# Population Analysis & Breeding and Transfer Plan

## Lion (*Panthera leo*)
## AZA Species Survival Plan®
## Green Program


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6 December 2022

PMC Population Management Center

LINCOLN PARK ZOO.

ASSOCIATION OF ZOOS & AQUARIUMS

# Table of Contents

# Acknowledgments

The Lion SSP planning meeting was held via online conferencing on 11 July 2022, attended by the following:

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Chelsea Mihalick, Roosevelt Park Zoo
Kathryn Sippel, Binder Park Zoo
Kara Schilling, Phoenix Zoo
Andrew Haertzen, Audubon Zoo
Jacob Shanks, San Diego Zoo Safari Park
Rebecca McCloskey, Denver Zoo
Katie Barry, Idaho Falls Zoo
Nicole Presley, Fresno Chaffee Zoo
Ryan Sears, Omaha's Henry Doorly Zoo & Aquarium
Anna Chaney, Memphis Zoo
Kurt Giesler, Fort Worth Zoo
Kim Walker, Calgary Zoo
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Cover photo courtesy of Cassy Kutilek
(Jabari and his cub Pilipili at Lincoln Park Zoo, Chicago, IL)

This plan was prepared and distributed with the assistance of the
Planning Coordinator and Program Assistant at the
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# Description of Population Status

## Species Survival Plan® for the Lion (*Panthera leo*)

**Introduction:** Lions are an iconic flagship species held at numerous zoos within AZA. Since the inception of the SSP, the AZA lion population has been divided into two groups: "pedigreed" lions of known ancestry and "generic" (non-pedigreed) lions of unknown ancestry. While the SSP will not make recommendations to breed the generic lions, they remain part of the total SSP population, and their records are important for demographic data. At the time of analyses, of the 349 lions (159 males and 190 females) in the total SSP population, 287 (129.158) are pedigreed lions and 62 (30.32) are generic lions, in 96 AZA facilities. Two new facilities will be joining the SSP and one will be phasing out. The Felid Taxon Advisory Group (TAG) has set the target population size for this population to be 350 animals (2019 Regional Collection Plan (RCP)) due to facility demand and space availability. However, after discussion with the TAG Chair and SSP Coordinator the target population size was set at 400 animals to account for additional space available at AZA international facilities. It's important that the space generic lions are occupying be considered as well. The Felid TAG RCP stated the goals for this population as education and an insurance population. Under AZA's current sustainability designations, this Program qualifies as a Green SSP (>90% gene diversity for 100 years). This is the eighth Breeding and Transfer Plan for this Program.

**Analytical Assumptions and Exclusions:** Prior to assumptions and exclusions, only 53.5% of the pedigree of this population is known. An analytical overlay was applied to the true studbook to complete the pedigrees of a number of cats (Appendix A). No assumptions were created for the generic (non-pedigreed) cats, as this sub-population will not be included in the potentially breeding population. All 62 (30.32) generic cats, as well as 33 (5.28) additional pedigreed animals were excluded from the genetic analysis for reasons outlined in Appendix C. After assumptions and exclusions, the potentially breeding population consists of 254 (124.130) animals with 100% known and 97.3% certain pedigree.

**Demography**: Studbook records show lions have existed in AZA zoos since the late 19th century with a few births recorded as early as 1895. Low numbers of lions were held for many years until a large growth phase began in the 1960s (Fig. 1). The SSP population reached its peak size of 436 individuals in 2015; however, since this time, the overall population has been declining due to the continued decrease of generic lions being held in AZA facilities. Over the past five years, the total SSP population has decreased by an average of 2.4% (λ = 0.976) with annual births totaling 88 (mean = 17.6) versus a total of 130 deaths (mean = 26). It should be noted that many of these deaths are older generic lions. As the generic lions pass out of the population the pedigreed lions will need to reproduce at a steady rate to fill these spaces. Historically the pedigreed population has increased while the generic population has steadily decreased (Fig. 2); however, the generic portion of the population increased significantly in 2019 due to the inclusion of generic lions at newly accredited international AZA facilities.

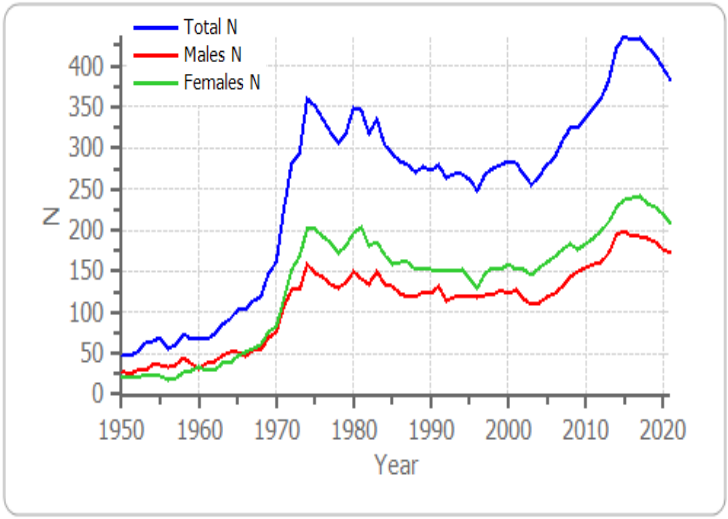


***Figure 1.*** *Census of the Lion SSP from 1950 to 2021 by sex.*

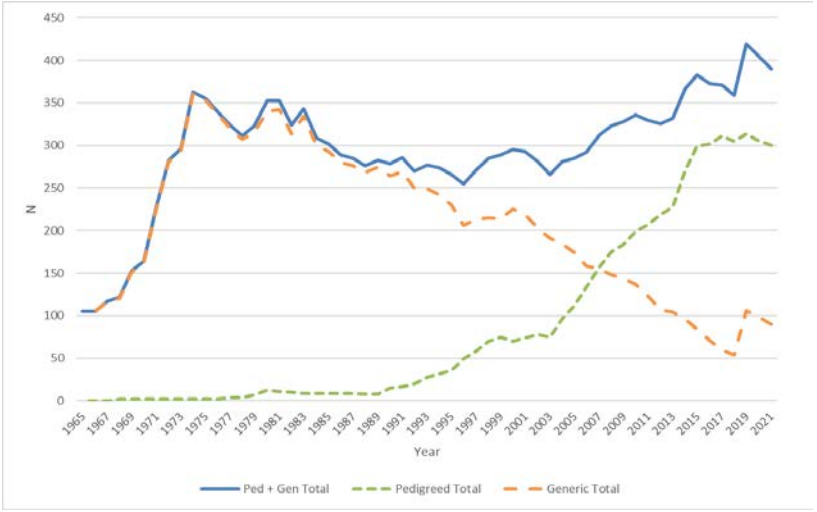


***Figure 2.*** *Census of the total, pedigreed and generic lion populations, illustrating the transition from generic to pedigreed lions. (Note: census numbers in graph may look different from past graphs due to the use of the new ZIMS software and new international AZA facilities)*

The age structures for the two sub-populations (generic cats and pedigreed cats) in the SSP (Figs. 3c, 3d) illustrate current management. The non-breeding generic group has few individuals in the younger age classes and is a significantly older population, typical of a phase-out, while the opposite is the case for the pedigreed cats. Despite

varying number of births over the last ten years (11–62 births per year), all age classes are full with a broad base of individuals in the younger age classes that will help support future breeding and offset deaths (Figs. 3a, 3b). This will be necessary for future growth and expansion of the pedigreed population into the available space created by the declining generic population.

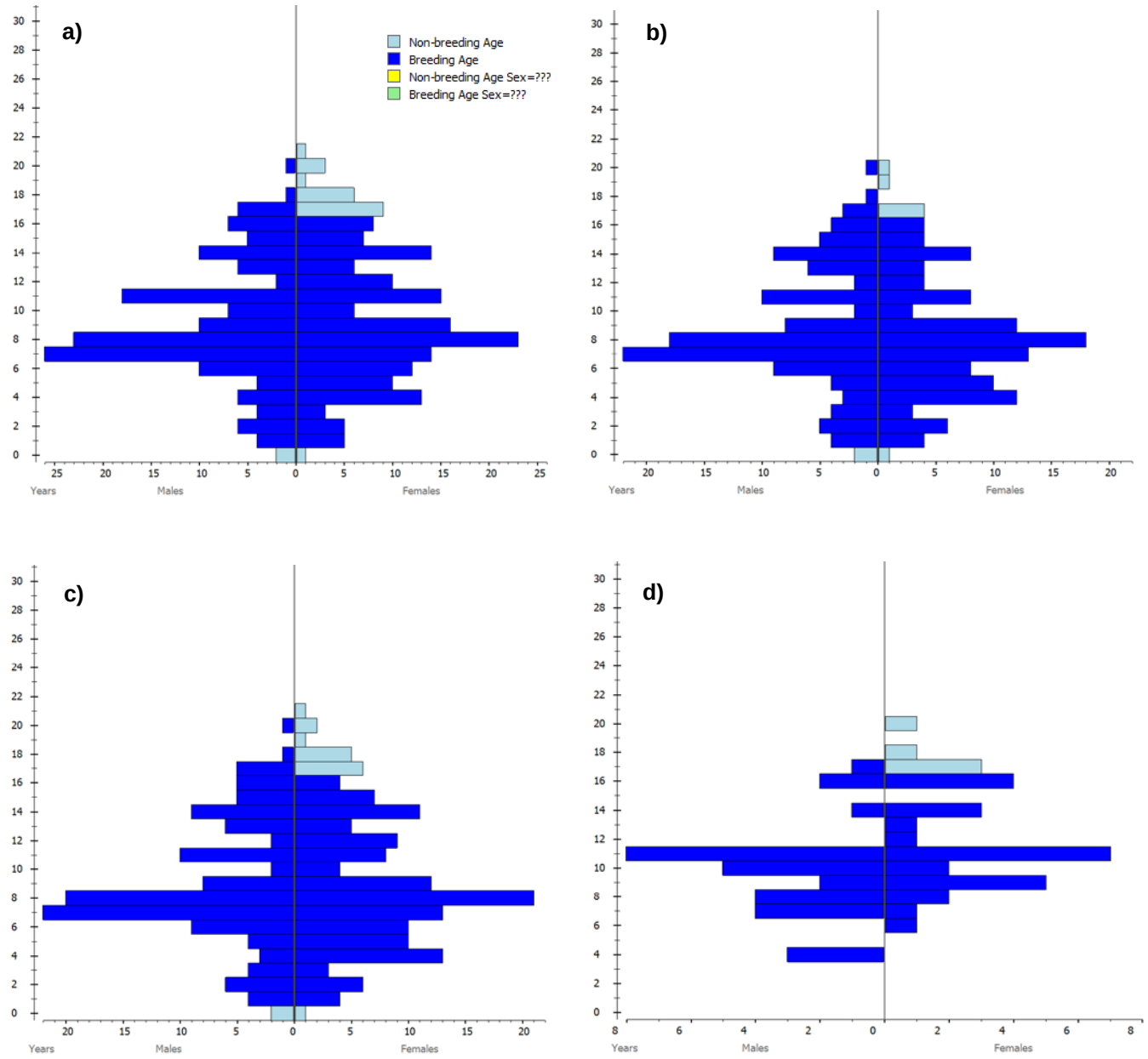


***Figure 3.*** *Age structures of the total Lion SSP population (349 (159.190)) (a), the potentially breeding population (254 (124.130)) (b), the pedigreed lions in the SSP (287 (129.158)) (c), and the declining generic lion subpopulation (62 (30.32)) (d).*

***Table 1:*** *Demographic status of the Lion SSP population, according to the studbook*

| Demography Summary | | |
|---|---|---|
| Current size of SSP population (N) – Total (Males.Females.Unknown Sex) | 349 (159.190.0) | |
| Number of individuals excluded from genetic analyses | 95 (35.60.0) | |
| Population size following exclusions | 254 (124.130.0) | |
| Target population size (Kt) from Felid TAG (updated 2022) | 400 | |
| Mean generation time (T, years) | 6.6 | |
| Population growth rates (λ; lambda)*: Life Table / 5-year / Projected | 0.986 / 0.976 / 0.958 | |
| Percentage (%) of living population born ex situ | 99.7% | |
| **Survival/Mortality** | **Males** | **Females** |
| Observed first year mortality rate ($Q_x$) | 0.297 | 0.271 |
| Median life expectancy (MLE), excluding first year mortalities (years) (from PopLink Survival Statistics Report (https://www.aza.org/species-survival-statistics)) | 16.9 | |
| Observed maximum longevity ($L_x$) (zoo born within AZA) | 26 | 26 |
| **Reproduction** | | |
| Observed reproductive age range | 1–22 | 1–16 |
| Gestation time | 110 days | |
| Median litter size born | 2 (range 1 - 6) | |

* Life table (AZA; 1980-present); 5-year from studbook census; Projected from PMx stochastic 20-year projections

**Genetics:** Based on pedigree assumptions and exclusions, the studbook pedigree indicates that this SSP is descended from 63 founders with no potential founders remaining (Table 2). The gene diversity of the population is 97.36%, which is equivalent to that found in approximately 19 founders (FGE = 18.92). Founder representation in the population is currently skewed (Fig. 4). Equalizing founder contributions through breeding under-represented founders will increase gene diversity within the SSP. Typical AZA program goals include thresholds for tolerance of gene diversity loss over time; 90% gene diversity retention for 100 years is a common population management goal. Decreases in gene diversity below 90% of that in the founding population have been associated with reproduction increasingly compromised by, among other factors, lower birth weights, smaller litter sizes, and greater neonatal mortality in some species. Based on current population parameters and recent growth rate trends, gene diversity is projected to decline to 91% over the next 100 years if the current population grows to the target size of 400 at projected growth rate of 1% (λ = 1.01). The population can also maintain 92.9% gene diversity over ten generations (Tx10 = 66 years). This population has had historical growth in the pedigreed portion of the population; thus, a growth rate of 1% was used.

By equalizing founder representation, the population has the potential to have as high as 98.57% gene diversity, the equivalent of 35 founder genomes (potential FGE = 35.01). The current level of gene diversity may be retained for an even longer period of time through managed breeding targeted at equalization of founder representation, increasing the target size, and increasing the effective size ratio (proportion of the potentially breeding population breeding and contributing genetically to the next generation).

***Table 2:*** *Genetic status and projections for the Lion SSP population*

| Genetics Summary* | | | | |
|---|---|---|---|---|
| | ***2016*** | ***2019*** | **2022**** | **Potential** |
| Founders | *65* | *65* | 63 | 0 |
| Founder genome equivalents (FGE) | *19.48* | *19.96* | 18.92 | 35.04 |
| Gene diversity (GD %) | *97.43* | *97.50* | 97.36 | 98.57 |
| Population mean kinship (MK) | *0.0257* | *0.0250* | 0.0264 | -- |
| Mean inbreeding (F) | *0.0049* | *0.0029* | 0.0111 | -- |
| Effective population size relative to population size ($N_e$/N) | *0.3258* | *0.3133* | 0.3187 | -- |
| Percentage of pedigree known before / after assumptions and exclusions | *62.2 / 100* | *54.2 / 100* | 53.5 / 100 | -- |
| Percentage pedigree certain after assumptions and exclusions | -- | *98.3* | 97.3 | -- |
| **Projections** | | | | |
| Years to 90% gene diversity | -- | *107* | 118 | -- |
| Years to 10% loss of gene diversity | -- | *146* | 169 | -- |
| Gene diversity at 100 Years (%) | *93**** | *90.5* | 91 | -- |
| Gene diversity in 10 generations (%) | -- | *92.8* | 92.9 | -- |
| | | *Assuming λ = 1.01, Target size = 350, Generation length = 6.4, Starting population size = 261* | Assuming λ = 1.01, Target size = 400, Generation length = 6.6, Starting population size = 254 | |

*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.
***Projected gene diversity based on the 2013 Population Viability Analysis (PVA).

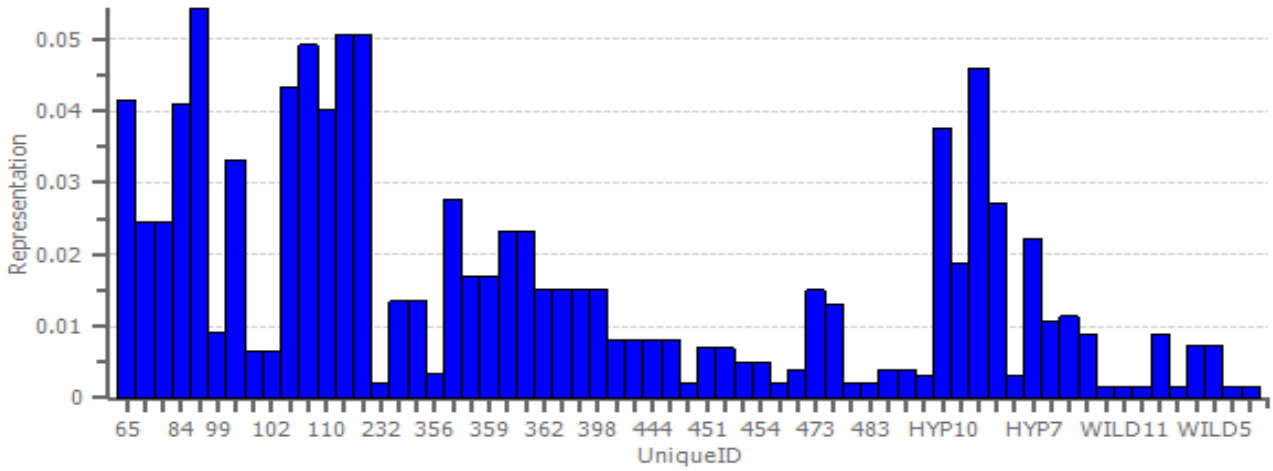


***Figure 4.*** *Founder representation distribution of the analytical Lion SSP population.*

**Recommendation Outcomes:** The website PMCTrack calculates the outcomes for SSP recommendations by comparing Breeding and Transfer Plan recommendations to births and transfers recorded in the studbook (Fig. 5). There are many reasons that recommendations might not be fulfilled, including interim recommendations issued by the SSP Coordinator; these reasons can be captured using PMCTrack Outcomes Surveys. Note that starting in 2022, SSP Coordinators directly add interim recommendations to PMCTrack to improve the accuracy of recommendation outcomes. The fulfillment rates of any plan that had outcomes calculated in 2022 or after may reflect inclusion of these interim rates; in the graph, this may include the last plan before 2022, such as a 2021 plan, plus any plans with a date of 2022 or after.

