SSP.

The age structure illustrates the number of males and females in each age class (Figure 2). Based on its current age structure and growth rate, if the population continues on its current trajectory, this population has the potential to remain stable over time (Table 1).

Table 1: Demographic status of the Pygmy Slow Loris SSP population according to studbook data.

Demography Summary		
Current size of SSP population (N) – Total (Males.Females.Unknown Sex)	46 (24.22.0)	
Number of individuals excluded from genetic analyses	5 (0.5.0)	
Population size following exclusions	41 (24.17.0)	
Target population size (Kt) derived in planning meeting	55	
Mean generation time (T, years)	7.0	
Population growth rates (λ; lambda)*: Life Table / 5-year / Projected	0.998 / 1.018 / 0.903 <> 0.964 <> 1.007	
Percentage (%) of living population produced ex situ	100	
Number of participating facilities	19	
Survival/Mortality	**Males**	**Females**
Observed first year mortality rate (Q_x)	0.466	0.438
Median life expectancy (MLE), excluding first year mortalities (years) **	12.4	
Observed maximum longevity (years)	21	20
Reproduction		
Observed reproductive age range	1.7 - 16	1.6 - 14
Gestation time (days)	182	
Median litter size hatched	2	

* Life table (AZA: 1 Jan 1987 – 15 Dec 2023); 5-year from studbook census; Projected from PMx stochastic 20-year projections
**Calculated from Descriptive Survival Analysis Report in PopLink. See table in Appendix C for AZA Survival Statistics Library link.

Genetics: Genetic values are calculated after incorporating pedigree assumptions and removing excluded individuals. Analysis of the studbook indicates that this SSP is descended from 30 founders with no potential founders remaining (Figure 3, Table 2). The gene diversity of the population is 92%. Based on current founder representations, gene diversity is equivalent to that found in approximately six founders. The current mean kinship in the population is 0.0799; first-cousins have a kinship of 0.0625, which means that the average relationship in the population is slightly closer than that of non-inbred first-cousins.

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 Pygmy Slow Loris SSP population.

Genetics Summary*						
	2017	**2019**	**2021**	**2023**	**2025****	**Potential**
Founders	30	28	28	30	30	0
Founder genome equivalents (FGE)	8.44	6.99	6.80	6.57	6.26	10.35
Gene diversity (GD %)	94.08	92.85	92.65	92.39	92.01	95.17
Population mean kinship (MK)	0.0457	0.0592	0.0715	0.0735	0.0799	--
Mean inbreeding (F)	0.0000	0.0015	0.0048	0.0073	0.0097	--
Effective population size relative to population size (N_e/N)	0.40	0.4678	0.4344	0.4915	0.4683	--
Percentage of pedigree known before / after assumptions and exclusions (%)	98 / 100	98.6 / 100	98.6 / 100	96.6 / 100	96.9 / 100	--

*Genetic statistics may not be comparable across years due to changes in software and parameters used for projections from year to year.
**Pedigree assumptions were created for this population and may over- or under-estimate genetic statistics shown in this table.

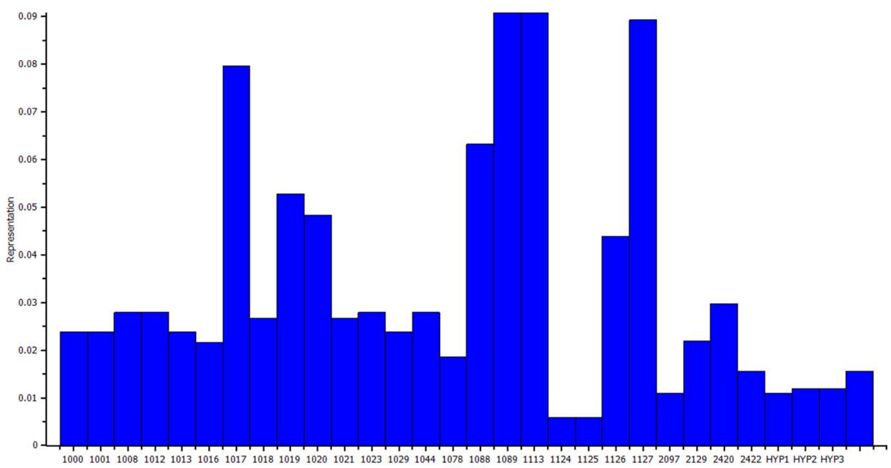


Figure 3: Founder representation distribution of the analytical Pygmy Slow Loris SSP population.

Based on current population parameters, gene diversity is projected to decline to 66% over the next 100 years if the current population grows to the recommended target size of 55 (Table 3, Scenario a). The most effective ways this population can maintain more gene diversity are to have an increasing growth rate (vs. stable) and a larger long-term population size. The effective population size is high and is helping to maintain gene diversity in this population.

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*. All additional scenarios represent exploratory scenarios for different target sizes/imports or other scenarios desired by PL and PB.

