

# Population Analysis & Breeding and Transfer Plan

## Malayan Tiger (*Panthera tigris jacksoni*) AZA Species Survival Plan® Yellow Program

Photo by Christopher Dulaney



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Data Current through: 18 August 2020

JANUARY 2021



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# Acknowledgments

The AZA Tiger SSP planning meeting for all four tiger SSP programs was held virtually on 19 August 2020. Attendees include Management Group members T. Harris, M. Dulaney, K. Goodrowe Beck, L. Myers, T. Fischer, K. Traylor-Holzer, S. Bircher, D. Goff, D. Dembiec, A. Morris, A. Nelson and J. Tetzloff.

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Citation: Harris, T., Myers, L. and Traylor-Holzer, K. 2020. Malayan tiger (*Panthera tigris jacksoni*). AZA Species Survival Plan Yellow Program Population Analysis & Breeding and Transfer Plan. IUCN SSC Conservation Planning Specialist Group, Apple Valley, MN.

## **MALAYAN TIGER (*Panthera tigris jacksoni*) Species Survival Plan®**

### **Description of Population Status**

#### **Introduction**

There are currently N = 51 animals (32 males; 19 females) at 26 North American institutions. The target population size designated by the AZA Felid Taxon Advisory Group is 150. In practice, available space within AZA institutions is much lower, due in part to space occupied by generic tigers. The AZA SSP population is the only intensively managed regional population for this tiger subspecies in the world.

The Tiger Species Survival Plan manages three tiger populations as recommended by the 1992 Tiger Global Conservation Strategy and by the AZA Felid Taxon Advisory Group (TAG) – Amur (*Panthera tigris altaica*), Sumatran (*P.t. sumatrae*), and Malayan (*P.t. jacksoni*) tigers – with 150 spaces currently allotted to each. As of August 2020, 272 tigers are maintained in 102 AZA or partner institutions, including 51 Malayan, 72 Sumatran, and 117 Amur tigers, as well as 32 generic (unknown pedigree) tigers. An additional 16 generic tigers are held by the International Exotic Feline Sanctuary (AZA member).

#### **Conservation Status**

The Malayan tiger was re-categorized as Critically Endangered on the IUCN Red List in 2015 based on a >25% decline within one generation and fewer than 250 mature individuals remaining. Population estimates in 2013 were 250-340 tigers remaining in the wild. Since the SSP population currently is the only managed captive population for this subspecies, it has the potential to serve as genetic reservoir and secondary population for the captive and wild Malayan tiger populations in Southeast Asia. Captive tigers outside of the SSP are maintained in zoos in Malaysia, Singapore and Europe.

#### **Taxonomic Status**

Recently, Wilting *et al.* (2015) examined morphological, ecological and molecular traits to propose only two tiger subspecies: the Sunda tiger (*P.t. sondaica*), which includes the Sumatran tiger; and a continental tiger (*P.t. tigris*) consisting of two management units (a northern unit, which includes the Amur tiger, and a southern unit, which includes the Malayan tiger). These taxonomy changes were recently adopted by the IUCN Cat Specialist Group, as part of their revised felid taxonomy (Kitchener *et al.* 2017). Liu *et al.* (2018) recognized six taxonomic management units based on whole genome sequencing, including the Malayan tiger. The Tiger SSP plans to continue managing our existing populations (Amur, Malayan, and Sumatran) and to continue using the same common names to describe these populations. The Tiger SSP is open to adopting the revised scientific names of the two tiger subspecies, to be in line with IUCN usage; however, we will wait to do so until those scientific names are adopted on the IUCN Red List ([www.iucnredlist.org/details/15955/0](http://www.iucnredlist.org/details/15955/0)) and by Species360. The Tiger SSP will work with Species360 to ensure a system is in place to continue tracking our managed populations in ZIMS, even if those populations have the same subspecies scientific names.