Of the recommendations proprosed in the 2019 Breeding and Transfer Plan, 15% of the BREED WITH recommendations were fulfilled, and 100% of SEND TO recommendations were fulfilled as requested. SSP participants are always encouraged to attempt to fulfill recommendations and communicate sucesses and challenges to the SSP Coordinator.

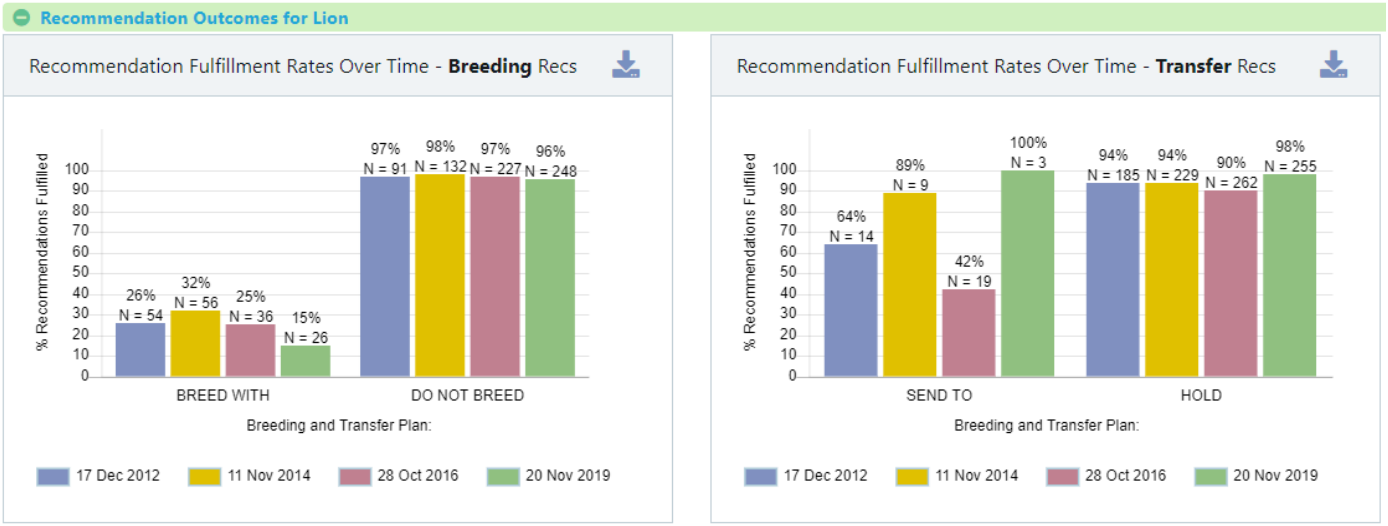


***Figure 5.*** *Recommendation outcomes by breeding (left) and transfers (right) for the past Lion SSP Breeding and Transfer Plans. N represents the number of recommendations scored for each recommendation type, per plan, and the number represents the percentage recommendations fulfilled. Please visit PMCTrack.org or contact pmctrack@lpzoo.org for more information or with any questions.*

**Management Strategies:** About 25 to 33 births per year over the next two years are needed in order for the population to maintain its current size (λ = 1.00) and approximately 31 to 40 births per year are needed to grow to the TAG recommended target size of 400 over the next ten years (λ = 1.014) (Table 3). These births will help offset pedigreed and generic deaths and grow the population to 400 pedigreed animals. As annual births over the last five years have ranged from 11 to 24 (mean = 17.6), the SSP will need to focus on breeding in order to maintain the current population size and allow the population to grow. Over the last ten years births have averaged 33.9 per year with as many as 62 births in one year showing the SSP is capable of achieving these demographic goals. The number of breeding females recommended is intended to replace animals expected to be lost to attrition in both the pedigreed and generic groups and well as grow the population to meet current facility demands. Offspring produced by the pairs need to be held by the facilities for at least *three years*.

This is a two-year plan (2022-2024). Interim recommendations will continue to be made as needed until another full set of recommendations are produced. Please promptly report any births or deaths to the SSP Coordinator, so that interim recommendations can be based on accurate population data. Recommendations contained in this plan supersede all previous recommendations.

***Table 3:*** *Historic reproduction and future population goals*

| **Current Reproductive Goals Summary** | | |
|---|---|---|
| | **Number of Births Needed per Year over the next 2 Years** | **Target Population Size** |
| To maintain current population size (λ = 1.00) | 25–33 | 349 |
| To grow to the TAG's recommended target population size in 10 years (λ = 1.014) | 31–40 | 400 |
| **Reproductive Goals Summary from the Last BTP (2019)** | | |
| Number of females recommended to breed | 26 | |
| Number of births since then | 39 | |
| **Average Number of Events in the SSP Population per Year over the Last Five Years** | | |
| Average number of births per year | 17.6 | |
| Average number of deaths per year | 26 | |
| Average number of imports per year | 1.2 | |
| Average number of exports per year | 2.4 | |

1. **The SSP recommends 33 females to breed at 20 facilities.**
    a. Waiting to breed until the previous litter has been placed is understandable and acceptable.
    b. **Facilities that have more than one female with a recommendation may only breed one female at a time if space is limited.**
    c. Please contact the SSP Coordinator if you have any questions or concerns about your recommendations.

2. **The SSP recommends 22 transfers to establish new pairs and meet facility requests.**

3. Facilities are expected to hold any offspring produced for at least *three years*. **Facilities that have breeding recommendations and do not have space to hold offspring should contact the SSP Coordinator to discuss options before their cats become pregnant.**

4. The Lion Animal Care Manual has been published and is available at https://www.aza.org/animal-care-manuals. Please contact the SSP Coordinator with questions or concerns about husbandry or breeding.

5. Contact the SSP Coordinator at least two years in advance if any facility is seeking animals or planning to build a new exhibit.

6. Appendix I is an update to the contraception recommendations published in the Lion SSP Manual from the AZA Reproductive Management Center (RMC). Facilities considering permanent sterilization should contact the SSP before proceeding. Further information can be found at http://www.stlzoo.org/rmc

**Long-term Contraception Study (November 2019):** The AZA Reproductive Management Center (RMC) is working in collaboration with the Lion SSP to study reversibility after Suprelorin (deslorelin) treatment. The RMC defines reversal as any offspring birth after contraception. Through its Contraception Program, the RMC monitors efficacy, safety and reversibility in all recommended products; therefore, it is critical that the RMC be notified of reversals. The RMC staff is also available to answer questions and provide recommendations for contraception options.

The SSP is currently collaborating with the RMC to see if ovulation can be induced in lions that are having trouble reversing from expired Suprelorin implants. This project will use exogenous gonadotropin treatment to try to accelerate reversal in lions. It requires six months of fecal endocrine monitoring both before and after the hormone treatment. Fecal samples will be analyzed at the Saint Louis Zoo's Endocrine Lab and will be paid for by the RMC/Saint Louis Zoo. If you are interested, please contact Monica McDonald at the RMC or the SSP Program Leader to see if your lion is eligible for this study.

In general, please contact the RMC if there are any questions about hormone monitoring during Suprelorin treatment, or about cycling and pregnancy after Suprelorin treatment. Understanding reversal dynamics, including calculating an accurate rate and time to reversal, is crucial for this species.

AZA Reproductive Management Center
contraception@stlzoo.org
Phone: 314-646-4595

# Breeding and Transfer Recommendations by Facility

**ABILENE**

**Abilene Zoological Gardens**

Abilene, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 439 | M20025 | M | 11 | SEND TO | FORTWORTH | BREED WITH | 440, 441 | |
| 440 | M20023 | F | 11 | SEND TO | FORTWORTH | BREED WITH | 439 | |
| 441 | M20024 | F | 11 | SEND TO | FORTWORTH | BREED WITH | 439 | |
| 512 | M10610 | M | 8 | RECEIVE FROM | ABQBIOPK | DO NOT BREED | | |
| 513 | M16011 | F | 8 | RECEIVE FROM | ABQBIOPK | DO NOT BREED | | Excluded - Spayed |

**ABQBIOPK**

**Albuquerque BioPark Zoo**

Albuquerque, NM

**Facility Note:** Facility needs to send out lions for construction on a new lion exhibit.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 512 | M10610 | M | 8 | SEND TO | ABILENE | DO NOT BREED | | |
| 513 | M16011 | F | 8 | SEND TO | ABILENE | DO NOT BREED | | Excluded - Spayed |

**AKRON**

**Akron Zoological Park**

Akron, OH

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 250 | 100409 | M | 17 | HOLD | AKRON | DO NOT BREED | | |
| 370 | 101160 | F | 14 | HOLD | AKRON | DO NOT BREED | | |
| 543 | 102073 | F | 8 | HOLD | AKRON | DO NOT BREED | | |
| 545 | 102072 | F | 8 | HOLD | AKRON | DO NOT BREED | | |
| 602 | 102030 | M | 7 | HOLD | AKRON | DO NOT BREED | | |

**ALEXANDRI**

**Alexandria Zoological Park**

Alexandria, LA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 469 | M00477 | M | 9 | HOLD | ALEXANDRI | DO NOT BREED | | |
| 520 | M00506 | F | 8 | HOLD | ALEXANDRI | DO NOT BREED | | |

**ASHEBORO**

**North Carolina Zoological Park**

Asheboro, NC

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 392 | 1881 | F | 12 | HOLD | ASHEBORO | DO NOT BREED | | |
| 665 | 20M002 | M | 2 | RECEIVE FROM | AUDUBON | DO NOT BREED | | Changed during comment period |
| ~~666~~ | ~~20M003~~ | ~~M~~ | ~~2~~ | ~~RECEIVE FROM~~ | ~~AUDUBON~~ | ~~DO NOT BREED~~ | | Changed during comment period |

**ATLANTA**

**Zoo Atlanta**

Atlanta, GA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 508 | 13M031 | M | 8 | HOLD | ATLANTA | DO NOT BREED | | |
| 510 | 13M033 | M | 8 | HOLD | ATLANTA | DO NOT BREED | | |
| 511 | 13M034 | M | 8 | HOLD | ATLANTA | DO NOT BREED | | |

**ATTLEBORO**

**Capron Park Zoo**

Attleboro, MA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T4862 | 105012 | F | 17 | HOLD | ATTLEBORO | DO NOT BREED | | Excluded - Generic |
| T5000 | 107111 | M | 16 | HOLD | ATTLEBORO | DO NOT BREED | | Excluded - Generic |

## AUDUBON

**Audubon Zoo**

New Orleans, LA

**Facility Note:** Male #585 can breed with either female #615 or #616. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 585 | 19M005 | M | 7 | HOLD | AUDUBON | BREED WITH | 615, 616 | See Note |
| 615 | 19M006 | F | 6 | HOLD | AUDUBON | BREED WITH | 585 | See Note |
| 616 | 19M007 | F | 6 | HOLD | AUDUBON | BREED WITH | 585 | See Note |
| 617 | 19M008 | F | 6 | HOLD | AUDUBON | DO NOT BREED | | Excluded - Medical |
| 665 | 20M002 | M | 2 | SEND TO | ~~MINOT~~ ASHEBORO | ~~BREED WITH~~ DO NOT BREED | ~~671, 672~~ | Changed during comment period |
| 666 | 20M003 | M | 2 | SEND TO | ~~ASHEBORO~~ MINOT | ~~DO NOT BREED~~ BREED WITH | 671, 672 | Changed during comment period |

## BALTIMORE

**Maryland Zoo in Baltimore**

Baltimore, MD

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 301 | 5674 | M | 15 | HOLD | BALTIMORE | DO NOT BREED | | |
| 499 | 7370 | F | 8 | HOLD | BALTIMORE | DO NOT BREED | | |

## BATTLE CR

**Binder Park Zoo**

Battle Creek, MI

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 550 | M17013 | M | 8 | HOLD | BATTLE CR | DO NOT BREED | | |
| 555 | M17010 | F | 8 | ~~SEND TO~~ HOLD | ~~BOISE~~ BATTLE CR | DO NOT BREED | | Changed during comment period |
| 556 | M17011 | F | 8 | HOLD | BATTLE CR | DO NOT BREED | | |

## BIRMINGHM

**Birmingham Zoo**

Birmingham, AL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 590 | 122003 | M | 7 | HOLD | BIRMINGHM | DO NOT BREED | | |

**BOISE**

**Zoo Boise**

Boise, ID

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 504 | 218045 | M | 8 | HOLD | BOISE | DO NOT BREED | | |
| ~~555~~ | ~~M17010~~ | ~~F~~ | ~~8~~ | ~~RECEIVE FROM~~ | ~~BATTLE CR~~ | ~~DO NOT BREED~~ | | Changed during comment period |
| 673 | 701227 | F | 1 | RECEIVE FROM | S BARBARA | DO NOT BREED | | Added during comment period |

**BREVARD**

**Brevard Zoo**

Melbourne, FL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 661 | 22050 | M | 3 | HOLD | BREVARD | DO NOT BREED | | |
| 662 | 22051 | M | 3 | HOLD | BREVARD | DO NOT BREED | | |
| 663 | 22052 | M | 3 | HOLD | BREVARD | DO NOT BREED | | |

**BROWNSVIL**

**Gladys Porter Zoo**

Brownsville, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 366 | 10848 | M | 14 | HOLD | BROWNSVIL | DO NOT BREED | | |

**BUFFALO**

**Buffalo Zoo**

Buffalo, NY

**Facility Note:** Male #479 can breed with either female #408 or #413. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 408 | M13028 | F | 12 | HOLD | BUFFALO | ~~DO NOT BREED~~ BREED WITH | 479 | Changed during comment period |
| 413 | M13029 | F | 11 | HOLD | BUFFALO | ~~DO NOT BREED~~ BREED WITH | 479 | Changed during comment period |
| 479 | M14038 | M | 9 | HOLD | BUFFALO | ~~DO NOT BREED~~ BREED WITH | 408, 413 | See Note (Changed during comment period) |
| 677 | M21000 | F | 1 | HOLD | BUFFALO | DO NOT BREED | | |
| 678 | M21001 | M | 1 | HOLD | BUFFALO | DO NOT BREED | | |

**BUSCH TAM**

**Busch Gardens Tampa Bay**

Tampa, FL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 486 | 65463 | M | 9 | SEND TO | SOUTHBEND | BREED WITH | 487, 488 | |
| 487 | 65464 | F | 9 | SEND TO | SOUTHBEND | BREED WITH | 486 | |
| 488 | 65465 | F | 9 | SEND TO | SOUTHBEND | BREED WITH | 486 | |
| T5005 | 63349 | M | 16 | HOLD | BUSCH TAM | DO NOT BREED | | Excluded - Generic |
| T5006 | 63350 | F | 16 | HOLD | BUSCH TAM | DO NOT BREED | | Excluded - Generic |
| T5007 | 63351 | F | 16 | HOLD | BUSCH TAM | DO NOT BREED | | Excluded - Generic |

**CALDWELL**

**Caldwell Zoo**

Tyler, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 427 | 107168 | F | 11 | HOLD | CALDWELL | BREED WITH | 429 | |
| 429 | 107174 | M | 11 | HOLD | CALDWELL | BREED WITH | 427 | |

**CALGARY**

**Calgary Zoo, Garden & Prehistoric Park**

Calgary, Alberta, Canada

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 411 | 108999 | M | 11 | HOLD | CALGARY | DO NOT BREED | | |
| 412 | 108998 | M | 11 | HOLD | CALGARY | DO NOT BREED | | |
| 542 | 110505 | F | 8 | HOLD | CALGARY | DO NOT BREED | | |
| 544 | 110506 | F | 8 | HOLD | CALGARY | DO NOT BREED | | |

**CALI**

**Fundacion Zoological de Cali**

Cali, Valle del Cauca, Colombia

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T5089 | M07108 | F | 16 | HOLD | CALI | DO NOT BREED | | Excluded - Generic |
| T5094 | M13004 | F | 9 | HOLD | CALI | DO NOT BREED | | Excluded - Generic |
| T5108 | M18035 | M | 9 | HOLD | CALI | DO NOT BREED | | Excluded - Generic |

## CAPE MAY

**Cape May County Park Zoo**

Cape May Court House, NJ

**Facility Note:** No Wants & Needs Survey response received. Contact SSP Coordinator to update recommendations.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T5072 | 3692 | M | 11 | HOLD | CAPE MAY | DO NOT BREED | | Excluded - Generic |
| T5073 | 3693 | F | 11 | HOLD | CAPE MAY | DO NOT BREED | | Excluded - Generic |

## CHICAGOBR

**Chicago Zoological Park / Brookfield Zoo**

Brookfield, IL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 631 | 9192 | M | 6 | HOLD | CHICAGOBR | DO NOT BREED | | |
| 638 | 9191 | M | 6 | HOLD | CHICAGOBR | DO NOT BREED | | |