Scenario Descriptions	Lambda	Ne/N	Max Allowable Population Size	Years to Reach Genetic Goal	GD Maintained (%)
a. Maintain 90% GD for 100 years	1.000	0.4683	TPS from meeting (55)	6	65.8
b. Maintain 10% GD loss (82.0%) for 100 years	1.000	0.4683	TPS from meeting (55)	34	65.8
c. Maintain 90% GD for 70 years (10 generations)	1.000	0.4683	TPS from meeting (55)	6	72.7
d. Maintain 90% GD for 70 years with higher growth rates and long-term target size	1.020	0.4683	70	6	78.0

*Starting population (N) = 46; Generation time (T) = 7.0; current GD = 91.98.

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 2024 report, 64% 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.

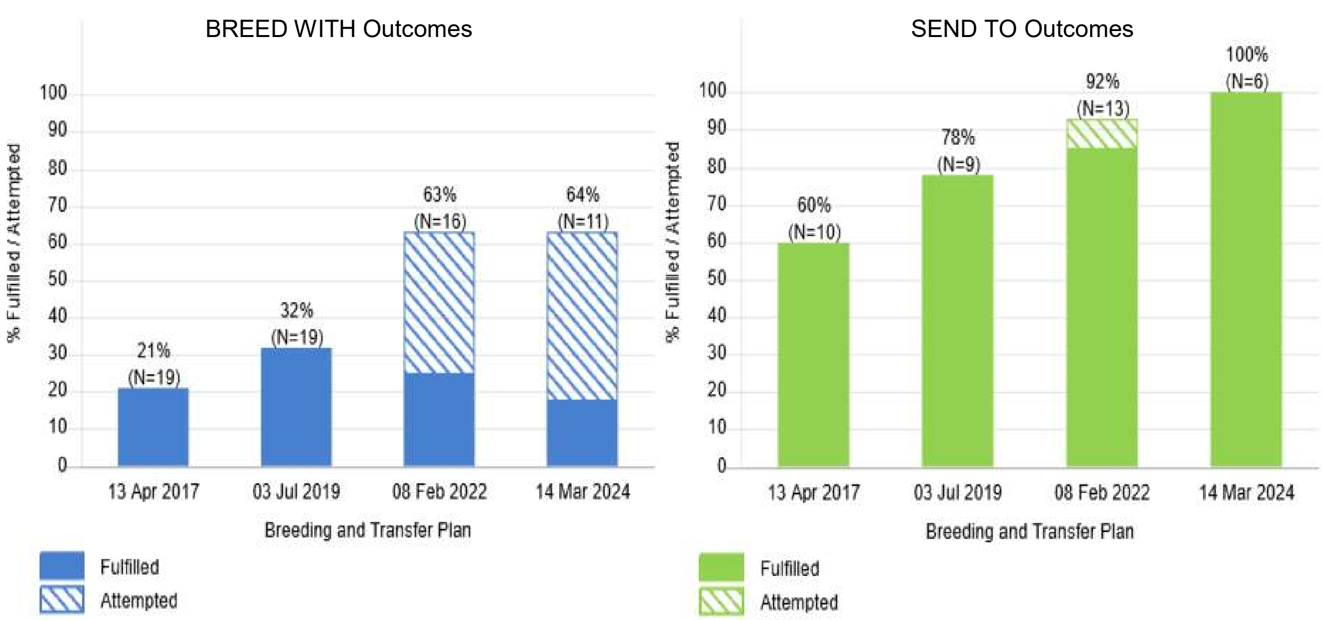


Figure 4: Recommendation outcomes by breeding (left) and transfer (right) for the past Pygmy Slow Loris SSP Breeding and Transfer Plans. *N* represents the number of recommendations scored for each recommendation type that was issued in the plan or during the interim, and the number represents the percent 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 two-year plan (2025 – 2027). Interim recommendations 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 Pygmy Slow Loris SSP will pursue the scenario of growing to 55 target size for this Breeding and Transfer Plan (Table 4, scenario b). This target size aligns with the TAG goal to grow the population and with current reproductive rates.

Table 4: Reproduction plan and history for the Pygmy Slow Loris SSP population.

Reproductive Goals**				
	Growth Rate (λ)	Year to Reach Goal	Number of Offspring Needed per Year	To Reach Target Population Size Of
a. Maintain current population size	1.00	2026	6 – 8	46
b. Grow size to the recommended target population size (TPS) in five years	**1.0364**	**2030**	**9 – 11**	**55**
Reproductive Goals Summary from the Last BTP (2024)				
Number of females recommended to breed	16			
Number of births since publication date of last report	6			
Average Number of Events in the SSP Population per Year over the Last Five Years*				
Average number of births per year	7.0			
Average number of deaths per year	6.2			
Average number of imports per year	0.0			
Average number of exports per year	0.0			

*Changes to numbers of imports or exports between reports may be due to changes in accreditation through time. These numbers pertain to the AZA Population at the time of analysis/publication.

Summary Recommendations:

1. **The SSP recommends 13 females to breed at 11 facilities.**
    a. Breeding facilities are excepted to hold offspring for at least two years when needed.