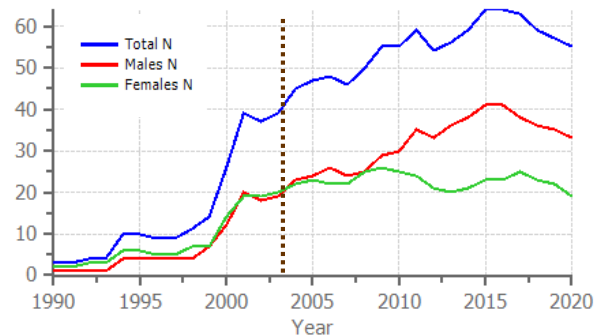
#### **Assumptions for Data Analysis and Masterplanning**

Data were taken from the AZA Malayan Tiger Regional Studbook (current as of 18 August 2020). One male and two females were excluded from the genetic analysis due to age. ZIMS for Studbooks was used to export data for analysis using PMx v1.6. Demographic data were exported for the historical North American population (1990 to present), and genetic data were used for the living population in SSP institutions. The probability of breeding success (i.e., producing a litter within the year) was calculated for each recommended pair based on the age, reproductive history and location of the male and female (Saunders *et al.* 2014) and used to estimate expected number of offspring and for stochastic projections.

## Demography

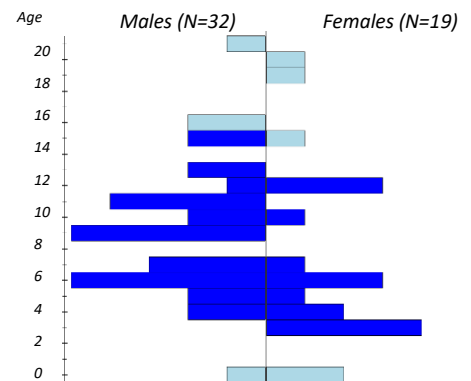
### Population Growth

The current SSP population began in 1990-92 with the importation of 1.3 tigers from Asia followed by modest breeding. Active management of this tiger subspecies began in 1998, when the decision was made by the SSP to expand this population and pursue the availability of additional founders from Southeast Asian zoos. The population quickly grew from 10 to over 40 individuals due to high reproductive success. During this time 60% of breeding recommendations produced a litter within one year, with mean litter size = 3.2 cubs and 30-day survival of 93%. Five wild-caught tigers were imported in 2003 (dotted line on graph) and produced multiple litters. Population growth slowed due to limited space availability and concentrated breeding efforts on the imported founders, with breeding efforts eventually expanded to include all lineages. New institutions are periodically incorporated into the program as institutions holding generic (non-studbook) tigers begin to move their collections toward managed tiger subspecies. Low reproductive success in the past few years has led to a decline in numbers. Future growth will depend upon both reproductive success and space availability influenced by the attrition of the generic tiger population and expansion of the Sumatran tiger SSP population. A 2-3% annual growth rate is projected as realistic both in terms of the biological potential of the species and increasing availability of space.



### Age/Sex Distribution

The current population is male biased (see graph; light blue bars indicate pre- or post-reproductive individuals). This limits growth and genetic management options, as essentially all females are needed for breeding regardless of genetic value. Experienced healthy male tigers potentially can breed their entire adult lives. Females can produce litters up to about age 14; however, reproductive success declines substantially after age 6 and is significantly higher for reproductively experienced females. Recruitment has been low in recent years but is improving in 2020. Expanded facilities are anticipated to be available in the next couple of years and will increase breeding options.



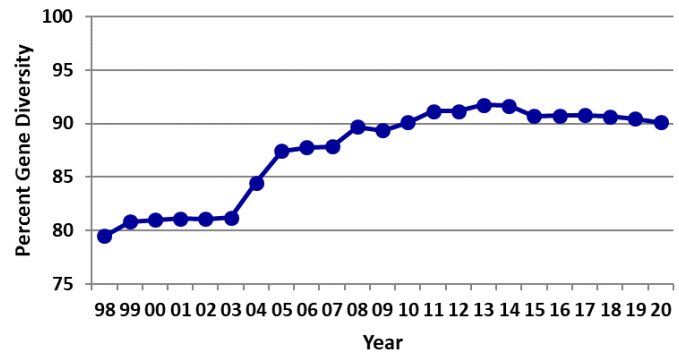
### Demographic Summary (as of 18 August 2020)

Current size of SSP population – total (males, females)	51 (32.19)
Number of individuals excluded from analyses	3 (1.2)
Population size following exclusions	48 (31.17)
Target population size from Felid TAG	150
Mean generation time	8.6 years
Population growth rate ( $\lambda$ )*: Historical / 5-year / Projected	1.04/1.00/1.02