## CHICAGOLP

**Lincoln Park Zoological Gardens**

Chicago, IL

**Facility Note:** Male #644 can breed with either female #651, #659 or #660. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 644 | 24278 | M | 4 | HOLD | CHICAGOLP | BREED WITH | 651, 659, 660 | See Note |
| 651 | 24269 | F | 4 | HOLD | CHICAGOLP | BREED WITH | 644 | See Note |
| 659 | 24270 | F | 3 | HOLD | CHICAGOLP | BREED WITH | 644 | See Note |
| 660 | 24271 | F | 3 | HOLD | CHICAGOLP | BREED WITH | 644 | See Note |
| 764 | 24317 | M | 0 | HOLD | CHICAGOLP | DO NOT BREED | | |

## CINCINNAT

**Cincinnati Zoo & Botanical Garden**

Cincinnati, OH

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 409 | 113052 | M | 12 | HOLD | CINCINNAT | DO NOT BREED | | |
| 432 | 113056 | F | 11 | HOLD | CINCINNAT | DO NOT BREED | | |

## CLEVELAND

**Cleveland Metroparks Zoo**

Cleveland, OH

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 534 | 151203 | M | 8 | HOLD | CLEVELAND | DO NOT BREED | | |
| ~~T5057~~ | ~~120704~~ | ~~F~~ | ~~18~~ | ~~HOLD~~ | ~~CLEVELAND~~ | ~~DO NOT BREED~~ | | Died during comment period |
| T5058 | 120705 | F | 17 | HOLD | CLEVELAND | DO NOT BREED | | Excluded - Generic |

## COLO SPRG

**Cheyenne Mountain Zoological Park**

Colorado Springs, CO

**Facility Note:** Facility can send either male #612 or #613 to SD-WAP.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 303 | 27M060 | F | 15 | HOLD | COLO SPRG | DO NOT BREED | | Excluded - Spayed |
| 430 | 13M001 | M | 11 | HOLD | COLO SPRG | DO NOT BREED | | |
| 612 | 15M043 | M | 7 | SEND TO | SD-WAP | DO NOT BREED | | See Note |
| 613 | 15M044 | M | 7 | ~~SEND TO~~ HOLD | ~~SD-WAP~~ COLO SPRG | DO NOT BREED | | See Note |
| 614 | 15M045 | F | 7 | HOLD | COLO SPRG | DO NOT BREED | | |

## COLUMBIA

**Riverbanks Zoo and Garden**

Columbia, SC

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 215 | 9115 | M | 18 | HOLD | COLUMBIA | DO NOT BREED | | |
| 574 | 14039 | F | 7 | HOLD | COLUMBIA | DO NOT BREED | | |
| 575 | 14040 | F | 7 | HOLD | COLUMBIA | DO NOT BREED | | |

## DALLAS

**Dallas Zoo**

Dallas, TX

**Facility Note:** SSP is aware facility would like to place male cub #670 and will contact the facility when placement is found.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 332 | 10K247 | F | 14 | HOLD | DALLAS | DO NOT BREED | | Excluded - Spayed |
| 333 | 10K246 | F | 14 | HOLD | DALLAS | DO NOT BREED | | Excluded - Spayed |
| 625 | 20C063 | M | 5 | HOLD | DALLAS | ~~BREED WITH~~ DO NOT BREED | ~~630~~ | Changed during comment period |
| 630 | 17W086 | F | 5 | HOLD | DALLAS | ~~BREED WITH~~ DO NOT BREED | ~~625~~ | Excluded – Medical (Updated during comment period) |
| 670 | 20C301 | M | 2 | HOLD | DALLAS | DO NOT BREED | | See Note |
| 671 | 20C302 | F | 2 | SEND TO | MINOT | BREED WITH | 665 | |
| 672 | 20C303 | F | 2 | SEND TO | MINOT | BREED WITH | 665 | |

## DENVER

**Denver Zoological Garden**

Denver, CO

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 472 | A14252 | F | 10 | HOLD | DENVER | DO NOT BREED | | |
| 477 | A12252 | F | 10 | HOLD | DENVER | DO NOT BREED | | Excluded - Spayed |
| 576 | A16127 | M | 7 | HOLD | DENVER | DO NOT BREED | | |
| 577 | A16128 | M | 7 | HOLD | DENVER | DO NOT BREED | | |
| 578 | A16130 | M | 7 | HOLD | DENVER | DO NOT BREED | | |
| 579 | A16129 | M | 7 | HOLD | DENVER | DO NOT BREED | | |
| 605 | A15228 | F | 6 | HOLD | DENVER | DO NOT BREED | | |
| 606 | A18258 | M | 6 | HOLD | DENVER | DO NOT BREED | | |
| 675 | A20024 | F | 2 | HOLD | DENVER | DO NOT BREED | | |
| 676 | A20025 | M | 2 | SEND TO | ROLLING H | DO NOT BREED | | |
| 763 | A19068 | M | 3 | SEND TO | TOPEKA | DO NOT BREED | | |

## DES MOINE

**Blank Park Zoo of Des Moines**

Des Moines, IA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 389 | 3510 | F | 13 | HOLD | DES MOINE | DO NOT BREED | | |
| 407 | 2998 | F | 12 | HOLD | DES MOINE | DO NOT BREED | | Excluded - Spayed |
| 410 | 2997 | F | 12 | HOLD | DES MOINE | DO NOT BREED | | Excluded - Spayed |
| 415 | 2501 | M | 11 | HOLD | DES MOINE | DO NOT BREED | | |

## DETROIT

**Detroit Zoological Society**

Royal Oak, MI

**Facility Note:** Facility is asked to breed pair #473 and #619 once cub is placed.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 473 | 13030 | M | 13 | HOLD | DETROIT | ~~DO NOT BREED~~ BREED WITH | 619 | See Note (Updated during comment period) |
| 618 | 14033 | F | 6 | HOLD | DETROIT | DO NOT BREED | | Excluded - Spayed |
| 619 | 14034 | F | 6 | HOLD | DETROIT | ~~DO NOT BREED~~ BREED WITH | 473 | See Note (Updated during comment period) |
| 681 | 14155 | F | 1 | HOLD | DETROIT | DO NOT BREED | | |

## DICKERSON

**Dickerson Park Zoo**

Springfield, MO

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 273 | 6172 | M | 16 | HOLD | DICKERSON | DO NOT BREED | | |
| 300 | 6174 | F | 15 | HOLD | DICKERSON | DO NOT BREED | | |

## DISNEY AK

**Disney's Animal Kingdom**

Lake Buena Vista, FL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 388 | 120010 | M | 13 | HOLD | DISNEY AK | DO NOT BREED | | |
| 400 | 110898 | F | 12 | HOLD | DISNEY AK | DO NOT BREED | | Excluded - Spayed |
| 402 | 110899 | F | 12 | HOLD | DISNEY AK | DO NOT BREED | | Excluded - Spayed |

## DULUTH

**Lake Superior Zoological Gardens**

Duluth, MN

**Facility Note:** No Wants & Needs Survey response received. Contact SSP Coordinator to update recommendations.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T5060 | 100321 | F | 14 | HOLD | DULUTH | DO NOT BREED | | Excluded - Generic |

**EL PASO**

**El Paso Zoo**

El Paso, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 308 | 200963 | F | 14 | HOLD | EL PASO | DO NOT BREED | | Excluded - Medical |
| 309 | 200962 | F | 14 | HOLD | EL PASO | BREED WITH | 639 | |
| 639 | 202287 | M | 4 | HOLD | EL PASO | BREED WITH | 309 | |

**FORTWORTH** *(New AZA Facility)*

**Fort Worth Zoological Park**

Fort Worth, TX

**Facility Note:** Male #439 can breed with either female #440 or #441. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 439 | M20025 | M | 11 | RECEIVE FROM | ABILENE | BREED WITH | 440, 441 | See Note |
| 440 | M20023 | F | 11 | RECEIVE FROM | ABILENE | BREED WITH | 439 | See Note |
| 441 | M20024 | F | 11 | RECEIVE FROM | ABILENE | BREED WITH | 439 | See Note |

**FRANKLINP**

**Zoo New England, Franklin Park Zoo**

Boston, MA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 381 | A15008 | M | 13 | HOLD | FRANKLINP | DO NOT BREED | | |
| 382 | A15007 | M | 13 | HOLD | FRANKLINP | DO NOT BREED | | |

**FRESNO**

**Fresno Chaffee Zoo**

Fresno, CA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 509 | 206098 | F | 8 | HOLD | FRESNO | BREED WITH | 527 | |
| 527 | 206182 | M | 8 | HOLD | FRESNO | BREED WITH | 509 | |

**FT WAYNE**

**Fort Wayne Children's Zoo**

Fort Wayne, IN

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 230 | 98087 | F | 15 | HOLD | FT WAYNE | DO NOT BREED | | |
| 552 | 98970 | M | 8 | HOLD | FT WAYNE | DO NOT BREED | | |

**GARDENCTY**

**Lee Richardson Zoo**

Garden City, KS

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 243 | 107038 | M | 16 | HOLD | GARDENCTY | DO NOT BREED | | |
| 287 | 105036 | F | 17 | HOLD | GARDENCTY | DO NOT BREED | | |
| 539 | 116041 | M | 8 | HOLD | GARDENCTY | DO NOT BREED | | |
| 540 | 116042 | M | 8 | HOLD | GARDENCTY | DO NOT BREED | | |
| 580 | 115011 | F | 7 | HOLD | GARDENCTY | DO NOT BREED | | |

**GLEN OAK**

**Peoria Zoo in Glen Oak Park**

Peoria, IL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 229 | 1007 | F | 15 | HOLD | GLEN OAK | DO NOT BREED | | |
| 280 | 1008 | M | 16 | HOLD | GLEN OAK | DO NOT BREED | | |

**GRANBY**

**Zoo de Granby**

Granby, Quebec, Canada

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 656 | 207147 | F | 5 | RECEIVE FROM | SEATTLE | DO NOT BREED | | |
| T4747 | M02003 | F | 20 | HOLD | GRANBY | DO NOT BREED | | Excluded - Generic |
| T5086 | M14029 | M | 8 | HOLD | GRANBY | DO NOT BREED | | Excluded - Generic |
| T5087 | M15042 | F | 7 | HOLD | GRANBY | DO NOT BREED | | Excluded - Generic |

**GREENBAY**

**NEW Zoo**

Green Bay, WI

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 211 | 200604 | F | 17 | HOLD | GREENBAY | DO NOT BREED | | |
| 603 | 201764 | M | 7 | HOLD | GREENBAY | DO NOT BREED | | |

**GREENVISC**

**Greenville Zoo**

Greenville, SC

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 331 | M10012 | M | 14 | HOLD | GREENVISC | DO NOT BREED | | |
| 334 | M10013 | M | 14 | HOLD | GREENVISC | DO NOT BREED | | |

**HOGLE**

**Utah's Hogle Zoo**

Salt Lake City, UT

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 420 | U14003 | M | 11 | HOLD | HOGLE | DO NOT BREED | | |
| 422 | U14004 | M | 11 | HOLD | HOGLE | DO NOT BREED | | |
| 464 | 14001 | F | 9 | HOLD | HOGLE | DO NOT BREED | | |
| 465 | 14002 | F | 9 | HOLD | HOGLE | DO NOT BREED | | |
| 637 | U16002 | F | 6 | HOLD | HOGLE | DO NOT BREED | | |

**HONOLULU**

**Honolulu Zoo**

Honolulu, HI

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 373 | 210099 | F | 13 | HOLD | HONOLULU | DO NOT BREED | | |
| 593 | 215032 | M | 6 | RECEIVE FROM | INDIANAPL | DO NOT BREED | | |

**HOUSTON**

**Houston Zoo, Inc.**

Houston, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 352 | 25091 | F | 14 | HOLD | HOUSTON | DO NOT BREED | | |
| 354 | 25093 | F | 14 | HOLD | HOUSTON | DO NOT BREED | | |
| 564 | 32000 | M | 7 | HOLD | HOUSTON | DO NOT BREED | | |

**INDIANAPL**

**Indianapolis Zoo**

Indianapolis, IN

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 244 | 207178 | F | 16 | HOLD | INDIANAPL | DO NOT BREED | | |
| 593 | 215032 | M | 6 | SEND TO | HONOLULU | DO NOT BREED | | |
| 595 | 215034 | F | 6 | HOLD | INDIANAPL | DO NOT BREED | | |

**JACKSONVL**

**Jacksonville Zoo and Gardens**

Jacksonville, FL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 314 | 809320 | F | 14 | HOLD | JACKSONVL | DO NOT BREED | | |
| 345 | 809319 | M | 16 | HOLD | JACKSONVL | DO NOT BREED | | |
| 558 | 814347 | M | 7 | HOLD | JACKSONVL | DO NOT BREED | | |
| 559 | 814348 | F | 7 | HOLD | JACKSONVL | DO NOT BREED | | |

**JNGLARY F**

**The Naples Zoo**

Naples, FL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 281 | A5C085 | F | 16 | HOLD | JNGLARY F | DO NOT BREED | | |
| 369 | A8C061 | M | 14 | HOLD | JNGLARY F | DO NOT BREED | | |

**JOHN BALL**

**John Ball Zoo**

Grand Rapids, MI

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 261 | 303286 | F | 16 | HOLD | JOHN BALL | DO NOT BREED | | |
| 425 | 303891 | M | 11 | HOLD | JOHN BALL | DO NOT BREED | | |

**KANSASCTY**

**Kansas City Zoo**

Kansas City, MO

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 177 | M01021 | F | 21 | HOLD | KANSASCTY | DO NOT BREED | | Excluded - Spayed |
| 294 | M05045 | M | 17 | HOLD | KANSASCTY | DO NOT BREED | | Excluded - Neutered/Sterile |
| 295 | M05046 | M | 17 | HOLD | KANSASCTY | DO NOT BREED | | Excluded - Neutered/Sterile |
| 297 | M05048 | F | 17 | HOLD | KANSASCTY | DO NOT BREED | | Excluded - Spayed |

**KNOXVILLE**

**Knoxville Zoological Gardens**

Knoxville, TN

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 581 | 5794 | M | 7 | HOLD | KNOXVILLE | DO NOT BREED | | |
| 653 | 5869 | F | 4 | HOLD | KNOXVILLE | DO NOT BREED | | Excluded - Spayed |
| 750 | 6041 | F | 0 | HOLD | KNOXVILLE | DO NOT BREED | | |
| 751 | 6042 | M | 0 | HOLD | KNOXVILLE | DO NOT BREED | | |

**LANSING**

**Potter Park Zoological Gardens**

Lansing, MI

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 223 | 3070 | F | 18 | HOLD | LANSING | DO NOT BREED | | Excluded - Age Related Issues |
| 231 | 2872 | M | 15 | HOLD | LANSING | DO NOT BREED | | |

**LITTLEROC**

**Little Rock Zoological Gardens**

Little Rock, AR

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 560 | 7687 | F | 7 | HOLD | LITTLEROC | DO NOT BREED | | |
| 561 | 7688 | F | 7 | HOLD | LITTLEROC | DO NOT BREED | | |
| 628 | 7870 | M | 5 | HOLD | LITTLEROC | DO NOT BREED | | |

**LOUISVILL**

**Louisville Zoological Garden**

Louisville, KY

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 480 | 103720 | F | 9 | HOLD | LOUISVILL | BREED WITH | 573 | |
| 490 | 103719 | F | 9 | HOLD | LOUISVILL | DO NOT BREED | | |
| 573 | 103633 | M | 7 | HOLD | LOUISVILL | BREED WITH | 480 | |

**LUFKIN**

**Ellen Trout Zoo**

Lufkin, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 589 | L15059 | F | 7 | RECEIVE FROM | SAN ANTON | DO NOT BREED | | |
| 634 | 10667 | M | 6 | HOLD | LUFKIN | DO NOT BREED | | |

**MADISON**

**Henry Vilas Zoo**

Madison, WI

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 417 | 2879 | F | 11 | HOLD | MADISON | DO NOT BREED | | |
| 463 | 2933 | M | 9 | HOLD | MADISON | DO NOT BREED | | |

## MEMPHIS

**Memphis Zoological Garden & Aquarium**

Memphis, TN

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 376 | 23192 | F | 13 | HOLD | MEMPHIS | DO NOT BREED | | |
| 377 | 23193 | F | 13 | HOLD | MEMPHIS | DO NOT BREED | | |
| 380 | 23181 | M | 13 | HOLD | MEMPHIS | DO NOT BREED | | |

## METROZOO

**Zoo Miami**

Miami, FL

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 326 | M80128 | M | 15 | HOLD | METROZOO | DO NOT BREED | | |
| 327 | M80127 | M | 15 | HOLD | METROZOO | DO NOT BREED | | |
| 541 | 14M029 | F | 8 | HOLD | METROZOO | DO NOT BREED | | Excluded - Spayed |

## MILWAUKEE

**Milwaukee County Zoological Gardens**

Milwaukee, WI

**Facility Note:** Please contact SSP Coordinator when ready to receive a male.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 588 | 6097 | F | 7 | HOLD | MILWAUKEE | DO NOT BREED | | |
| 647 | 6098 | F | 4 | HOLD | MILWAUKEE | DO NOT BREED | | |
| 648 | 6099 | F | 4 | HOLD | MILWAUKEE | DO NOT BREED | | |