2. **The SSP recommends four transfers to establish new pairs and meet facility requests.**

3. Please consult with the 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

4. **The SSP requests that breeding facilities closely monitor breeding** and contact the SSP Coordinator to discuss ideas to aid in successful pregnancies and births. **Please report all occurrences of stillbirths and/or miscarriage to the SSP Coordinator.**
    a. **No recorded female has bred for the first time after the age of 10**. Any females approaching that age that have not yet bred should be a focus for that facility.

5. Sex determination can be challenging for this species, and sex should be confirmed for any individuals in pairs that have not yet been successful. A new method to determine sex is included in Appendix J.

6. **The SSP recommends that diet and weight be closely tracked. The recommended weight range for pygmy slow lorises in captivity is 300 – 500g** (Appendix K; The Little Fireface Project, www.nocturama.org). In the temperature-controlled environments in which these individuals live, there is no reason they should exceed 500g.

Breeding and Transfer Recommendations by Facility

AKRON

Akron Zoological Park

500 Edgewood Avenue, Akron, Ohio 44307, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2690	102386	M	5	HOLD	AKRON	DO NOT BREED		

BLOOMINGT

Miller Park Zoo

1020 S Morris Avenue, Bloomington, Illinois 61701, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2622	119021	M	14	RECEIVE FROM	CINCINNAT	BREED WITH	2661	
2661	M17002	F	9	HOLD	BLOOMINGT	BREED WITH	2622	
2682	M19007	M	7	SEND TO	NY BRONX	BREED WITH	2708	

CHICAGOLP

Lincoln Park Zoological Gardens

2001 N Clark Street, Chicago, Illinois 60614, United States

Facility Note: The SSP Coordinator is aware of the health monitoring of #2707, please reach out if you are interested in breeding in the future.

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2637	23548	F	13	HOLD	CHICAGOLP	DO NOT BREED		Excluded - Behavior
2646	23550	M	11	HOLD	CHICAGOLP	DO NOT BREED		
2707	24349	F	4	HOLD	CHICAGOLP	DO NOT BREED		

CINCINNAT

Cincinnati Zoo & Botanical Garden

3400 Vine Street, Cincinnati, Ohio 45220, United States

Facility Note: A breeding option for male #2738 will be identified as more space and individuals become available.

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2622	119021	M	14	SEND TO	BLOOMINGT	BREED WITH	2661	
2630	UND	F	14	HOLD	CINCINNAT	DO NOT BREED		Excluded - Behavior
2738	124049	M	0	HOLD	CINCINNAT	DO NOT BREED		

CLEVELAND

Cleveland Metroparks Zoo

3900 Wildlife Way, Cleveland, Ohio 44109, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2667	UND	M	8	HOLD	CLEVELAND	DO NOT BREED		
2714	220801	F	3	HOLD	CLEVELAND	DO NOT BREED		
2727	230707	M	1	HOLD	CLEVELAND	DO NOT BREED		

COLUMBUS

Columbus Zoo and Aquarium

PO Box 400, Powell, Ohio 43065, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
~~2639~~	~~213146~~	~~M~~	~~13~~	~~HOLD~~	~~COLUMBUS~~	~~DO NOT BREED~~		Died during comment period
2642	213145	F	13	HOLD	COLUMBUS	BREED WITH	2689	
2689	219051	M	5	HOLD	COLUMBUS	BREED WITH	2642	

DULUTH

Lake Superior Zoological Gardens

7210 Fremont Street, Duluth, Minnesota 55807, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2679	100503	F	7	HOLD	DULUTH	BREED WITH	2685	
2685	100504	M	7	HOLD	DULUTH	BREED WITH	2679	

EL PASO

El Paso Zoo

4001 E Paisano Drive, El Paso, Texas 79905, United States

Facility Note: Please reach out to the SSP Coordinator when you are ready to receive new individuals.

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2504	202393	F	17	HOLD	EL PASO	DO NOT BREED		Excluded - Age

GARDENCTY

Lee Richardson Zoo

312 Finnup Drive, Garden City, Kansas 67846, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2666	117017	F	8	HOLD	GARDENCTY	BREED WITH	2671	
2671	117022	M	8	HOLD	GARDENCTY	BREED WITH	2666	

LITTLEROC

Little Rock Zoological Gardens

One Jonesboro Drive, Little Rock, Arkansas 72205, United States

Facility Note: The SSP Coordinator is aware of your request to place the offspring and will work to fulfill this request as more space becomes available.