## MINOT

**Roosevelt Park Zoo**

Minot, ND

**Facility Note:** Male #666 can breed with either female #671 or #672. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 249 | 510 | M | 17 | HOLD | MINOT | DO NOT BREED | | |
| ~~665~~ | ~~20M002~~ | ~~M~~ | ~~2~~ | ~~RECEIVE FROM~~ | ~~AUDUBON~~ | ~~BREED WITH~~ | ~~671, 672~~ | Changed during comment period |
| 666 | 20M003 | M | 2 | RECEIVE FROM | AUDUBON | BREED WITH | 671, 672 | See Note (Changed during comment period) |
| 671 | 20C302 | F | 2 | RECEIVE FROM | DALLAS | BREED WITH | 666 | See Note |
| 672 | 20C303 | F | 2 | RECEIVE FROM | DALLAS | BREED WITH | 666 | See Note |

## NORFOLK

**Virginia Zoological Park**

Norfolk, VA

**Facility Note:** Male #627 can breed with either female #642 or #643. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 627 | 222005 | M | 5 | HOLD | NORFOLK | BREED WITH | 642, 643 | See Note |
| 642 | 222042 | F | 4 | HOLD | NORFOLK | BREED WITH | 627 | See Note |
| 643 | 222043 | F | 4 | HOLD | NORFOLK | BREED WITH | 627 | See Note |

## NY BRONX

**Bronx Zoo/Wildlife Conservation Society**

Bronx, NY

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 501 | M13140 | M | 9 | HOLD | NY BRONX | DO NOT BREED | | |
| 502 | M13141 | M | 9 | HOLD | NY BRONX | DO NOT BREED | | |
| 503 | M13142 | M | 9 | HOLD | NY BRONX | DO NOT BREED | | |

## NZP-WASH

**Smithsonian National Zoological Park**

Washington, DC

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| ~~246~~ | ~~114162~~ | ~~F~~ | ~~18~~ | ~~HOLD~~ | ~~NZP-WASH~~ | ~~DO NOT BREED~~ | | Died during comment period |
| 247 | 114163 | F | 17 | HOLD | NZP-WASH | DO NOT BREED | | Excluded - Spayed |
| ~~248~~ | ~~114161~~ | ~~M~~ | ~~16~~ | ~~HOLD~~ | ~~NZP-WASH~~ | ~~DO NOT BREED~~ | | Died during comment period |
| 525 | 115033 | M | 8 | HOLD | NZP-WASH | DO NOT BREED | | |
| 526 | 115034 | M | 8 | HOLD | NZP-WASH | DO NOT BREED | | |
| 528 | 115036 | F | 8 | HOLD | NZP-WASH | DO NOT BREED | | |

## OAKLAND

**Oakland Zoo**

Oakland, CA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 570 | 3709 | M | 7 | HOLD | OAKLAND | DO NOT BREED | | |
| 571 | 3710 | M | 7 | SEND TO | SEATTLE | BREED WITH | 657 | |
| 572 | 3711 | M | 7 | HOLD | OAKLAND | DO NOT BREED | | |

## OKLAHOMA

**Oklahoma City Zoological Park**

Oklahoma City, OK

**Facility Note:** Male #426 can breed with either female #582 or #584. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 426 | 773240 | M | 11 | HOLD | OKLAHOMA | BREED WITH | 582, 584 | See Note |
| 582 | 773341 | F | 7 | HOLD | OKLAHOMA | BREED WITH | 426 | See Note |
| 584 | 773342 | F | 7 | HOLD | OKLAHOMA | BREED WITH | 426 | See Note |
| 767 | 784751 | M | 0 | HOLD | OKLAHOMA | DO NOT BREED | | Born during comment period |
| 768 | 784752 | F | 0 | HOLD | OKLAHOMA | DO NOT BREED | | Born during comment period |
| 769 | 784753 | F | 0 | HOLD | OKLAHOMA | DO NOT BREED | | Born during comment period |
| 770 | 784754 | F | 0 | HOLD | OKLAHOMA | DO NOT BREED | | Born during comment period |

## OMAHA

**Omaha's Henry Doorly Zoo**

Omaha, NE

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 347 | 18472 | F | 15 | HOLD | OMAHA | DO NOT BREED | | |
| 378 | 18473 | F | 14 | HOLD | OMAHA | DO NOT BREED | | |
| 567 | 23124 | M | 7 | HOLD | OMAHA | DO NOT BREED | | |
| 568 | 23125 | M | 7 | HOLD | OMAHA | DO NOT BREED | | |
| 569 | 23126 | F | 7 | HOLD | OMAHA | DO NOT BREED | | |

## PHILADELP

**Philadelphia Zoo**

Philadelphia, PA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 379 | 104872 | M | 13 | HOLD | PHILADELP | DO NOT BREED | | |
| 405 | 104878 | F | 12 | HOLD | PHILADELP | DO NOT BREED | | |

## PHOENIX

**Phoenix Zoo**

Phoenix, AZ

**Facility Note:** Male #597 can breed with either female #640 or #641. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 597 | 14086 | M | 7 | HOLD | PHOENIX | BREED WITH | 640, 641 | See Note |
| 640 | M37018 | F | 4 | RECEIVE FROM | PUEBLO | BREED WITH | 597 | See Note |
| 641 | M37019 | F | 4 | RECEIVE FROM | PUEBLO | BREED WITH | 597 | See Note |

**PORTLAND**

**Oregon Zoo**

Portland, OR

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 312 | A90136 | M | 14 | HOLD | PORTLAND | DO NOT BREED | | |
| 329 | A90159 | F | 15 | HOLD | PORTLAND | DO NOT BREED | | Excluded - Spayed |
| 341 | A90157 | F | 15 | HOLD | PORTLAND | DO NOT BREED | | Excluded - Spayed |
| 565 | 401197 | F | 7 | ~~SEND TO~~ HOLD | ~~SAN FRAN~~ PORTLAND | DO NOT BREED | | Changed during comment period |
| 566 | B40198 | F | 7 | ~~SEND TO~~ HOLD | ~~SAN FRAN~~ PORTLAND | DO NOT BREED | | Changed during comment period |

**PUEBLA**

**Africam Safari**

Puebla, Mexico

**Facility Note:** Please keep SSP Coordinator updated on current animal holdings.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 336 | 7401 | M | 14 | HOLD | PUEBLA | DO NOT BREED | | |
| 337 | 7402 | M | 14 | HOLD | PUEBLA | DO NOT BREED | | |
| 421 | 8384 | F | 11 | HOLD | PUEBLA | DO NOT BREED | | |
| 680 | 9918 | F | 5 | HOLD | PUEBLA | DO NOT BREED | | |
| 683 | 11500 | M | 1 | HOLD | PUEBLA | DO NOT BREED | | |
| 684 | 11501 | M | 1 | HOLD | PUEBLA | DO NOT BREED | | |
| 685 | 9916 | F | 5 | HOLD | PUEBLA | DO NOT BREED | | |
| 686 | 11428 | F | 1 | HOLD | PUEBLA | DO NOT BREED | | |
| 687 | 11429 | F | 1 | HOLD | PUEBLA | DO NOT BREED | | |
| 688 | 11184 | F | 2 | HOLD | PUEBLA | DO NOT BREED | | |
| 694 | 9917 | F | 5 | HOLD | PUEBLA | DO NOT BREED | | |
| 691 | 11083 | F | 3 | HOLD | PUEBLA | DO NOT BREED | | |
| 692 | 10210 | F | 4 | HOLD | PUEBLA | DO NOT BREED | | |
| 693 | 10211 | F | 4 | HOLD | PUEBLA | DO NOT BREED | | |
| 695 | 10212 | F | 4 | HOLD | PUEBLA | DO NOT BREED | | |
| 696 | 9820 | F | 5 | HOLD | PUEBLA | DO NOT BREED | | |
| 697 | 9821 | F | 5 | HOLD | PUEBLA | DO NOT BREED | | |
| 698 | 9822 | F | 5 | HOLD | PUEBLA | DO NOT BREED | | |
| 699 | 9823 | F | 5 | HOLD | PUEBLA | DO NOT BREED | | |
| 700 | 9592 | M | 6 | HOLD | PUEBLA | DO NOT BREED | | |
| 701 | 9593 | F | 6 | HOLD | PUEBLA | DO NOT BREED | | |
| 702 | 9594 | F | 6 | HOLD | PUEBLA | DO NOT BREED | | |
| 703 | 9455 | M | --- | HOLD | PUEBLA | DO NOT BREED | | |
| 704 | 9343 | M | 6 | HOLD | PUEBLA | DO NOT BREED | | |
| 705 | 9279 | F | 6 | HOLD | PUEBLA | DO NOT BREED | | |
| 742 | 11427 | M | 1 | HOLD | PUEBLA | DO NOT BREED | | |
| 743 | 10209 | M | 4 | HOLD | PUEBLA | DO NOT BREED | | |
| 744 | 11170 | M | 2 | HOLD | PUEBLA | DO NOT BREED | | |

**PUEBLO**

**Pueblo Zoo**

Pueblo, CO

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 190 | M23038 | M | 20 | HOLD | PUEBLO | BREED WITH | 292 | |
| 292 | M31033 | F | 16 | HOLD | PUEBLO | BREED WITH | 190 | |
| 640 | M37018 | F | 4 | SEND TO | PHOENIX | BREED WITH | 597 | |
| 641 | M37019 | F | 4 | SEND TO | PHOENIX | BREED WITH | 597 | |

**RACINE**

**Racine Zoological Gardens**

Racine, WI

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 428 | M1206 | F | 11 | HOLD | RACINE | DO NOT BREED | | |
| 551 | M1417 | F | 8 | HOLD | RACINE | DO NOT BREED | | |

**ROCHESTER**

**Seneca Park Zoo**

Rochester, NY

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 448 | 105852 | M | 11 | HOLD | ROCHESTER | BREED WITH | 449 | |
| 449 | 105853 | F | 11 | HOLD | ROCHESTER | BREED WITH | 448 | |
| 450 | 105854 | F | 11 | HOLD | ROCHESTER | DO NOT BREED | | Excluded - Spayed |

**ROLLING H**

**Rolling Hills Zoo**

Salina, KS

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 518 | 190607 | F | 8 | HOLD | ROLLING H | DO NOT BREED | | |
| 519 | 190606 | F | 8 | HOLD | ROLLING H | DO NOT BREED | | |
| 676 | A20025 | M | 2 | RECEIVE FROM | DENVER | DO NOT BREED | | |

**S BARBARA**

**Santa Barbara Zoological Gardens**

Santa Barbara, CA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 594 | 701215 | M | 6 | HOLD | S BARBARA | BREED WITH | 652 | |
| 652 | 701214 | F | 4 | HOLD | S BARBARA | BREED WITH | 594 | |
| 673 | 701227 | F | 1 | ~~HOLD~~ SEND TO | ~~S BARBARA~~ BOISE | DO NOT BREED | | Updated during comment period |

**SACRAMNTO**

**Sacramento Zoo**

Sacramento, CA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 262 | 101120 | M | 16 | HOLD | SACRAMNTO | DO NOT BREED | | |
| 282 | 101108 | F | 16 | HOLD | SACRAMNTO | DO NOT BREED | | |

**SAN ANTON**

**San Antonio Zoological Gardens & Aquarium**

San Antonio, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 317 | N13042 | F | 14 | HOLD | SAN ANTON | DO NOT BREED | | |
| 342 | N13041 | M | 15 | HOLD | SAN ANTON | DO NOT BREED | | |
| 589 | L15059 | F | 7 | SEND TO | LUFKIN | DO NOT BREED | | |

**SAN FRAN**

**San Francisco Zoological Gardens**

San Francisco, CA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 206 | 109029 | F | 20 | HOLD | SAN FRAN | DO NOT BREED | | |
| ~~565~~ | ~~401197~~ | ~~F~~ | ~~7~~ | ~~RECEIVE FROM~~ | ~~PORTLAND~~ | ~~DO NOT BREED~~ | | Updated during comment period |
| ~~566~~ | ~~B40198~~ | ~~F~~ | ~~7~~ | ~~RECEIVE FROM~~ | ~~PORTLAND~~ | ~~DO NOT BREED~~ | | Updated during comment period |
| 592 | 115010 | M | 7 | HOLD | SAN FRAN | DO NOT BREED | | |

**SANDIEGOZ**

**San Diego Zoo**

San Diego, CA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 546 | 614316 | M | 8 | HOLD | SANDIEGOZ | DO NOT BREED | | Excluded - Neutered/Sterile |
| 549 | 614319 | F | 8 | HOLD | SANDIEGOZ | DO NOT BREED | | Excluded - Spayed |

**SD-WAP**

**San Diego Zoo Safari Park**

Escondido, CA

**Facility Note:** COLO SPRG can send either male #612 or #613.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 535 | 614246 | F | 8 | HOLD | SD-WAP | DO NOT BREED | | |
| 536 | 4004439 | F | 8 | HOLD | SD-WAP | DO NOT BREED | | |
| 537 | 4004440 | F | 8 | HOLD | SD-WAP | DO NOT BREED | | |
| 612 | 15M043 | M | 7 | RECEIVE FROM | COLO SPRG | DO NOT BREED | | See Note |
| ~~613~~ | ~~15M044~~ | ~~M~~ | ~~7~~ | ~~RECEIVE FROM~~ | ~~COLO SPRG~~ | ~~DO NOT BREED~~ | | Changed during comment period |

**SEATTLE**

**Woodland Park Zoo**

Seattle, WA

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 571 | 3710 | M | 7 | RECEIVE FROM | OAKLAND | BREED WITH | 657 | |
| 656 | 207147 | F | 5 | SEND TO | GRANBY | DO NOT BREED | | |
| 657 | 207146 | F | 5 | HOLD | SEATTLE | BREED WITH | 571 | |

**SEDGWICK**

**Sedgwick County Zoo**

Wichita, KS

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 367 | 12236 | M | 14 | HOLD | SEDGWICK | DO NOT BREED | | |
| 383 | 13138 | F | 13 | HOLD | SEDGWICK | DO NOT BREED | | Excluded - Non-cycling |

**SEOUL**

**Seoul Zoo**

Gwacheon-city, Gyeonggi-do, South Korea

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T5129 | M7-7-10-39 | F | 17 | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |
| T5132 | M7-7-10-43 | F | 16 | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |
| T5134 | M7-7-10-69 | M | 11 | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |
| T5135 | M7-7-10-68 | M | 11 | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |
| T5136 | M7-7-10-66 | F | --- | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |
| T5137 | M7-7-10-71 | M | 11 | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |
| T5140 | M7-7-10-64 | F | 11 | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |
| T5178 | M7-7-10-73 | M | 7 | HOLD | SEOUL | DO NOT BREED | | Excluded - Generic |

**SOUTHBEND** *(New AZA Facility)*

**Potawatomi Zoo**

South Bend, IN

**Facility Note:** Male #486 can breed either female #487 or #488. Only breed one female at a time.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 486 | 65463 | M | 9 | RECEIVE FROM | BUSCH TAM | BREED WITH | 487, 488 | See Note |
| 487 | 65464 | F | 9 | RECEIVE FROM | BUSCH TAM | BREED WITH | 486 | See Note |
| 488 | 65465 | F | 9 | RECEIVE FROM | BUSCH TAM | BREED WITH | 486 | See Note |

**ST LOUIS**

**Saint Louis Zoological Park**

St Louis, MO

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 316 | 107059 | M | 14 | HOLD | ST LOUIS | DO NOT BREED | | |
| 346 | 105701 | F | 16 | HOLD | ST LOUIS | DO NOT BREED | | |

**ST PAUL**

**Como Park Zoo and Conservatory**

Saint Paul, MN

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 583 | 5217 | F | 7 | HOLD | ST PAUL | DO NOT BREED | | |
| 596 | 5179 | M | 6 | HOLD | ST PAUL | DO NOT BREED | | |

**TAUTPHAUS**

**Idaho Falls Zoo at Tautphaus Park**

Idaho Falls, ID

**Facility Note:** Please contact SSP Coordinator when ready to receive an animal.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 200 | K9M027 | F | 19 | HOLD | TAUTPHAUS | DO NOT BREED | | |
| 629 | 17M003 | M | 5 | HOLD | TAUTPHAUS | DO NOT BREED | | |

**TOPEKA**

**Topeka Zoological Park**

Topeka, KS

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 276 | 107105 | F | 18 | HOLD | TOPEKA | DO NOT BREED | | Excluded - Age Related Issues |
| 277 | 107205 | F | 18 | HOLD | TOPEKA | DO NOT BREED | | Excluded - Age Related Issues |
| 763 | A19068 | M | 3 | RECEIVE FROM | DENVER | DO NOT BREED | | |

**TORONTO**

**Toronto Zoo**

Scarborough, Ontario, Canada

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T5079 | 45626 | F | 11 | HOLD | TORONTO | DO NOT BREED | | Excluded - Generic |
| T5080 | 45627 | F | 11 | HOLD | TORONTO | DO NOT BREED | | Excluded - Generic |
| T5081 | 45851 | M | 11 | HOLD | TORONTO | DO NOT BREED | | Excluded - Generic |

**TUCSON**

**Reid Park Zoo**

Tucson, AZ

**Facility Note:** No Wants & Needs Survey response received. Contact SSP Coordinator to update recommendations.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 318 | T95339 | F | 14 | HOLD | TUCSON | DO NOT BREED | | |
| 530 | M13058 | F | 8 | HOLD | TUCSON | DO NOT BREED | | |
| 591 | M20140 | M | 7 | HOLD | TUCSON | DO NOT BREED | | |

**TULSA**

**Tulsa Zoo**

Tulsa, OK

**Facility Note:** Please contact SSP Coordinator when ready to receive animals.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 205 | 15310 | F | 20 | HOLD | TULSA | DO NOT BREED | | Excluded - Spayed |
| 604 | 18130 | M | 6 | HOLD | TULSA | DO NOT BREED | | |