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
~~2634~~	~~7403~~	~~M~~	~~14~~	~~HOLD~~	~~LITTLEROC~~	~~DO NOT BREED~~		Died during comment period
2654	7508	F	10	HOLD	LITTLEROC	DO NOT BREED		
2729	7997	M	1	HOLD	LITTLEROC	DO NOT BREED		
2730	7998	M	1	HOLD	LITTLEROC	DO NOT BREED		

MEMPHIS

Memphis Zoological Garden & Aquarium

2000 Prentiss Place, Memphis, Tennessee 38112, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2673	19M042	M	8	HOLD	MEMPHIS	BREED WITH	2718	
2718	24M011	F	2	HOLD	MEMPHIS	BREED WITH	2673	
2732	23M072	M	1	HOLD	MEMPHIS	DO NOT BREED		

MILWAUKEE

Milwaukee County Zoological Gardens

10001 W Bluemound Road, Milwaukee, Wisconsin 53226, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2626	UND	F	14	HOLD	MILWAUKEE	DO NOT BREED		Excluded - Behavior
2631	UND	M	14	HOLD	MILWAUKEE	DO NOT BREED		

MOODY

Aquarium at Moody Gardens

1 Hope Boulevard, Galveston, Texas 77554, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2649	7832	M	12	HOLD	MOODY	BREED WITH	2659	
2659	10066	F	9	HOLD	MOODY	BREED WITH	2649	
2719	10167	F	2	HOLD	MOODY	BREED WITH	2723	
2723	9885	M	1	HOLD	MOODY	BREED WITH	2719	

NY BRONX

Bronx Zoo/Wildlife Conservation Society

2300 Southern Boulevard, Bronx, New York 10460, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2623	M14052	M	14	HOLD	NY BRONX	BREED WITH	2640	
2640	M14053	F	12	HOLD	NY BRONX	BREED WITH	2623	
2682	M19007	M	7	RECEIVE FROM	BLOOMINGT	BREED WITH	2708	
2708	116283	F	4	RECEIVE FROM	NZP-WASH	BREED WITH	2682	

NZP-WASH

Smithsonian National Zoological Park

3001 Connecticut Avenue NW, Washington, DC 20008, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2708	116283	F	4	SEND TO	NY BRONX	BREED WITH	2682	
2715	116282	M	3	HOLD	NZP-WASH	DO NOT BREED		
2735	116461	M	0	HOLD	NZP-WASH	DO NOT BREED		
2736	116462	F	0	HOLD	NZP-WASH	DO NOT BREED		

OMAHA

Omaha's Henry Doorly Zoo

3701 S 10th Street, Omaha, Nebraska 68107, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2652	24485	M	11	HOLD	OMAHA	BREED WITH	2677	
2677	24709	F	7	HOLD	OMAHA	BREED WITH	2652	

PHILADELP

Philadelphia Zoo

3400 W Girard Avenue, Philadelphia, Pennsylvania 19104, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2617	104733	F	14	HOLD	PHILADELP	DO NOT BREED		Excluded - Age/No breeding success
2676	105322	M	8	HOLD	PHILADELP	BREED WITH	2713	
2713	2815	F	3	RECEIVE FROM	W ORANGE	BREED WITH	2676	

PUEBLO

Pueblo Zoo

3455 Nuckolls Avenue, Pueblo, Colorado 81005, United States

Facility Note: The SSP Coordinator acknowledges the lower likelihood of this pair breeding due to the female's age, however, please do not prevent breeding.

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2614	M39021	F	15	HOLD	PUEBLO	BREED WITH	2653	
2653	M39022	M	10	HOLD	PUEBLO	BREED WITH	2614	

W ORANGE

Turtle Back Zoo

560 Northfield Avenue, West Orange, New Jersey 7052, United States

SB ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
2641	2889	M	12	HOLD	W ORANGE	BREED WITH	2717	
2713	2815	F	3	SEND TO	PHILADELP	BREED WITH	2676	
2717	2691	F	---	HOLD	W ORANGE	BREED WITH	2641	

Appendices

A. Analytical Assumptions

HYPOTHETICAL INDIVIDUALS

Studbook ID	Sire	Dam	Notes
HYP1	WILD	WILD	To represent likely wild caught sire of SB# 2108, which was born at IRCHEL in Switzerland on 4/10/1989.
HYP2	WILD	WILD	Created to represent parents of 2717, which is likely unrelated to the rest of the population due to origin.
HYP3	WILD	WILD	

ANALYTICAL DATA FOR TRUE INDIVIDUALS

Studbook ID	Field	TRUE	Overlay	Notes
2108	Sire	UNK	HYP1	No individuals in the SB are recorded as having been at institution at which 2108 was born (IRCHEL) other than SB#s 2108 and 2097. Therefore, created and assigned a wild-origin hypothetical sire, which seems reasonable given the birth date of SB# 2108 and the origins of the recorded mother.
2717	Sire	UNK	HYP2	This individual is possibly from the pet trade. No other animals from GREENWICH or VA SAFARI have previously entered the studbook, so the animal is unlikely to be related to any individuals currently in the population. Assumed to have wild (unrelated) origins.
	Dam	UNK	HYP3	

B. Animals Excluded from Genetic Analysis

ID	Sex	Age	Location	Reason for Exclusion
2504	F	17	EL PASO	Age
2617	F	14	PHILADELP	Age
2626	F	14	MILWAUKEE	Behavior
2630	F	14	CINCINNAT	Behavior
2637	F	13	CHICAGOLP	Behavior

C. Summary of Data Exports

Studbook Software and version #	PopLink version 2.5.2 / ZIMS for Studbooks 3.0 – 7 August 2024
Overlay Name	Parental_Assumptions_2020
Descriptive Survival Statistics Report	Report is archived with PMC/AZA and Median Life Expectancy can be viewed here: https://www.aza.org/species-survival-statistics