**UTICA**

**Utica Zoo**

Utica, NY

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T5099 | 111022 | M | 11 | HOLD | UTICA | DO NOT BREED | | Excluded - Generic |
| T5103 | 112016 | M | 10 | HOLD | UTICA | DO NOT BREED | | Excluded - Generic |
| T5105 | 112017 | F | 10 | HOLD | UTICA | DO NOT BREED | | Excluded - Generic |

**W ORANGE**

**Turtle Back Zoo**

West Orange, NJ

**Facility Note:** Please contact SSP Coordinator when ready to receive animals.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 238 | 934 | F | 18 | HOLD | W ORANGE | DO NOT BREED | | Excluded - Age Related Issues |
| 562 | 1995 | M | 7 | HOLD | W ORANGE | DO NOT BREED | | |

## W PALM BE

**Lion Country Safari Inc - Florida**

Loxahatchee, FL

**Facility Note:** Facility should only breed to facility capacity. These pairings are for demographic purposes only.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 470 | M14047 | F | 9 | HOLD | W PALM BE | BREED WITH | 553, 554 | See Note |
| 471 | M14046 | F | 9 | HOLD | W PALM BE | BREED WITH | 553, 554 | See Note |
| 492 | M14048 | F | 9 | HOLD | W PALM BE | BREED WITH | 553, 554 | See Note |
| 521 | M14186 | M | 8 | HOLD | W PALM BE | DO NOT BREED | | |
| 538 | M14187 | M | 8 | HOLD | W PALM BE | DO NOT BREED | | Excluded - Neutered/Sterile |
| 553 | M20056 | M | 8 | HOLD | W PALM BE | BREED WITH | 470, 471, 492 | See Note |
| 554 | M20057 | M | 8 | HOLD | W PALM BE | BREED WITH | 470, 471, 492 | See Note |
| 689 | M19174 | M | 2 | HOLD | W PALM BE | DO NOT BREED | | Excluded - Neutered/Sterile |
| 690 | M19175 | F | 2 | HOLD | W PALM BE | DO NOT BREED | | |

## WACO

**Cameron Park Zoo**

Waco, TX

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 467 | M00114 | M | 9 | HOLD | WACO | DO NOT BREED | | |
| 505 | M01415 | F | 8 | HOLD | WACO | DO NOT BREED | | |
| 649 | M01117 | F | 4 | HOLD | WACO | DO NOT BREED | | |

## WINSTON

**Wildlife Safari Inc**

Winston, OR

**Facility Note:** Either male (#475 or #476) can breed with either female (#435 or #436). Facility should only breed to facility capacity.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| 435 | 270655 | F | 10 | HOLD | WINSTON | BREED WITH | 475, 476 | See Note |
| 436 | 270656 | F | 10 | HOLD | WINSTON | BREED WITH | 475, 476 | See Note |
| 475 | 270586 | M | 10 | HOLD | WINSTON | BREED WITH | 435, 436 | See Note |
| 476 | 270587 | M | 10 | HOLD | WINSTON | BREED WITH | 435, 436 | See Note |

**YONG IN**

**Everland Zoological Gardens**

Yongin-si, Gyeonggido, Republic of Korea

**Facility Note:** Please contact SSP Coordinator to discuss current holdings.

| SB ID | Local ID | Sex | Age | Disposition | Location | Breeding | With | Notes |
|---|---|---|---|---|---|---|---|---|
| T5141 | 5197 | M | 17 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5142 | 5205 | M | 14 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5143 | 5220 | F | 14 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5144 | 5211 | F | 14 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5145 | 5218 | F | 13 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5146 | 5196 | F | 12 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5148 | 5221 | F | 11 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5149 | 5198 | F | 11 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5150 | 5219 | M | 11 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5151 | 5203 | M | 11 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5152 | 5213 | F | 11 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5153 | 5222 | M | 10 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5154 | 5208 | M | 10 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5155 | 5209 | M | 10 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5156 | 5207 | M | 10 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5157 | 5216 | F | 10 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5158 | 5214 | F | 9 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5159 | 5217 | F | 9 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5160 | 5195 | F | 9 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5162 | 5202 | M | 9 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5163 | 5184 | F | 8 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5164 | 5210 | M | 8 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5165 | 5201 | M | 8 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5166 | 5187 | F | 8 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5167 | 5192 | F | 8 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5168 | 5193 | M | 8 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5169 | 5223 | M | 7 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5170 | 5224 | M | 7 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5171 | 5320 | M | 7 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5172 | 5321 | F | 6 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5174 | 6289 | M | 4 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5176 | 511 | M | 4 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |
| T5177 | 512 | M | 4 | HOLD | YONG IN | DO NOT BREED | | Excluded - Generic |

# Appendices

## A. Analytical Assumptions

**HYPOTHETICAL INDIVIDUALS**

| SB ID | Sire | Dam | Sex | Notes |
|---|---|---|---|---|
| HYP1 | WILD | WILD | Male | Hypothetical sire of captive born 105 (with wild caught grandparents) |
| HYP10 | WILD | WILD | Female | Hypothetical individual to represent real dam, Tanya, who is not yet recorded in the studbook, but information received from the Farm Inn Zoo in Pretoria list "Tanya" and "Apollo" as the known sire dam and sire, respectively. |
| HYP11 | HYP12 | HYP13 | Male | Hypothetical individual to represent real sire, Apollo, who is not yet recorded in the studbook, but information received from the Farm Inn Zoo in Pretoria list "Tanya" and "Apollo" as the known dam and sire, respectively. Apollo's mother, "Casey" (HYP13), is also the dam of individuals 255, 256, and 259, so HYP#s were used to connect these two litters. |
| HYP12 | WILD | WILD | Male | Hypothetical individual to represent the hypothetical wild caught grandfather of individuals 252 to 254. |
| HYP13 | WILD | WILD | Female | Hypothetical individual to represent the known grandmother, "Tania," of 252 - 254, who is also the mother of individuals 255 - 257 and is not yet recorded in the studbook. This information was received by the SSP coordinator from the Farm Inn Zoo in Pretoria, and HYP#s were used to connect these two litters. |
| HYP14 | WILD | WILD | Male | Hypothetical individual to represent known sire ("Tao") of individuals 255 - 257. Information received from the Farm Inn Zoo in Pretoria list "Casey" and "Tao" as the known dam and sire, respectively, for individuals 255-257. Casey is also listed as the grandmother of individuals 252 - 254. However, these historical parents and grandparents are not yet recorded in the studbook, so instead HYP#s were used to connect these litters. |
| HYP2 | WILD1 | WILD3 | Female | Hypothetical individual to represent the dam of captive born 105, who shares a grandparent (WILD1) with 95 in order to establish potential relatedness. |
| HYP3 | WILD1 | WILD4 | Male | Hypothetical sire of captive born 95, who also shares a grand-sire (WILD1) with 105 in order to establish possible relatedness. |
| HYP4 | WILD2 | WILD5 | Female | Hypothetical dam of captive born 95, who also shares a grand-sire (WILD2) with 106 in order to establish possible relatedness. |
| HYP5 | WILD2 | WILD12 | Male | Hypothetical sire of captive born 106, who also shares a grand-sire (WILD2) with 95 in order to establish possible relatedness. |
| HYP6 | WILD | WILD | Female | Hypothetical dam of captive born 106 (with wild caught grandparents) |
| HYP7 | WILD | WILD | Male | Hypothetical individual to represent a wild caught sire connecting 233 and 235 as assumed half siblings. 233 and 235 were captured at same location but months apart. |
| HYP8 | WILD | WILD | Female | Hypothetical individual to represent a wild caught dam of 233 |
| HYP9 | WILD | WILD | Female | Hypothetical individual to represent a wild caught dam of 235 |

**ANALYTICAL DATA FOR TRUE INDIVIDUALS**

| ID | Field | TRUE | Overlay | Notes |
|---|---|---|---|---|
| 15 | Dam | WILD | WILD7 | 15, 16, 17, 18, 19, 20 all captured on same date and location so assumed to be full siblings |
| | Sire | WILD | WILD6 | |
| 16 | Dam | WILD | WILD7 | 15, 16, 17, 18, 19, 20 all captured on same date and location so assumed to be full siblings |
| | Sire | WILD | WILD6 | |
| 17 | Dam | WILD | WILD7 | 15, 16, 17, 18, 19, 20 all captured on same date and location so assumed to be full siblings |
| | Sire | WILD | WILD6 | |
| 18 | Dam | WILD | WILD7 | 15, 16, 17, 18, 19, 20 all captured on same date and location so assumed to be full siblings |
| | Sire | WILD | WILD6 | |
| 19 | Dam | WILD | WILD7 | 15, 16, 17, 18, 19, 20 all captured on same date and location so assumed to be full siblings |
| | Sire | WILD | WILD6 | |
| 20 | Dam | WILD | WILD7 | 15, 16, 17, 18, 19, 20 all captured on same date and location so assumed to be full siblings |
| | Sire | WILD | WILD6 | |
| 41 | Dam | WILD | WILD11 | 41 and 42 were captured in the same location on the same date, assumed to be full siblings. |
| | Sire | WILD | WILD10 | |
| 42 | Dam | WILD | WILD11 | 41 and 42 were captured in the same location on the same date, assumed to be full siblings. |
| | Sire | WILD | WILD10 | |
| 47 | Dam | WILD | WILD9 | 47 and 48 were captured in the same location on the same date, assumed to be full siblings |
| | Sire | WILD | WILD8 | |
| 48 | Dam | WILD | WILD9 | 47 and 48 were captured in the same location on the same date, assumed to be full siblings |
| | Sire | WILD | WILD8 | |
| 83 | Dam | UNK | HYP2 | Historical notes: "Captive born at GHIAZZA, unrelated to 105/106; Inadequate records to ensure not related to 95/97 so shares grandparents with them." HYPs were simplified for 2013, but 95 still shares a grandparent with 83 (WILD1) and 106 (WILD2) each to establish potential relatedness. 97 was not included since dead with no living descendants. |
| | Sire | UNK | HYP1 | |
| 95 | Dam | UNK | HYP4 | Historical notes: "Captive born at GHIAZZA, unrelated to 97; Inadequate records to ensure not related to 83, 105, 106 so shares grandparents with them." HYPs were simplified for 2013, but 95 still shares a grandparent with 83 (WILD1) and 106 (WILD2) each to establish potential relatedness. 105 was not included since older with no living descendants and further research identified known parents. |
| | Sire | UNK | HYP3 | |
| 98 | Dam | UNK | WILD | Captive born, dam from E. Transvaal, unrelated to other E. Transvaal cats exported to N. America. Assumed unrelated to the managed population. |
| | Sire | UNK | WILD | |
| 106 | Dam | UNK | HYP6 | Captive born, unrelated to 83, 105. Inadequate records to ensure unrelated to 95 and 97 so shares a grandparent with 95 (97 is dead with no living descendants) |
| | Sire | UNK | HYP5 | |
| 173 | Dam | UNK | 357 | Lincoln Park records indicate 173 had the same mother (357) as 124. Could also be related to 103 so he shares the same sire (100). |
| | Sire | UNK | 100 | |
| 232 | Dam | UNK | WILD | Captive born animal from OUDTSHORN, imported to COLUMBUS, whose parents are assumed to be wild and unrelated to the managed population. |
| | Sire | UNK | WILD | |
| 233 | Dam | WILD | HYP8 | 233 and 235 were captured at same location but about 1 month apart, assumed to be half sibs and share sire HYP7 |
| | Sire | WILD | HYP7 | |
| 235 | Dam | WILD | HYP9 | 233 and 235 were captured at same location but about 1 month apart, assumed to be half sibs and share sire HYP7 |
| | Sire | WILD | HYP7 | |

| ID | Field | TRUE | Overlay | Notes |
|---|---|---|---|---|
| 252 | Dam | UNK | HYP10 | Hypothetical parents to represent known sire ("Apollo") and dam ("Tania") of assumed full siblings 252 - 254 (captured at the same location on the same date). Information received from the Farm Inn Zoo in Pretoria note that the dam of "Apollo" ("Casey") is also the dam of 255 - 257. However, these historical parents and grandparents are not yet recorded in the studbook, so instead HYP#s were used to connect these two litters. |
| | Sire | UNK | HYP11 | |
| 253 | Dam | UNK | HYP10 | Hypothetical parents to represent known sire ("Apollo") and dam ("Tania") of assumed full siblings 252 - 254 (captured at the same location on the same date). Information received from the Farm Inn Zoo in Pretoria note that the dam of "Apollo" ("Casey") is also the dam of 255 - 257. However, these historical parents and grandparents are not yet recorded in the studbook, so instead HYP#s were used to connect these two litters. |
| | Sire | UNK | HYP11 | |
| 254 | Dam | UNK | HYP10 | Hypothetical parents to represent known sire ("Apollo") and dam ("Tania") of assumed full siblings 252 - 254 (captured at the same location on the same date). Information received from the Farm Inn Zoo in Pretoria note that the dam of "Apollo" ("Casey") is also the dam of 255 - 257. However, these historical parents and grandparents are not yet recorded in the studbook, so instead HYP#s were used to connect these two litters. |
| | Sire | UNK | HYP11 | |
| 255 | Dam | WILD | HYP13 | Hypothetical parents to represent known sire ("Tao") and dam ("Casey") of assumed full siblings 255 - 257 (captured at the same location on the same date). Information received from the Farm Inn Zoo in Pretoria note that "Casey" is also the grandmother of 252 - 254. However, these historical parents and grandparents are not yet recorded in the studbook, so instead HYP#s are used to connect these two litters. |
| | Sire | WILD | HYP14 | |
| 256 | Dam | WILD | HYP13 | Hypothetical parents to represent known sire ("Tao") and dam ("Casey") of assumed full siblings 255 - 257 (captured at the same location on the same date). Information received from the Farm Inn Zoo in Pretoria note that "Casey" is also the grandmother of 252 - 254. However, these historical parents and grandparents are not yet recorded in the studbook, so instead HYP#s are used to connect these two litters. |
| | Sire | WILD | HYP14 | |
| 257 | Dam | WILD | HYP13 | Hypothetical parents to represent known sire ("Tao") and dam ("Casey") of assumed full siblings 255 - 257 (captured at the same location on the same date). Information received from the Farm Inn Zoo in Pretoria note that "Casey" is also the grandmother of 252 - 254. However, these historical parents and grandparents are not yet recorded in the studbook, so instead HYP#s are used to connect these two litters. |
| | Sire | WILD | WILD14 | |
| 397 | Dam | UNK | WILD | To represent parent of NZP-WASH import (248) from BESTER, assumed to be unrelated to the AZA population |
| | Sire | UNK | WILD | |
| 398 | Dam | UNK | WILD | To represent parent of NZP-WASH import (248) from BESTER, assumed to be unrelated to the AZA population |
| | Sire | UNK | WILD | |
| 441 | Sire | 446 | 456 | 441 was imported from Uitspan Lion Farm. Records indicate sire 446's name is Barby, which is similar name to the sire of 449 (456) ... it is possible that 456 and 446 may be the same individual, so to be conservative until more information can be gathered, make the sire of 441 the same as 449. |
| 451 | Dam | UNK | WILD | 451 and 452 are parents of 448, imported from Uitspan Lion Farm, South Africa by Bester. Records indicate both animals were wild caught. |
| | Sire | UNK | WILD | |
| 454 | Dam | UNK | WILD | Parent of 450, imported from Uitspan Lion Farm, South Africa by Bester. Captive born at Uitspan, unrelated to 452. Assumed unrelated to the managed population. |
| | Sire | UNK | WILD | |
| 482 | Dam | UNK | WILD | To represent parent of BUSCH TAM import (486) from BESTER, assumed to be unrelated to the AZA population |
| | Sire | UNK | WILD | |

| ID | Field | TRUE | Overlay | Notes |
|---|---|---|---|---|
| 483 | Dam<br>Sire | UNK<br>UNK | WILD<br>WILD | To represent parent of BUSCH TAM import (486) from BESTER, assumed to be unrelated to the AZA population |
| 484 | Dam<br>Sire | UNK<br>UNK | WILD<br>WILD | To represent parent of BUSCH TAM imports (487 and 488) from BESTER, assumed to be unrelated to the rest of the population |
| 485 | Dam<br>Sire | UNK<br>UNK | WILD<br>WILD | To represent parent of BUSCH TAM imports (487 and 488) from BESTER, assumed to be unrelated to the rest of the population |
| 499 | Sire | MULT | PMx MULT | Assigned potential sires 326 and 327 as MULT1 |
| 521 | Sire | MULT | PMx MULT | Assigned potential sires 326 and 327 as MULT1 |
| 538 | Sire | MULT | PMx MULT | Assigned potential sires 326 and 327 as MULT1 |
| 539 | Sire | MULT | PMx MULT | Assigned potential sires 326 and 327 as MULT1 |
| 540 | Sire | MULT | PMx MULT | Assigned potential sires 326 and 327 as MULT1 |
| 541 | Sire | MULT | PMx MULT | Assigned potential sires 326 and 327 as MULT1 |
| 581 | Sire | MULT | PMx MULT | Assigned potential sires 475 and 476 as MULT2 |
| 582 | Sire | MULT | PMx MULT | Assigned potential sires 475 and 476 as MULT2 |
| 583 | Sire | MULT | PMx MULT | Assigned potential sires 475 and 476 as MULT2 |
| 584 | Sire | MULT | PMx MULT | Assigned potential sires 475 and 476 as MULT2 |

| MULTs | NOTES |
|---|---|
| ID: MULT1<br>*SIRES: 326; 327 | Brothers, still living with no known living descendants. Assume equal probability for each of being the true sire. |
| ID: MULT2<br>*SIRES: 475; 476 | Brothers, still living, but only 475 has known living descendants. Assume equal probability for each of being the true sire. |