PMx Project: Loris_PygmySlow_Dec2024
Created: 2024-12-20 by PMx version 1.8.0.20240108
File: C:\PMxProjects\Loris_PygmySlow_Dec2024.pmxproj

Primary data file
Data File Name: zims.zims
Common Name: Pygmy slow loris
Scientific Name: Nycticebus pygmaeus
Data Source: ZIMS for Studbooks
Studbook Name: Loris, Pygmy Slow (Nycticebus pygmaeus) SSP
Exported On: 2024-12-20
Software version: ZIMS for Studbooks 3.0
Current Through: 2021-07-14
Compiled By: ELENA A LESS
Scope: AZA

Demographic, Census, & Genetic Filter:
Dates: 1987-01-01 to 2024-12-20
Association: AZA / Association of Zoos & Aquariums (AZA)

69 births to parents with unknown ages have been added in proportion to known aged parents.
This is 24% of TOTAL births (N=287)

Selected population was changed from the originally imported data.

D. Life Tables

Px = survival; Qx = mortality; Lx = cumulative survivorship; Mx = fecundity;
At Risk (Qx and Mx) = number of animals corresponding values are estimated from.

MALES

Age	Px	Qx	Risk Qx	Lx	Mx	Risk Mx
0	0.53	0.47	83.85	1.00	0.00	83.85
1	0.96	0.04	79.56	0.53	0.00	79.56
2	0.96	0.04	80.76	0.52	0.05	80.78
3	0.98	0.03	78.23	0.50	0.15	78.25
4	0.97	0.03	75.99	0.48	0.23	76.05
5	0.99	0.01	73.47	0.47	0.18	73.52
6	0.99	0.01	72.74	0.47	0.27	72.79
7	0.94	0.06	68.72	0.46	0.24	68.77
8	0.95	0.05	61.86	0.43	0.20	61.92
9	0.90	0.10	56.34	0.41	0.15	56.36
10	0.92	0.08	49.49	0.37	0.27	49.55
11	0.85	0.15	43.66	0.34	0.20	43.68
12	0.79	0.21	33.83	0.29	0.16	33.87
13	0.90	0.10	25.93	0.23	0.26	25.97
14	0.82	0.18	20.68	0.21	0.05	20.70
15	0.82	0.18	15.67	0.17	0.07	15.68
16	0.57	0.43	12.09	0.14	0.21	12.13
17	0.63	0.38	7.02	0.08	0.00	7.02
18	0.40	0.60	3.82	0.05	0.00	3.82
19	0.50	0.50	1.30	0.02	0.00	1.30
20	1.00	0.00	1.00	0.01	0.00	1.00
21	0.00	1.00	0.00	0.01	0.00	0.00
22	0.00	1.00	0.00	0.00	0.00	0.00

r = -0.004, λ = 0.996, Ro = 0.968, T = 7.7, N@20 = 17

FEMALES

Age	Px	Qx	Risk Qx	Lx	Mx	Risk Mx
0	0.56	0.44	76.45	1.00	0.00	76.45
1	0.99	0.01	75.54	0.56	0.03	75.55
2	0.95	0.05	77.90	0.55	0.09	77.96
3	0.96	0.04	75.87	0.53	0.20	75.97
4	0.97	0.03	72.38	0.51	0.21	72.45
5	0.96	0.04	70.27	0.49	0.31	70.42
6	0.93	0.07	68.21	0.47	0.30	68.32
7	0.97	0.03	63.14	0.44	0.35	63.22
8	0.98	0.02	59.89	0.42	0.11	59.93
9	0.90	0.10	54.34	0.42	0.23	54.47
10	0.94	0.06	49.28	0.37	0.13	49.34
11	0.94	0.06	46.09	0.35	0.14	46.13
12	0.89	0.12	41.16	0.33	0.06	41.19
13	0.83	0.17	32.18	0.29	0.08	32.19
14	0.86	0.14	24.84	0.24	0.07	24.85
15	0.82	0.18	19.31	0.21	0.00	19.31
16	0.89	0.11	16.88	0.17	0.00	16.88
17	0.63	0.38	11.86	0.15	0.00	11.86
18	0.78	0.22	7.45	0.09	0.00	7.45
19	0.14	0.86	3.27	0.07	0.00	3.27
20	0.00	1.00	0.83	0.01	0.00	0.83
21	0.00	1.00	0.00	0.00	0.00	0.00
22	0.00	1.00	0.00	0.00	0.00	0.00

r = 0.000, λ = 1.000, Ro = 0.995, T = 6.4, N@20 = 17

E. Ordered Mean Kinship List

These lists are current to February 2025 and values are subject to change with any birth, death, import, export, inclusion, exclusion, or changes in pedigree or pedigree assumptions.

Population Mean Kinship = 0.0799
(As indicated by a black line below)

MALES

SB ID	MK	Known	Age	Location
2652	0.0339	1.0000	11	OMAHA
2641	0.0465	1.0000	12	W ORANGE
2622	0.0560	1.0000	14	CINCINNAT
2623	0.0560	1.0000	14	NY BRONX
2649	0.0606	1.0000	12	MOODY
2738	0.0700	1.0000	0	CINCINNAT
2723	0.0746	1.0000	1	MOODY
2673	0.0776	1.0000	8	MEMPHIS
2653	0.0777	1.0000	10	PUEBLO
2671	0.0777	1.0000	8	GARDENCTY
2685	0.0834	1.0000	7	DULUTH
2676	0.0837	1.0000	8	PHILADELP
2646	0.0838	1.0000	11	CHICAGOLP
2631	0.0871	1.0000	14	MILWAUKEE
2689	0.0897	1.0000	5	COLUMBUS
2690	0.0897	1.0000	5	AKRON
2732	0.0912	1.0000	1	MEMPHIS
2667	0.0944	1.0000	8	CLEVELAND
2682	0.0958	1.0000	7	BLOOMINGT
2729	0.0958	1.0000	1	LITTLEROC
2730	0.0958	1.0000	1	LITTLEROC
2735	0.1019	1.0000	0	NZP-WASH
2715	0.1019	1.0000	3	NZP-WASH
2727	0.1179	1.0000	1	CLEVELAND

FEMALES

SB ID	MK	Known	Age	Location
2717	0.0122	1.0000	---	W ORANGE
2640	0.0495	1.0000	12	NY BRONX
2713	0.0589	1.0000	3	W ORANGE
2614	0.0609	1.0000	15	PUEBLO
2677	0.0670	1.0000	7	OMAHA
2659	0.0755	1.0000	9	MOODY
2642	0.0788	1.0000	13	COLUMBUS
2707	0.0837	1.0000	4	CHICAGOLP
2708	0.0898	1.0000	4	NZP-WASH
2661	0.0913	1.0000	9	BLOOMINGT
2666	0.0913	1.0000	8	GARDENCTY
2718	0.0965	1.0000	2	MEMPHIS
2719	0.0965	1.0000	2	MOODY
2679	0.0961	1.0000	7	DULUTH
2714	0.0989	1.0000	3	CLEVELAND
2654	0.0991	1.0000	10	LITTLEROC
2736	0.1019	1.0000	0	NZP-WASH

F. Definitions

(as of July 2024)

Demographic Terms

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

Lambda (λ) or Population Growth Rate – The proportional change in population size from one year to the next. 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, from the PMx life tables, the change in the population based on the demographic regional and date window exported from the studbook, the life table lambda is the rate at which the population would be expected to grow (in the future) given the birth and death rates reported in the life tables and assuming a stable age distribution (does NOT factor in imports or exports); 2) 5-year, 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 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® (Signature SSP) 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

as of July 2024

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

H. Directory of Institutional Representatives

Exported from PMCTrack as of 19 February 2024

Mnemonic	Facility Name	Institutional Representative	IR Email
AKRON	Akron Zoological Park	Lauren McKenna	l.mckenna@akronzoo.org
BLOOMINGT	Miller Park Zoo	Rose Johnson	Rijohnson@cityblm.org
CHICAGOLP	Lincoln Park Zoo	Dan Boehm	dboehm@lpzoo.org
CINCINNAT	Cincinnati Zoo & Botanical Garden	Jon Kiefer	Jonathan.Kiefer@cincinnatizoo.org
CLEVELAND	Cleveland Metroparks Zoo	Elena Less	eah@clevelandmetroparks.com
COLUMBUS	Columbus Zoo and Aquarium	Rebecca Koller	rebecca.koller@columbuszoo.org
DULUTH	Lake Superior Zoo	Emily Perala	eperala@lszoo.org
EL PASO	El Paso Zoo	John Kiseda	kisedajj@elpasotexas.gov
EVANSVLLE	Mesker Park Zoo & Botanic Garden	Shannon Irmscher	sirmscher@meskerparkzoo.com
GARDENCTY	Lee Richardson Zoo	Isabelle Fricano	isabelle.fricano@gardencityks.us
LITTLEROC	Little Rock Zoo	Karen Caster	kcaster@littlerock.gov
MEMPHIS	Memphis Zoo	Lauren Caskey	lcaskey@memphiszoo.org
MILWAUKEE	Milwaukee County Zoological Gardens	Amos Morris	amos.morris@milwaukeecountywi.gov
MOODY	Rainforest & Aquarium at Moody Gardens, Inc.	Paula Kolvig	pkolvig@moodygardens.org
NY BRONX	Bronx Zoo	Jessica Moody	jmoody@wcs.org
NZP-CRC	Smithsonian's Conservation Biology Institute	Kara Ingraham	ingrahamk@si.edu
NZP-WASH	Smithsonian National Zoological Park	Kara Ingraham	ingrahamk@si.edu
OMAHA	Omaha's Henry Doorly Zoo & Aquarium	Christie Eddie	christiee@omahazoo.com
PHILADELP	Philadelphia Zoo	Amy Skokowski	skokowski.amy@phillyzoo.org
PROSPECTP	Prospect Park Zoo	Nichole Shelmidine	nshelmidine@wcs.org
PUEBLO	Pueblo Zoo	Gina Gley	ggley@pueblozoo.org
SANDIEGOZ	San Diego Zoo	Dean Gibson	dgibson@sdzwa.org
W ORANGE	Turtle Back Zoo	Lisa Hartman	lhartman@parks.essexcountynj.org