# B. Summary of Data Exports

| | |
|---|---|
| **Studbook Name** | Lion (*Panthera leo*) |
| **Studbook Currentness Date** | Apr 30, 2022 |
| **Studbook Software and version #** | ZIMS for Studbooks (Aug 30, 2022) |
| **Overlay Name (if applicable)** | Overlay_2021 |
| **PMx version #** | 1.6.5.20220325 |
| **.fed file** | AZA.fed |
| **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: Lion_21Nov2022
Created: 2022-11-21 by PMx version 1.6.5.20220325
File: C:\PMxProjects\Lion_21Nov2022.pmxproj
Description: Created for final report

Primary data file
Data File Name: zims.zims
Common Name: Lion
Scientific Name: Panthera leo
Data Source: ZIMS for Studbooks
Studbook Name: Lion (Panthera leo)
Exported On: 2022-11-21
Software version: ZIMS for Studbooks 3.0
Current Through: 2022-04-30
Compiled By: Sue Pfaff, Hollie Colahan
Scope: AZA
**Dates: 1980-01-01 to 2022-11-21**
**Association: Association of Zoos & Aquariums (AZA)**
Other Filters: Status = Living
User: Amanda Lawless

Moves data file
Data File Name: genetic.csv
Common Name: Lion
Scientific Name: Panthera leo
Data Source: ZIMS for Studbooks
Studbook Name: Lion (Panthera leo)
Exported On: 2022-11-21
Software version: ZIMS for Studbooks 3.0
Current Through: 2022-04-30
Compiled By: Sue Pfaff, Hollie Colahan
Scope: AZA
**Dates: 1980-01-01 to 2022-11-21**
**Association: Association of Zoos & Aquariums (AZA)**
Other Filters: Status = None
User: Amanda Lawless

Moves data file
Data File Name: demographic.csv
Common Name: Lion
Scientific Name: Panthera leo
Data Source: ZIMS for Studbooks
Studbook Name: Lion (Panthera leo)
Exported On: 2022-11-21
Software version: ZIMS for Studbooks 3.0
Current Through: 2022-04-30
Compiled By: Sue Pfaff, Hollie Colahan
Scope: AZA
**Dates: 1980-01-01 to 2022-11-21**
**Association: Association of Zoos & Aquariums (AZA)**
Other Filters: Status = None
User: Amanda Lawless

Locations data file
Data File Name: location.txt

Demographic input files
Census1 file: Exchcens.txt

Raw Qx day age class 9644 modified from 1.0 to 0.67

73 births to parents with unknown ages have been added in proportion to known aged parents.
This is 6% of TOTAL births (N=1273)

**Data changes reported during comment period:**
(*Note these changes were incorporated in all final analyses*)

- SB ID #246 (F) died at NZP-WASH on 09/26/2022
- 1.3 (SB ID #767-#770) were born at OKLAHOMA on 09/26/2022
- SB ID #T5057 (F) died at CLEVELAND on 09/28/2022
- SB ID #248 (M) died at NZP-WASH on 10/19/2022

# C. Animals Excluded from Genetic Analyses

In addition to the animals listed below, all non-pedigreed / generic cats (Studbook IDs that begin with “T”) were excluded from the genetic analyses due to unknown origin and ancestry.

| SB ID | Location | Sex | Age | Reason for Exclusion |
|---|---|---|---|---|
| 177 | KANSASCTY | F | 20 | Spayed |
| 205 | TULSA | F | 20 | Spayed |
| 223 | LANSING | F | 18 | Age related issues |
| 238 | W ORANGE | F | 17 | Age related issues |
| ~~246~~ | ~~NZP-WASH~~ | ~~F~~ | ~~18~~ | ~~Spayed~~ (Died during comment period) |
| 247 | NZP-WASH | F | 17 | Spayed |
| ~~248~~ | ~~NZP-WASH~~ | ~~M~~ | ~~16~~ | ~~Medical~~ (Died during comment period) |
| 276 | TOPEKA | F | 18 | Age related issues |
| 277 | TOPEKA | F | 18 | Age related issues |
| 294 | KANSASCTY | M | 17 | Neutered/Sterile |
| 295 | KANSASCTY | M | 17 | Neutered/Sterile |
| 297 | KANSASCTY | F | 17 | Spayed |
| 303 | COLO SPRG | F | 14 | Spayed |
| 308 | EL PASO | F | 14 | Medical |
| 329 | PORTLAND | F | 14 | Spayed |
| 332 | DALLAS | F | 14 | Spayed |
| 333 | DALLAS | F | 14 | Spayed |
| 341 | PORTLAND | F | 14 | Spayed |
| 383 | SEDGWICK | F | 13 | Non-cycling |
| 400 | DISNEY AK | F | 12 | Spayed |
| 402 | DISNEY AK | F | 12 | Spayed |
| 407 | DES MOINE | F | 11 | Spayed |
| 410 | DES MOINE | F | 11 | Spayed |
| 450 | ROCHESTER | F | 11 | Spayed |
| 477 | DENVER | F | 10 | Spayed |
| 513 | ABQBIOPK | F | 8 | Spayed |
| 538 | W PALM BE | M | 8 | Neutered/Sterile |
| 541 | METROZOO | F | 8 | Spayed |
| 546 | SANDIEGOZ | M | 8 | Neutered/Sterile |
| 549 | SANDIEGOZ | F | 8 | Spayed |
| 617 | AUDUBON | F | 6 | Medical |
| 618 | DETROIT | F | 6 | Spayed |
| 630 | DALLAS | F | 5 | Medical (Added during comment period) |
| 653 | KNOXVILLE | F | 4 | Spayed |
| 689 | W PALM BE | M | 2 | Neutered/Sterile |

# D. Life Tables

Px = survival; Qx = mortality; Lx = cumulative survivorship; Mx = fecundity; Ex = life expectancy; Vx = expected future reproduction, At Risk (Qx and Mx) = number of animals corresponding values are estimated from.

**MALES**

| Age | Px | Qx | Risk Qx | Lx | Mx | Risk Mx | Ex | Vx |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.70 | 0.30 | 437.68 | 1.00 | 0.00 | 437.68 | 12.96 | 1.18 |
| 1 | 0.98 | 0.02 | 415.44 | 0.70 | 0.02 | 415.45 | 14.64 | 1.44 |
| 2 | 0.98 | 0.02 | 402.67 | 0.69 | 0.13 | 402.69 | 13.95 | 1.45 |
| 3 | 0.99 | 0.01 | 401.02 | 0.67 | 0.17 | 401.05 | 13.16 | 1.35 |
| 4 | 0.99 | 0.01 | 397.26 | 0.67 | 0.18 | 397.29 | 12.27 | 1.19 |
| 5 | 0.99 | 0.01 | 395.71 | 0.66 | 0.15 | 395.74 | 11.35 | 1.02 |
| 6 | 0.98 | 0.02 | 402.09 | 0.66 | 0.12 | 402.11 | 10.51 | 0.88 |
| 7 | 0.98 | 0.02 | 371.40 | 0.64 | 0.11 | 371.42 | 9.70 | 0.78 |
| 8 | 0.99 | 0.01 | 341.60 | 0.63 | 0.13 | 341.62 | 8.81 | 0.68 |
| 9 | 0.98 | 0.03 | 322.58 | 0.63 | 0.11 | 322.59 | 7.93 | 0.56 |
| 10 | 0.97 | 0.04 | 308.48 | 0.61 | 0.11 | 308.50 | 7.15 | 0.47 |
| 11 | 0.96 | 0.04 | 287.66 | 0.59 | 0.10 | 287.67 | 6.38 | 0.37 |
| 12 | 0.94 | 0.06 | 267.53 | 0.57 | 0.07 | 267.54 | 5.65 | 0.29 |
| 13 | 0.92 | 0.08 | 250.80 | 0.53 | 0.10 | 250.82 | 5.00 | 0.23 |
| 14 | 0.90 | 0.10 | 218.20 | 0.49 | 0.03 | 218.20 | 4.40 | 0.15 |
| 15 | 0.91 | 0.10 | 193.21 | 0.44 | 0.08 | 193.22 | 3.77 | 0.13 |
| 16 | 0.81 | 0.19 | 156.53 | 0.40 | 0.04 | 156.54 | 3.21 | 0.06 |
| 17 | 0.77 | 0.23 | 122.15 | 0.32 | 0.00 | 122.15 | 2.78 | 0.02 |
| 18 | 0.67 | 0.34 | 89.86 | 0.25 | 0.02 | 89.86 | 2.45 | 0.03 |
| 19 | 0.67 | 0.33 | 58.15 | 0.17 | 0.00 | 58.15 | 2.18 | 0.02 |
| 20 | 0.52 | 0.48 | 33.36 | 0.11 | 0.00 | 33.36 | 1.94 | 0.04 |
| 21 | 0.46 | 0.54 | 17.92 | 0.06 | 0.00 | 17.92 | 1.89 | 0.08 |
| 22 | 0.46 | 0.55 | 7.27 | 0.03 | 0.18 | 7.27 | 1.94 | 0.18 |
| 23 | 0.60 | 0.40 | 3.69 | 0.01 | 0.00 | 3.69 | 1.88 | 0.00 |
| 24 | 0.33 | 0.67 | 1.26 | 0.01 | 0.00 | 1.26 | 1.75 | 0.00 |
| 25 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | 1.50 | 0.00 |
| 26 | 0.00 | 1.00 | 0.35 | 0.00 | 0.00 | 0.35 | 1.00 | 0.00 |
| 27 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 28 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 29 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 30 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 31 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 32 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| 33 | 0.00 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

r = 0.002, λ = 1.002, Ro = 1.011, T = 7.1, N@20 = 81

**FEMALES**

| Age | Px | Qx | Risk Qx | Lx | Mx | Risk Mx | Ex | Vx |
|---|---|---|---|---|---|---|---|---|
| 0 | 0.73 | 0.27 | 459.04 | 1.00 | 0.00 | 459.04 | --- | 1.16 |
| 1 | 0.97 | 0.03 | 447.40 | 0.73 | 0.01 | 447.40 | --- | 1.35 |
| 2 | 0.99 | 0.01 | 453.52 | 0.71 | 0.14 | 453.52 | --- | 1.33 |
| 3 | 0.99 | 0.01 | 461.71 | 0.70 | 0.20 | 461.71 | --- | 1.18 |
| 4 | 0.98 | 0.02 | 463.26 | 0.69 | 0.18 | 463.27 | --- | 0.96 |
| 5 | 0.97 | 0.03 | 460.74 | 0.68 | 0.18 | 460.74 | --- | 0.78 |
| 6 | 0.99 | 0.02 | 456.34 | 0.66 | 0.10 | 456.34 | --- | 0.60 |
| 7 | 0.98 | 0.02 | 442.88 | 0.65 | 0.12 | 442.89 | --- | 0.49 |
| 8 | 0.99 | 0.01 | 434.27 | 0.64 | 0.08 | 434.27 | --- | 0.36 |
| 9 | 0.98 | 0.02 | 418.83 | 0.63 | 0.08 | 418.83 | --- | 0.28 |
| 10 | 0.97 | 0.03 | 402.39 | 0.62 | 0.07 | 402.39 | --- | 0.20 |
| 11 | 0.97 | 0.04 | 388.16 | 0.60 | 0.03 | 388.16 | --- | 0.13 |
| 12 | 0.95 | 0.05 | 361.96 | 0.58 | 0.04 | 361.96 | --- | 0.10 |
| 13 | 0.93 | 0.07 | 336.73 | 0.55 | 0.02 | 336.73 | --- | 0.06 |
| 14 | 0.93 | 0.07 | 304.57 | 0.52 | 0.03 | 304.57 | --- | 0.04 |
| 15 | 0.88 | 0.12 | 269.28 | 0.48 | 0.01 | 269.28 | --- | 0.02 |
| 16 | 0.90 | 0.10 | 229.41 | 0.42 | 0.01 | 229.41 | --- | 0.01 |
| 17 | 0.87 | 0.13 | 195.04 | 0.38 | 0.00 | 195.04 | --- | 0.00 |
| 18 | 0.79 | 0.21 | 157.32 | 0.33 | 0.00 | 157.32 | --- | 0.00 |
| 19 | 0.68 | 0.32 | 110.82 | 0.26 | 0.00 | 110.82 | --- | 0.00 |
| 20 | 0.75 | 0.25 | 75.88 | 0.17 | 0.00 | 75.88 | --- | 0.00 |
| 21 | 0.69 | 0.31 | 52.26 | 0.13 | 0.00 | 52.26 | --- | 0.00 |
| 22 | 0.26 | 0.74 | 29.52 | 0.09 | 0.00 | 29.52 | --- | 0.00 |
| 23 | 0.46 | 0.55 | 9.11 | 0.02 | 0.00 | 9.11 | --- | 0.00 |
| 24 | 0.80 | 0.20 | 4.36 | 0.01 | 0.00 | 4.36 | --- | 0.00 |
| 25 | 0.25 | 0.75 | 1.87 | 0.01 | 0.00 | 1.87 | --- | 0.00 |
| 26 | 0.33 | 0.67 | 0.43 | 0.00 | 0.00 | 0.43 | --- | 0.00 |
| 27 | 1.00 | 0.00 | 0.98 | 0.00 | 0.00 | 0.98 | --- | 0.00 |
| 28 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | --- | 0.00 |
| 29 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | --- | 0.00 |
| 30 | 1.00 | 0.00 | 1.00 | 0.00 | 0.00 | 1.00 | --- | 0.00 |
| 31 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | --- | 0.00 |
| 32 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | --- | 0.00 |
| 33 | 1.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | --- | 0.00 |

r = -0.029, λ = 0.971, Ro = 0.839, T = 6.0, N@20 = 81

# E. Ordered Mean Kinship List

*These lists are current to October 2022 and values are subject to change with any birth, death, import, export, inclusion, exclusion, or changes in pedigree or pedigree assumptions.*

Population MK = 0.0264
(as indicated by the black line)

| MALES | | | | | FEMALES | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SB ID** | **MK** | **Known** | **Age** | **Location** | **SB ID** | **MK** | **Known** | **Age** | **Location** |
| 486 | 0.0020 | 1.0000 | 9 | BUSCH TAM | 441 | 0.0025 | 1.0000 | 11 | ABILENE |
| 448 | 0.0069 | 1.0000 | 12 | ROCHESTER | 449 | 0.0025 | 1.0000 | 12 | ROCHESTER |
| 439 | 0.0079 | 1.0000 | 11 | ABILENE | 487 | 0.0030 | 1.0000 | 9 | BUSCH TAM |
| 473 | 0.0084 | 1.0000 | 13 | DETROIT | 488 | 0.0030 | 1.0000 | 9 | BUSCH TAM |
| 573 | 0.0089 | 1.0000 | 7 | LOUISVILL | 200 | 0.0063 | 1.0000 | 19 | TAUTPHAUS |
| 345 | 0.0091 | 1.0000 | 16 | JACKSONVL | 480 | 0.0069 | 1.0000 | 9 | LOUISVILL |
| 479 | 0.0099 | 1.0000 | 9 | BUFFALO | 440 | 0.0079 | 1.0000 | 11 | ABILENE |
| 476 | 0.0106 | 1.0000 | 10 | WINSTON | 574 | 0.0099 | 1.0000 | 7 | COLUMBIA |
| 475 | 0.0126 | 1.0000 | 10 | WINSTON | 575 | 0.0109 | 1.0000 | 7 | COLUMBIA |
| 411 | 0.0133 | 1.0000 | 12 | CALGARY | 681 | 0.0117 | 1.0000 | 2 | DETROIT |
| 412 | 0.0133 | 1.0000 | 12 | CALGARY | 346 | 0.0124 | 1.0000 | 16 | ST LOUIS |
| 678 | 0.0134 | 1.0000 | 1 | BUFFALO | 619 | 0.0134 | 1.0000 | 6 | DETROIT |
| 409 | 0.0146 | 1.0000 | 12 | CINCINNAT | 677 | 0.0134 | 1.0000 | 1 | BUFFALO |
| 525 | 0.0146 | 1.0000 | 8 | NZP-WASH | 528 | 0.0146 | 1.0000 | 8 | NZP-WASH |
| 526 | 0.0146 | 1.0000 | 8 | NZP-WASH | 413 | 0.0150 | 1.0000 | 12 | BUFFALO |
| 606 | 0.0153 | 1.0000 | 6 | DENVER | 408 | 0.0159 | 1.0000 | 12 | BUFFALO |
| 527 | 0.0159 | 1.0000 | 8 | FRESNO | 352 | 0.0191 | 1.0000 | 14 | HOUSTON |
| 592 | 0.0181 | 1.0000 | 7 | SAN FRAN | 354 | 0.0191 | 1.0000 | 14 | HOUSTON |
| 190 | 0.0183 | 1.0000 | 20 | PUEBLO | 656 | 0.0193 | 1.0000 | 5 | GRANBY |
| 763 | 0.0190 | 1.0000 | 3 | DENVER | 657 | 0.0193 | 1.0000 | 5 | SEATTLE |
| 629 | 0.0193 | 1.0000 | 5 | TAUTPHAUS | 309 | 0.0200 | 1.0000 | 15 | EL PASO |
| 280 | 0.0206 | 1.0000 | 17 | GLEN OAK | 659 | 0.0201 | 1.0000 | 4 | CHICAGOLP |
| 334 | 0.0206 | 1.0000 | 14 | GREENVISC | 660 | 0.0201 | 1.0000 | 4 | CHICAGOLP |
| 331 | 0.0208 | 1.0000 | 14 | GREENVISC | 281 | 0.0206 | 1.0000 | 17 | JNGLARY F |
| 602 | 0.0210 | 1.0000 | 7 | AKRON | 282 | 0.0206 | 1.0000 | 17 | SACRAMNTO |
| 603 | 0.0210 | 1.0000 | 7 | GREENBAY | 472 | 0.0207 | 1.0000 | 10 | DENVER |
| 676 | 0.0211 | 1.0000 | 2 | DENVER | 244 | 0.0208 | 1.0000 | 16 | INDIANAPL |
| 625 | 0.0216 | 1.0000 | 6 | DALLAS | 582 | 0.0211 | 1.0000 | 7 | OKLAHOMA |
| 585 | 0.0218 | 1.0000 | 7 | AUDUBON | 583 | 0.0211 | 1.0000 | 7 | ST PAUL |
| 558 | 0.0219 | 1.0000 | 8 | JACKSONVL | 651 | 0.0211 | 1.0000 | 4 | CHICAGOLP |
| 581 | 0.0222 | 1.0000 | 7 | KNOXVILLE | 652 | 0.0211 | 1.0000 | 4 | S BARBARA |
| 751 | 0.0224 | 1.0000 | 0 | KNOXVILLE | 675 | 0.0211 | 1.0000 | 2 | DENVER |
| 243 | 0.0225 | 1.0000 | 16 | GARDENCTY | 588 | 0.0218 | 1.0000 | 7 | MILWAUKEE |
| 273 | 0.0228 | 1.0000 | 16 | DICKERSON | 559 | 0.0219 | 1.0000 | 8 | JACKSONVL |
| 593 | 0.0228 | 1.0000 | 7 | INDIANAPL | 750 | 0.0224 | 1.0000 | 0 | KNOXVILLE |
| 596 | 0.0232 | 1.0000 | 6 | ST PAUL | 595 | 0.0228 | 1.0000 | 7 | INDIANAPL |
| 639 | 0.0232 | 1.0000 | 5 | EL PASO | 642 | 0.0230 | 1.0000 | 5 | NORFOLK |
| 594 | 0.0233 | 1.0000 | 7 | S BARBARA | 643 | 0.0230 | 1.0000 | 5 | NORFOLK |
| 764 | 0.0233 | 1.0000 | 0 | CHICAGOLP | 300 | 0.0232 | 1.0000 | 16 | DICKERSON |