I. Contraception and Reproductive Health

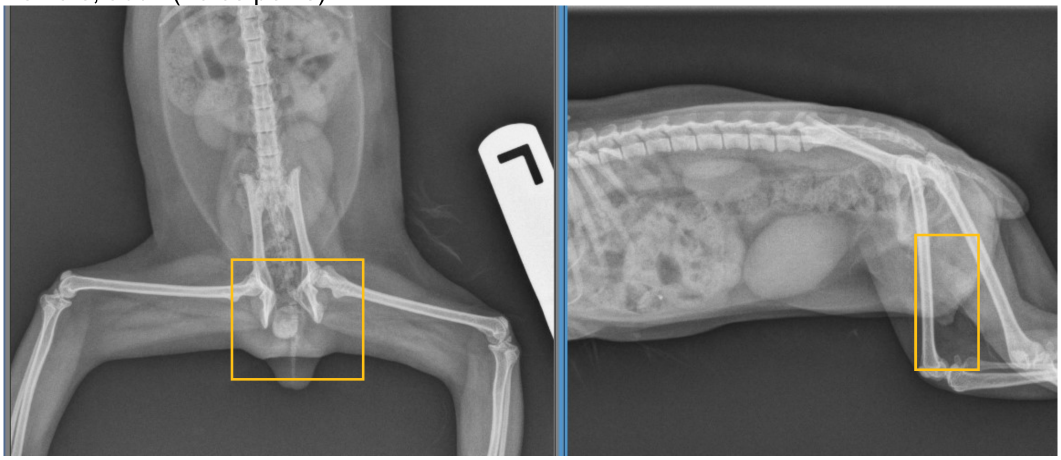
Reproductive management is essential to meeting genetic and demographic goals and supporting long-term sustainability of populations in human care. The AZA Reproductive Management Center (RMC) can provide services related to contraception, and a variety of other reproductive challenges. If contraception 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.

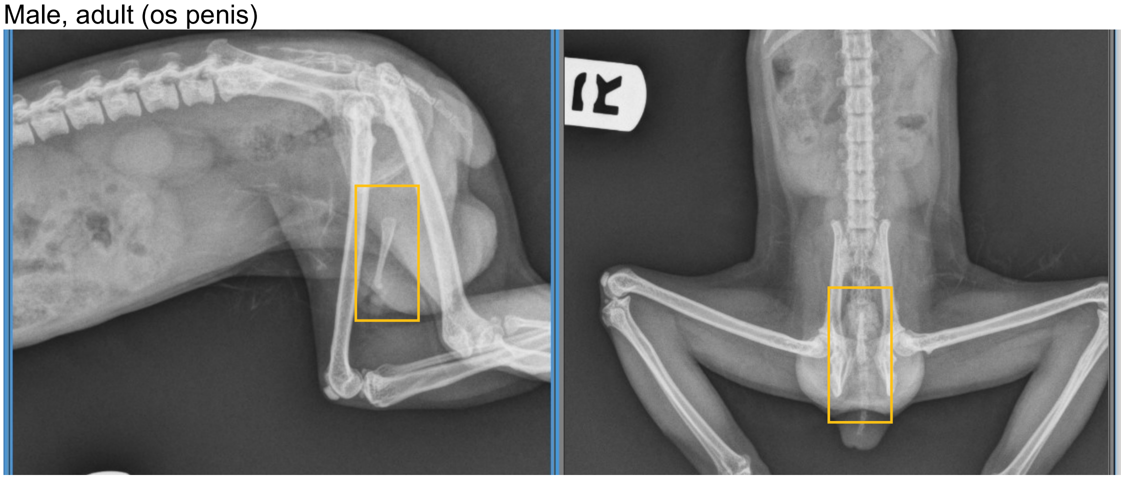
In addition, the Reproductive Health Surveillance Program (RHSP) conducts comprehensive pathologic examinations on reproductive tracts to detect deleterious effects associated with contraception or other reproductive management practices. The results of these analyses are shared with the RMC and provide 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. Sex Determination Protocol