| MALES | | | | | FEMALES | | | | |
|---|---|---|---|---|---|---|---|---|---|
| SB ID | MK | Known | Age | Location | SB ID | MK | Known | Age | Location |
| 644 | 0.0235 | 1.0000 | 5 | CHICAGOLP | 640 | 0.0232 | 1.0000 | 5 | PUEBLO |
| 670 | 0.0237 | 1.0000 | 2 | DALLAS | 641 | 0.0232 | 1.0000 | 5 | PUEBLO |
| 604 | 0.0238 | 1.0000 | 7 | TULSA | 673 | 0.0232 | 1.0000 | 2 | S BARBARA |
| 425 | 0.0240 | 1.0000 | 11 | JOHN BALL | 584 | 0.0233 | 1.0000 | 7 | OKLAHOMA |
| 366 | 0.0241 | 1.0000 | 14 | BROWNSVIL | 671 | 0.0237 | 1.0000 | 2 | DALLAS |
| 336 | 0.0243 | 1.0000 | 14 | PUEBLA | 672 | 0.0237 | 1.0000 | 2 | DALLAS |
| 508 | 0.0243 | 1.0000 | 9 | ATLANTA | 509 | 0.0243 | 1.0000 | 9 | FRESNO |
| 510 | 0.0243 | 1.0000 | 9 | ATLANTA | 647 | 0.0244 | 1.0000 | 5 | MILWAUKEE |
| 511 | 0.0243 | 1.0000 | 9 | ATLANTA | 648 | 0.0244 | 1.0000 | 5 | MILWAUKEE |
| 634 | 0.0244 | 1.0000 | 6 | LUFKIN | 605 | 0.0248 | 1.0000 | 7 | DENVER |
| 367 | 0.0251 | 1.0000 | 14 | SEDGWICK | 432 | 0.0250 | 1.0000 | 11 | CINCINNAT |
| 381 | 0.0251 | 1.0000 | 13 | FRANKLINP | 417 | 0.0251 | 1.0000 | 12 | MADISON |
| 382 | 0.0251 | 1.0000 | 13 | FRANKLINP | 580 | 0.0251 | 1.0000 | 7 | GARDENCTY |
| 570 | 0.0251 | 1.0000 | 8 | OAKLAND | 768 | 0.0256 | 1.0000 | 0 | OKLAHOMA |
| 571 | 0.0251 | 1.0000 | 8 | OAKLAND | 769 | 0.0256 | 1.0000 | 0 | OKLAHOMA |
| 572 | 0.0251 | 1.0000 | 8 | OAKLAND | 770 | 0.0256 | 1.0000 | 0 | OKLAHOMA |
| 576 | 0.0251 | 1.0000 | 7 | DENVER | 287 | 0.0258 | 1.0000 | 17 | GARDENCTY |
| 577 | 0.0251 | 1.0000 | 7 | DENVER | 389 | 0.0258 | 1.0000 | 13 | DES MOINE |
| 578 | 0.0251 | 1.0000 | 7 | DENVER | 427 | 0.0259 | 1.0000 | 11 | CALDWELL |
| 579 | 0.0251 | 1.0000 | 7 | DENVER | 292 | 0.0261 | 1.0000 | 16 | PUEBLO |
| 661 | 0.0254 | 1.0000 | 3 | BREVARD | 465 | 0.0261 | 1.0000 | 10 | HOGLE |
| 662 | 0.0254 | 1.0000 | 3 | BREVARD | 490 | 0.0266 | 1.0000 | 9 | LOUISVILL |
| 663 | 0.0254 | 1.0000 | 3 | BREVARD | 370 | 0.0268 | 1.0000 | 14 | AKRON |
| 767 | 0.0256 | 1.0000 | 0 | OKLAHOMA | 376 | 0.0270 | 1.0000 | 14 | MEMPHIS |
| 597 | 0.0257 | 1.0000 | 7 | PHOENIX | 377 | 0.0270 | 1.0000 | 14 | MEMPHIS |
| 388 | 0.0258 | 1.0000 | 13 | DISNEY AK | 436 | 0.0270 | 1.0000 | 10 | WINSTON |
| 426 | 0.0259 | 1.0000 | 11 | OKLAHOMA | 373 | 0.0273 | 1.0000 | 14 | HONOLULU |
| 380 | 0.0260 | 1.0000 | 13 | MEMPHIS | 464 | 0.0275 | 1.0000 | 10 | HOGLE |
| 665 | 0.0262 | 1.0000 | 2 | AUDUBON | 392 | 0.0277 | 1.0000 | 13 | ASHEBORO |
| 666 | 0.0262 | 1.0000 | 2 | AUDUBON | 560 | 0.0278 | 1.0000 | 8 | LITTLEROC |
| 249 | 0.0266 | 1.0000 | 17 | MINOT | 561 | 0.0278 | 1.0000 | 8 | LITTLEROC |
| 250 | 0.0266 | 1.0000 | 17 | AKRON | 615 | 0.0278 | 1.0000 | 6 | AUDUBON |
| 501 | 0.0266 | 1.0000 | 9 | NY BRONX | 211 | 0.0279 | 1.0000 | 18 | GREENBAY |
| 502 | 0.0266 | 1.0000 | 9 | NY BRONX | 435 | 0.0284 | 1.0000 | 10 | WINSTON |
| 503 | 0.0266 | 1.0000 | 9 | NY BRONX | 616 | 0.0288 | 1.0000 | 6 | AUDUBON |
| 463 | 0.0271 | 1.0000 | 10 | MADISON | 555 | 0.0293 | 1.0000 | 8 | BATTLE CR |
| 627 | 0.0271 | 1.0000 | 5 | NORFOLK | 556 | 0.0293 | 1.0000 | 8 | BATTLE CR |
| 628 | 0.0271 | 1.0000 | 5 | LITTLEROC | 206 | 0.0299 | 1.0000 | 20 | SAN FRAN |
| 342 | 0.0273 | 1.0000 | 15 | SAN ANTON | 535 | 0.0300 | 1.0000 | 8 | SD-WAP |
| 301 | 0.0278 | 1.0000 | 15 | BALTIMORE | 536 | 0.0300 | 1.0000 | 8 | SD-WAP |
| 562 | 0.0278 | 1.0000 | 8 | W ORANGE | 537 | 0.0300 | 1.0000 | 8 | SD-WAP |
| 379 | 0.0280 | 1.0000 | 13 | PHILADELP | 261 | 0.0302 | 1.0000 | 16 | JOHN BALL |
| 369 | 0.0283 | 1.0000 | 14 | JNGLARY F | 530 | 0.0303 | 1.0000 | 8 | TUCSON |
| 215 | 0.0284 | 1.0000 | 18 | COLUMBIA | 614 | 0.0304 | 1.0000 | 7 | COLO SPRG |
| 337 | 0.0286 | 1.0000 | 14 | PUEBLA | 470 | 0.0305 | 1.0000 | 9 | W PALM BE |
| 415 | 0.0287 | 1.0000 | 11 | DES MOINE | 471 | 0.0305 | 1.0000 | 9 | W PALM BE |

| MALES | | | | | FEMALES | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **SB ID** | **MK** | **Known** | **Age** | **Location** | **SB ID** | **MK** | **Known** | **Age** | **Location** |
| 553 | 0.0293 | 1.0000 | 8 | W PALM BE | 569 | 0.0305 | 1.0000 | 8 | OMAHA |
| 554 | 0.0293 | 1.0000 | 8 | W PALM BE | 518 | 0.0307 | 1.0000 | 9 | ROLLING H |
| 534 | 0.0300 | 1.0000 | 8 | CLEVELAND | 519 | 0.0307 | 1.0000 | 9 | ROLLING H |
| 467 | 0.0301 | 1.0000 | 9 | WACO | 520 | 0.0307 | 1.0000 | 9 | ALEXANDRI |
| 512 | 0.0302 | 1.0000 | 8 | ABQBIOPK | 492 | 0.0310 | 1.0000 | 9 | W PALM BE |
| 612 | 0.0304 | 1.0000 | 7 | COLO SPRG | 347 | 0.0311 | 1.0000 | 15 | OMAHA |
| 613 | 0.0304 | 1.0000 | 7 | COLO SPRG | 589 | 0.0311 | 1.0000 | 7 | SAN ANTON |
| 469 | 0.0305 | 1.0000 | 9 | ALEXANDRI | 230 | 0.0315 | 1.0000 | 16 | FT WAYNE |
| 567 | 0.0305 | 1.0000 | 8 | OMAHA | 637 | 0.0315 | 1.0000 | 6 | HOGLE |
| 568 | 0.0305 | 1.0000 | 8 | OMAHA | 428 | 0.0317 | 1.0000 | 11 | RACINE |
| 590 | 0.0311 | 1.0000 | 7 | BIRMINGHM | 314 | 0.0327 | 1.0000 | 15 | JACKSONVL |
| 591 | 0.0311 | 1.0000 | 7 | TUCSON | 229 | 0.0330 | 1.0000 | 16 | GLEN OAK |
| 231 | 0.0315 | 1.0000 | 16 | LANSING | 317 | 0.0331 | 1.0000 | 15 | SAN ANTON |
| 631 | 0.0315 | 1.0000 | 6 | CHICAGOBR | 692 | 0.0333 | 1.0000 | 4 | PUEBLA |
| 638 | 0.0315 | 1.0000 | 6 | CHICAGOBR | 693 | 0.0333 | 1.0000 | 4 | PUEBLA |
| 430 | 0.0317 | 1.0000 | 11 | COLO SPRG | 695 | 0.0333 | 1.0000 | 4 | PUEBLA |
| 420 | 0.0321 | 1.0000 | 11 | HOGLE | 696 | 0.0333 | 1.0000 | 6 | PUEBLA |
| 429 | 0.0322 | 1.0000 | 11 | CALDWELL | 697 | 0.0333 | 1.0000 | 6 | PUEBLA |
| 262 | 0.0331 | 1.0000 | 16 | SACRAMNTO | 698 | 0.0333 | 1.0000 | 6 | PUEBLA |
| 312 | 0.0332 | 1.0000 | 15 | PORTLAND | 699 | 0.0333 | 1.0000 | 6 | PUEBLA |
| 703 | 0.0333 | 1.0000 | --- | PUEBLA | 705 | 0.0333 | 1.0000 | 7 | PUEBLA |
| 743 | 0.0333 | 1.0000 | 4 | PUEBLA | 421 | 0.0336 | 1.0000 | 11 | PUEBLA |
| 422 | 0.0336 | 1.0000 | 11 | HOGLE | 649 | 0.0337 | 1.0000 | 5 | WACO |
| 504 | 0.0348 | 1.0000 | 9 | BOISE | 690 | 0.0341 | 1.0000 | 3 | W PALM BE |
| 539 | 0.0350 | 1.0000 | 8 | GARDENCTY | 378 | 0.0348 | 1.0000 | 14 | OMAHA |
| 540 | 0.0350 | 1.0000 | 8 | GARDENCTY | 499 | 0.0350 | 1.0000 | 9 | BALTIMORE |
| 521 | 0.0352 | 1.0000 | 8 | W PALM BE | 505 | 0.0353 | 1.0000 | 9 | WACO |
| 550 | 0.0354 | 1.0000 | 8 | BATTLE CR | 551 | 0.0354 | 1.0000 | 8 | RACINE |
| 552 | 0.0354 | 1.0000 | 8 | FT WAYNE | 542 | 0.0358 | 1.0000 | 8 | CALGARY |
| 316 | 0.0358 | 1.0000 | 15 | ST LOUIS | 543 | 0.0358 | 1.0000 | 8 | AKRON |
| 564 | 0.0376 | 1.0000 | 8 | HOUSTON | 544 | 0.0358 | 1.0000 | 8 | CALGARY |
| 326 | 0.0407 | 1.0000 | 15 | METROZOO | 545 | 0.0358 | 1.0000 | 8 | AKRON |
| 327 | 0.0407 | 1.0000 | 15 | METROZOO | 318 | 0.0361 | 1.0000 | 15 | TUCSON |
| 700 | 0.0418 | 1.0000 | 6 | PUEBLA | 565 | 0.0376 | 1.0000 | 8 | PORTLAND |
| 704 | 0.0425 | 1.0000 | 6 | PUEBLA | 566 | 0.0376 | 1.0000 | 8 | PORTLAND |
| 683 | 0.0471 | 1.0000 | 1 | PUEBLA | 405 | 0.0416 | 1.0000 | 12 | PHILADELP |
| 684 | 0.0471 | 1.0000 | 1 | PUEBLA | 701 | 0.0418 | 1.0000 | 6 | PUEBLA |
| 742 | 0.0471 | 1.0000 | 1 | PUEBLA | 702 | 0.0418 | 1.0000 | 6 | PUEBLA |
| 744 | 0.0471 | 1.0000 | 2 | PUEBLA | 694 | 0.0428 | 1.0000 | 6 | PUEBLA |
| | | | | | 680 | 0.0443 | 1.0000 | 6 | PUEBLA |
| | | | | | 685 | 0.0443 | 1.0000 | 6 | PUEBLA |
| | | | | | 686 | 0.0471 | 1.0000 | 1 | PUEBLA |
| | | | | | 687 | 0.0471 | 1.0000 | 1 | PUEBLA |
| | | | | | 688 | 0.0471 | 1.0000 | 2 | PUEBLA |
| | | | | | 691 | 0.0471 | 1.0000 | 3 | PUEBLA |

# F. Definitions

**Management Terms** (as of December 2021)

**Green Species Survival Plan® (Green SSP) Program –** A Green SSP Program has a population size of 50 or more animals and is projected to retain 90% gene diversity for a minimum of 100 years or 10 generations. Green SSP Programs are subject to AZA's Full Participation and Sustainability Partner Policies.

**Yellow Species Survival Plan® (Yellow SSP) Program –** A Yellow SSP Program has a population size of 50 or more animals but cannot retain 90% gene diversity for 100 years or 10 generations. Yellow SSP participation by AZA facilities is voluntary. Yellow SSP Programs are subject to AZA's Sustainability Partner Policy.

**Red Species Survival Plan® (Red SSP) Program –** A Red SSP Program has a population size of twenty or more animals managed among three or more participating AZA facilities. If a population does not meet these minimum criteria, but has an IUCN designation of Critically Endangered, Endangered, or Extinct in the Wild, and the TAG has developed three goals to sustain this population, then the population will be considered a Red SSP Program. Red SSPs cannot retain 90% gene diversity for 100 years or 10 generations and participation by AZA facilities is voluntary. Red SSP Programs are subject to AZA's Sustainability Partner Policy.

**Candidate Program –** A Candidate Program either has a population size of fewer than twenty individuals and/or found at fewer than three AZA facilities or it does not yet have a completed studbook so the population size is unclear. A Candidate Program is overseen by the TAG, with no additional AZA accountability requirements.

**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.

**Full Participation –** AZA policy stating that all AZA accredited facilities and certified related facilities having a Green SSP animal in their collection are required to participate in the collaborative SSP planning process (e.g., provide relevant animal data to the AZA Studbook Keeper, assign an Institutional Representative who will communicate facility wants and needs to the SSP Coordinator and comment on the draft plan during the 30-day review period, and abide by the recommendations agreed upon in the final plan).

All AZA member facilities and Animal Programs, regardless of management designation, must adhere to the AZA Policy on Responsible Population Management and the AZA Code of Professional Ethics. For more information on AZA policies, see https://www.aza.org/board-approved-policies-and-position-statements.

**Currentness Date –** The date when the entire studbook is updated. This equates to the first date you received an update after requesting updates from all the facilities included in your studbook.

## Demographic Terms

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

**Ex, Life Expectancy –** The average years of further life for an animal in age class x.

**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 excludes 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.

**Target Population Size (TPS) –** The desired number of SSP animals to be held across AZA and approved partner facilities over a specific, stated timeframe. This number is determined with consideration for program roles and goals (genetic, demographic, and others), logistical constraints, spatial competition with other TAG-managed species, and other population-specific concerns. Target Population Size is determined by the Taxon Advisory Group (TAG) and published in their Regional Collection Plan (RCP).

**Vx**, **Reproductive Value –** The expected number of offspring produced this year and in future years by an animal of age *x*.

## Genetic Terms

**Allele –** Alternate forms of DNA at a particular position in a genome (genetic locus). Alleles represent the most basic form of genetic diversity.

**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.

**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 uses the definition as the size of the current population that have 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.

**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, captive-born 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*.

# G. AZA Animal Population Management (APM) Committee Disclaimers

as of June 2019

*This managed population is currently a Green SSP and subject to AZA Full Participation and Sustainability Partner policies. APM Committee-approved Sustainability Partners are expected to agree and abide by AZA's Code of Professional Ethics, SSP Full Participation Policy, Policy on Responsible Population Management, and Accreditation Standards related to animal care and welfare.*

# H. Directory of Institutional Representatives

| Facility Name | Mnemonic | Contact Name (IR or Advisor) | Email |
|---|---|---|---|
| Abilene Zoological Gardens | ABILENE | Denise Ibarra | denise.ibarra@abilenetx.gov |
| Albuquerque Biological Park | ABQBIOPK | Lynn Tupa | ltupa@cabq.gov |
| Akron Zoological Park | AKRON | Eric Albers | e.albers@akronzoo.org |
| Alexandria Zoological Park | ALEXANDRI | Lisa Laskoski | lisa.laskoski@cityofalex.com |
| North Carolina Zoo | ASHEBORO | Jennifer Ireland | jennifer.ireland@nczoo.org |
| Zoo Atlanta | ATLANTA | Kenn Harwood | KHarwood@zooatlanta.org |
| Capron Park Zoo | ATTLEBORO | Brenda Young | brenda.asstdirector@cityofattleboro.us |
| Audubon Zoo | AUDUBON | Joe Forys | jforys@auduboninstitute.org |
| Maryland Zoo in Baltimore | BALTIMORE | Erin Grimm | Erin.Cantwell@marylandzoo.org |
| Binder Park Zoo | BATTLE CR | Kathryn Sippel | ksippel@binderparkzoo.org |
| Birmingham Zoo | BIRMINGHM | Hollie Colahan | hcolahan@birminghamzoo.com |
| Zoo Boise | BOISE | Melissa Wade | mwilliams@cityofboise.org |
| Brevard Zoo | BREVARD | Chelsea Herman | cherman@brevardzoo.org |
| Gladys Porter Zoo | BROWNSVIL | Walter DuPree | wdupree@gpz.org |
| Buffalo Zoo | BUFFALO | Lisa Smith | lsmith@buffalozoo.org |
| Busch Gardens Tampa Bay | BUSCH TAM | Kat Wheaton | Kat.Wheaton@buschgardens.com |
| Caldwell Zoo | CALDWELL | Scotty Stainback | sstainback@caldwellzoo.org |
| Calgary Zoo | CALGARY | Kim Walker | kimw@calgaryzoo.com |
| Zoologico de Cali | CALI | Carlos Andrés Galvis | carlos.galvis@fzc.com.co |
| Cape May County Park Zoo | CAPE MAY | Alexander Ernst | aernst@co.cape-may.nj.us |
| Chicago Zoological Society - Brookfield Zoo | CHICAGOBR | Mark Wanner | mark.wanner@czs.org |
| Lincoln Park Zoo | CHICAGOLP | Michael Murray | mmurray@lpzoo.org |
| Cincinnati Zoo & Botanical Garden | CINCINNAT | Wendy Rice | wendy.rice@cincinnatizoo.org |
| Cleveland Metroparks Zoo | CLEVELAND | Travis Vineyard | tgv@clevelandmetroparks.com |
| Cheyenne Mountain Zoo | COLO SPRG | Amy Schilz | aschilz@cmzoo.org |
| Riverbanks Zoo & Garden | COLUMBIA | Catherine Connell | cconnell@riverbanks.org |
| Dallas Zoo | DALLAS | Lisa Van Slett | Lisa.VanSlett@dallaszoo.com |
| Denver Zoo | DENVER | Rebecca McCloskey | rmccloskey@denverzoo.org |
| Blank Park Zoo | DES MOINE | Jay Tetzloff | jrtetzloff@blankparkzoo.org |
| Detroit Zoo | DETROIT | Betsie Meister | emeister@dzs.org |
| Dickerson Park Zoo | DICKERSON | Kesha Schreiber | kschreib@springfieldmo.gov |
| Disney's Animal Kingdom | DISNEY AK | David Shrake | david.shrake@disney.com |
| Lake Superior Zoo | DULUTH | Grant Piepkorn | gpiepkorn@lszoo.org |
| El Paso Zoo | EL PASO | Heather Rivera | RiveraHX@elpasotexas.gov |
| Fort Worth Zoo | FORTWORTH | Kurt Giesler | KGiesler@fortworthzoo.org |
| Franklin Park Zoo | FRANKLINP | Christine Bartos | cbartos@zoonewengland.org |
| Fresno Chaffee Zoo | FRESNO | Nicole Presley | npresley@fresnochaffeezoo.org |
| Fort Wayne Children's Zoo | FT WAYNE | Jacquelynn Schmalzried | jacquelynn.schmalzried@kidszoo.org |
| Lee Richardson Zoo | GARDENCTY | Kristi Newland | Kristi.Newland@gardencityks.us |
| Peoria Zoo | GLEN OAK | Dawn Petefish | dpetefish@peoriazoo.org |
| Zoo de Granby | GRANBY | Chantal Routhier | crouthier@zoodegranby.com |
| Northeastern Wisconsin (NEW) Zoo & Adventure Park | GREENBAY | Carmen Murach | carmen.murach@browncountywi.gov |

| Facility Name | Mnemonic | Contact Name (IR or Advisor) | Email |
|---|---|---|---|
| Greenville Zoo | GREENVISC | James Traverse | jtraverse@greenvillesc.gov |
| Utah's Hogle Zoo | HOGLE | Bob Cisneros | bcisneros@hoglezoo.org |
| Honolulu Zoo | HONOLULU | Tyris A. K. Perreira | tperreira@honolulu.gov |
| Houston Zoo, Inc. | HOUSTON | John Register | jregister@houstonzoo.org |
| Indianapolis Zoological Society, Inc. | INDIANAPL | Thomas Granberry | tgranberry@indyzoo.com |
| Jacksonville Zoo and Gardens | JACKSONVL | Corey Neatrour | neatrourc@jacksonvillezoo.org |
| Naples Zoo | JNGLARY F | Elizabeth Johnson | ejohnson@napleszoo.org |
| John Ball Zoo | JOHN BALL | Tim Sampson | tsampson@jbzoo.org |
| Kansas City Zoo | KANSASCTY | Joni Hartman | jhartman@fotzkc.org |
| Zoo Knoxville | KNOXVILLE | Terry Cannon | tcannon@zooknoxville.org |
| Potter Park Zoological Gardens | LANSING | Annabell Marcum | amarcum@ingham.org |
| Little Rock Zoo | LITTLEROC | Kate Neal | kneal@littlerock.gov |
| Los Angeles Zoo and Botanical Gardens | LOSANGELE | Beth Schaefer | Beth.Schaefer@lacity.org |
| Louisville Zoological Garden | LOUISVILL | Michael Jones | michael.jones@louisvilleky.gov |
| Ellen Trout Zoo | LUFKIN | Celia Falzone | cfalzone@ellentroutzoo.com |
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| Memphis Zoo | MEMPHIS | Anna Chaney | achaney@memphiszoo.org |
| Zoo Miami | METROZOO | Ivy Brower | Ivy.Brower@miamidade.gov |
| Milwaukee County Zoological Gardens | MILWAUKEE | Tim Wild | timothy.wild@milwaukeecountywi.gov |
| Roosevelt Park Zoo | MINOT | Chelsea Mihalick | chelseam@minotparks.com |
| Virginia Zoological Park | NORFOLK | Crystal Matthews | crystal.matthews@norfolk.gov |
| Bronx Zoo | NY BRONX | Donna Doherty | ddoherty@wcs.org |
| Smithsonian National Zoological Park | NZP-WASH | Craig Saffoe | SaffoeC@si.edu |
| Oakland Zoo | OAKLAND | Colleen Kinzley | colleen@oaklandzoo.org |
| Oklahoma City Zoo and Botanical Garden | OKLAHOMA | Shawn Sims | ssims@okczoo.org |
| Omaha's Henry Doorly Zoo & Aquarium | OMAHA | Ryan Sears | Ryan.Sears@OmahaZoo.com |
| The Living Desert Zoo and Gardens | PALM DES | Wendy Enright | wenright@livingdesert.org |
| Philadelphia Zoo | PHILADELP | Maggie Morse | morse.maggie@phillyzoo.org |
| Phoenix Zoo | PHOENIX | Kara Schilling | kschilling@phoenixzoo.org |
| Oregon Zoo | PORTLAND | Kelly Gomez | kelly.gomez@oregonzoo.org |
| Africam Safari Park | PUEBLA | Lilia Gonzalez | cholguin@africamsafari.com |
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| Racine Zoological Gardens | RACINE | Aszya Summers | asummers@racinezoo.org |
| Seneca Park Zoo | ROCHESTER | Sue Rea | srea@monroecounty.gov |
| Rolling Hills Zoo | ROLLING H | Brenda Gunder | Brenda@rollinghillszoo.org |
| Santa Barbara Zoological Gardens | S BARBARA | Rachel Ritchason | rritchason@sbzoo.org |
| Sacramento Zoo | SACRAMNTO | Anela Medeiros | amedeiros@saczoo.org |
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| Como Park Zoo and Conservatory | ST PAUL | Jillian Erzar | jill.erzar@ci.stpaul.mn.us |
| Idaho Falls Zoo at Tautphaus Park | TAUTPHAUS | Katie Barry | kbarry@idahofallszoo.org |
| Toledo Zoo & Aquarium | TOLEDO | Michael Frushour | Michael.Frushour@Toledozoo.org |
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| Turtle Back Zoo | W ORANGE | Jilian Fazio | jfazio@parks.essexcountynj.org |
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# I. Breeding Age and Contraception

(November 2019)

Most female lions do not reach physical maturity until approximately 3 years of age. Some may mature as early as 2 and others not until 4 years of age so managers should evaluate when pairing animals for breeding. Females may become pregnant as early as 18 months so precautions should be taken to prevent breeding until she is physically mature or serious and even fatal complications may result. This may include separation during estrus or a temporary contraceptive method described below.

Males have sired offspring as early as one year of age so male cubs housed with female siblings and/or their dams should be separated during estrus or females should be contracepted to prevent unwanted breeding.

Short-term separation is the safest and least expensive reversible contraceptive method for lions but its effectiveness is susceptible to human error. This method requires an experienced and observant staff to note the first signs of estrous and to get the animals separated. Each institution should consider their resources and choose the option that is best suited to their situation.

The following is an update to the contraception recommendations published in the Lion SSP Manual from the AZA Reproductive Management Center (RMC). Institutions considering permanent sterilization should contact the SSP before proceeding.

Further information can be found at http://www.stlzoo.org/rmc

**4.6 Recommend means and duration of contraception for lions; include all acceptable alternatives and identify the benefits and drawbacks of each**

In addition to reversible contraception, reproduction can be prevented by separating the sexes or by permanent sterilization. In general, reversible contraception is preferable because it allows natural social groups to be maintained while managing the genetic health of the population. Permanent sterilization may be considered for individuals that are genetically well-represented or for whom reproduction would pose health risks. The contraceptive methods most suitable for lions are outlined below. More details on products, application, and ordering information can be found on the AZA Reproductive Management Center (RMC) webpage: www.stlzoo.org/contraception.

The progestin-based melengestrol acetate (MGA) implant, previously the most widely used contraceptive in zoos, has been associated with uterine and mammary pathology in felids (Munson 2006) and endometrial hyperplasia and pyometra in canids (Asa et al. 2014; Moresco et al. 2006). Long-term use of other progestins (e.g., Depo-Provera®, Ovaban®) is likely to have the same deleterious effects. **For carnivores, the AZA Reproductive Management Center recommends GnRH agonists, e.g., Suprelorin® (deslorelin) implants or Lupron Depot® (leuprolide acetate)** (although the latter has become prohibitively expensive and we have much fewer data on dosing)**,** as safer long-term alternatives. GnRH agonist dosages and durations of efficacy have not been systematically evaluated for all species. GnRH agonists can be used in either females or males, and side effects are generally those associated with gonadectomy, especially weight gain, which should be managed through diet. Suprelorin® was developed for domestic dogs and has been used successfully in lions and other felids (Bertschinger et al. 2001; Munson et al. 2001; Putnam et al. 2015).

Gonadotropin releasing hormone (GnRH) agonists [Suprelorin® implants, or Lupron Depot®]: GnRH agonists achieve contraception by reversibly suppressing the reproductive endocrine system, preventing production of pituitary (FSH and LH) and gonadal (estradiol and progesterone in females and testosterone in males) hormones. The observed effects are similar to those following either ovariectomy in females or castration in males, but are reversible. GnRH agonists first stimulate the reproductive system, which can result in estrus and ovulation in females or temporary enhancement of testosterone and semen production in males. Then, down-regulation follows the initial stimulation. The stimulatory phase can be prevented in females by daily Ovaban administration for one week before and one week after implant placement (Wright et al. 2001). This protocol is recommended for all carnivores to minimize exposure to endogenous estrogen followed by the prolonged period of elevated progesterone associated with pseudopregnancy.

GnRH agonists should not be used during pregnancy, since they may cause spontaneous abortion or prevent mammary development necessary for lactation. They may prevent initiation of lactation by inhibiting progesterone secretion, but effects on established lactation are less likely. New data from domestic cats have shown no effect on subsequent reproduction when treatment began before puberty; no research in prepubertal lions has been conducted.

A drawback of these products is that time to reversal can be very unpredictable. The most widely used formulations are designed to be effective either 6 or 12 months, but those are minimum durations, which can be longer in some individuals. Data gathered to date indicate time to reversal can be especially long for large felids (up to 8.5 years in lions), and so the RMC recommends routine removal

of implants to hasten time to reversal. More information on implant placement and removal can be found on the RMC's website. The RMC also recommends that institutions treating lions with Suprelorin consult with the RMC and the SSP before annual re-treatment. Since multiple consecutive treatments may prolong suppression, each lion should be discussed on a case-by-case basis to weigh the pros and cons of annual re-treatment.

Although GnRH agonists can also be an effective contraceptive in males, they are more commonly used in females. In males, changes in physical appearance are likely to occur (i.e. loss of secondary sexual characteristics). Also, monitoring efficacy by suppression of estrous behavior or cyclic gonadal steroids in feces is usually easier than ensuring continued absence of sperm in males, since most institutions cannot perform regular semen collections. Suprelorin® has been tested primarily in domestic dogs, whereas Lupron Depot® has been used primarily in humans, but should be as effective as Suprelorin®, since the GnRH molecule is identical in all mammalian species. If used in males, disappearance of sperm from the ejaculate following down-regulation of testosterone may take an additional 6 weeks, as with vasectomy. It should be easier to suppress the onset of spermatogenesis in seasonally breeding species, but that process begins at least 2 months before the first typical appearance of sperm. Thus, treatment should be initiated at least 2 months before the anticipated onset of breeding.

Progestins [Melengestrol acetate (MGA) implants, Depo-Provera® injections, Ovaban® pills] If progestins must be used, they should be administered for no more than 2 years and then discontinued to allow for a pregnancy. **Discontinuing progestin contraception and allowing non-pregnant cycles does not substitute for a pregnancy. Use of progestins for more than a total of 4 years is not recommended.** MGA implants last at least 2 years, and clearance of the hormone from the system occurs rapidly after implant removal. Progestins are considered safe to use during lactation. For felids, Depo-Provera is the least preferable of the progestins due to the unpredictable duration of efficacy and because it has more side effects than other types of progestins.

Vaccines: The porcine zona pellucida (PZP) vaccine has not been tested in lions but may cause permanent sterility in carnivore species after only one or two treatments, so **this method is not recommended**.

Ovariectomy or Ovariohysterectomy: Removal of the ovaries is a safe and effective method to prevent reproduction in animals that are eligible for permanent sterilization. The RMC recommends ovariohysterectomy rather than overiectomy for all female lions, regardless of age. The rationale being that a female that is considered young but is nulliparous is more likely to have endometrial hyperplasia than a female that is considered old but has been bred every year.

Tubal Ligation: Although blocking access of sperm to eggs will prevent fertilization, it will not prevent the potential adverse effects to females that can result from prolonged, cyclic exposure to the endogenous progesterone associated with the pseudo-pregnancy that follows ovulation induced by copulation. **This method is not recommended for lions.**

Vasectomy: As with tubal ligation, above, vasectomy of males will not prevent potential adverse effects to females that can result from prolonged, cyclic exposure to the endogenous progesterone associated with the pseudo-pregnancy that follows ovulation induced by copulation. **This method is not recommended for lions.**


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