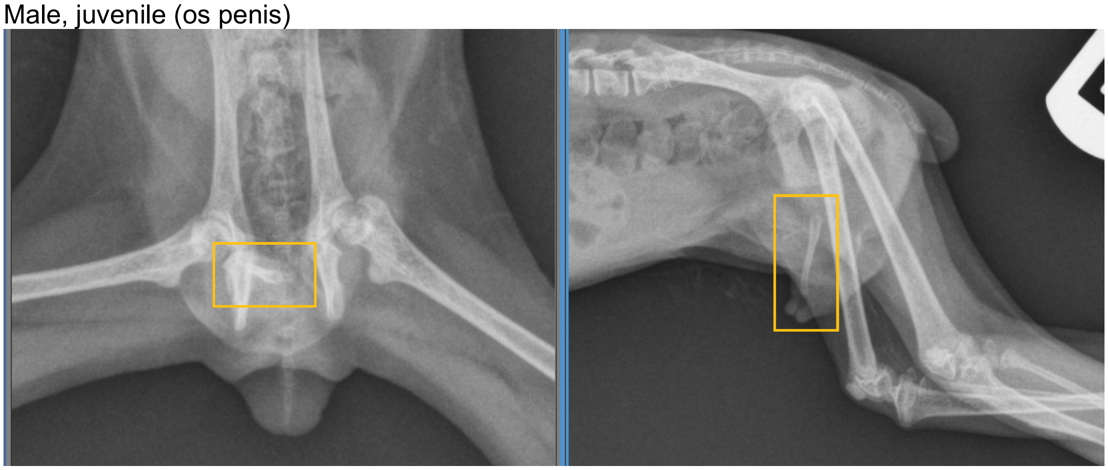
Female, adult (no os penis)



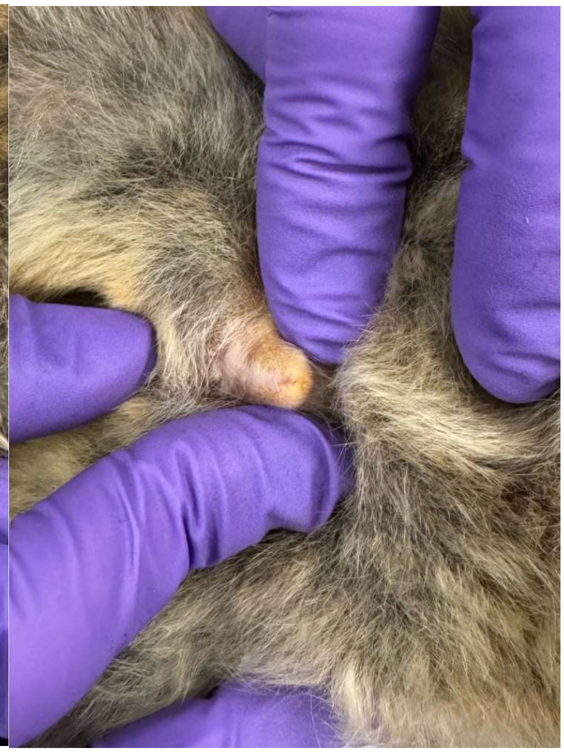
Male, adult (os penis)



Male, juvenile (os penis)



Sex Determination Protocol (continued)



Male (os penis) Female (no os penis)

K. Diet and Husbandry Protocol

Little Fireface Project
Saving the slow loris via ecology, education, empowerment

Captive Loris Diet Fact Sheet

Behaviour in Captivity

These species all require complex climbing structures with vertical, horizontal and diagonal angles within their enclosures. Reversed lighting enclosures can work well if the light used is red and NOT blue as our research has shown that blue light impacts circadian rhythms, increases stress, and reduces fertility. The pygmy slow loris and greater slow loris naturally seek shelter between bamboo strands and would benefit from dense strands of bamboo in lieu of a sleeping box. Meanwhile the Bengal slow loris requires neither but will instead sleep curled in a ball, ideally on a network of branches where it can still feel hidden if necessary.

Pygmy Slow Loris
(*Nycticebus pygmaeus*)
Daily Diet

- **10 g** Gum Arabic (with mineral supplement)
- **4 g** insects
- **50 ml** diluted lory bird nectar
- **20 g** non-leafy vegetables
- **One** tree branch (with variation in leaves and blossoms)

Bengal Slow Loris
(*Nycticebus bengalensis*)
Daily Diet

- **15 g** Gum Arabic (with mineral supplement)
- **5 g** insects
- **50 ml** diluted lory bird nectar
- **40 g** non leafy vegetables
- **Two** tree branches (with variation in leaves and blossoms)

Greater slow loris
(*Nycticebus coucang*)
Daily Diet

- **10 g** Gum Arabic (with mineral supplement)
- **5 g** of insects
- **50 ml** diluted lory bird nectar
- **25 g** non-leafy vegetables
- **One** tree branch (with variation in leaves and blossoms)

Insects

Slow lorises eat insects & small animals regularly. Boiled eggs, cooked chicken, and cooked shrimp are good protein sources. Crickets, locusts and other insects should be fed daily. Mealworms, and wax worms can be fed periodically but may cause transient diarrhea.

Fruits

Slow lorises eat minimal fruit; excessive fruit causes diabetes, obesity and tooth decay. Feed daily more vegetables than cultivated fruits, such as: broccoli, carrot, cucumber, cooked yams, sweetcorn, aubergine, cooked or raw beans.

Exudates

The most commonly eaten food of slow lorises, gum and nectar can be replicated with commercially available gum crystals and nectar powder, fed in feeders.

Little Fireface Project