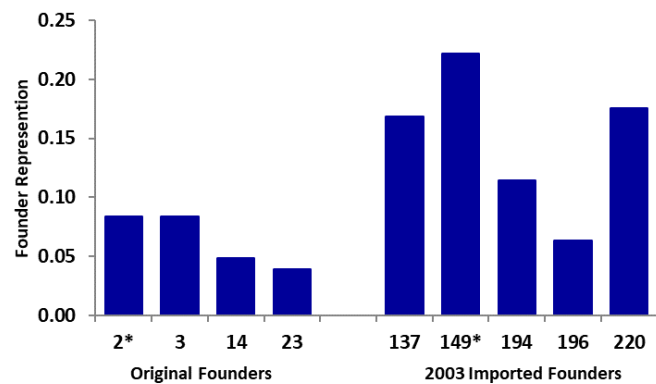
\*Historical from life tables; 5-year from studbook census; Projected from PMx stochastic 20 yr projections

## Genetics

Prior to 2003 only eight Malayan tigers had been imported to establish the SSP population, all from Southeast Asian zoos. Most of these individuals were descendants of the same founders that are responsible for almost all captive Malayan tigers worldwide, the exception being the importation of wild-caught male SB 14. At that time the SSP population was descended from only four founders, and all potential breeders were related, making inbreeding unavoidable.



In 2003 the SSP imported five Malayan tigers from Zoo Melaka in Malaysia, all of which were wild-caught individuals that were captured in connection with human-tiger conflict events and were unrelated to the SSP population. Successful reproduction by all of these imports brought the population gene diversity from 81.2% to 91.7% in 11 years. Allele retention is ~75% for one founder and 97-100% for the remaining four new founders. Breeding of the newly imported tigers and their descendants is now mixed with breeding of the original founder line to preserve all founder lines. Each of the nine founders now represents 4-22% of the genetic make-up of the living SSP population, with the recent imports accounting for ~75%.



### Genetic Summary (as of 18 August 2020)

	Current	Potential
Number of founders	9 (actual)*	0 additional
Founder genome equivalents (FGE)	5.07	6.73
Gene diversity retained (GD%)	90.13	92.57
Population mean kinship (MK)	0.0987	
Mean inbreeding (F)	0.0156	
Effective population size/census size ratio ( $N_e / N$ )	0.20	
% of pedigree known	100	
Projections	<b>Deterministic (PMx)</b>	<b>Stochastic (Vortex)</b>
Years to 90% gene diversity	0	4
Years to 10% loss of gene diversity	34	60; n/a
Gene diversity at 100 years from present (%)	71.4	76.4; 83.0
	Assuming $\lambda = 1.05$ , target size = 150	Assuming target size = 75; 150 (2015 analysis)

\*10 founders are indicated in PMx analysis rather than 9, as PMx calculates two founders for SB 149, whose parents are designated as WILD#s to better represent genetic relationships with other captive tigers in Malaysia; actual founders = 9

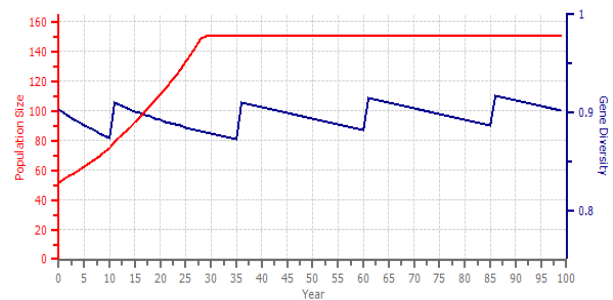


## Management Goals and Strategy

### Long-Term Management Strategy

Historically the Tiger SSP was allotted 450 spaces for tigers by the Felid TAG, either 225 each for two subspecies or 150 each for three subspecies. At the 1998 master plan meeting the SSP evaluated the potential viability of each of the three managed subspecies. The SSP recognized that population viability would be increased by managing only two subspecies, one temperate (i.e., Amur) and one tropical (i.e., either Sumatran or Malayan). Given the uncertain availability of additional founders for either tropical subspecies, the status of the global captive population and the threats to the wild population, the decision was made to allot 150 spaces for each subspecies at this time. If a viable population for either tropical subspecies becomes unachievable, it is anticipated that one population may be eliminated through attrition in favor of the other tropical subspecies. The Malayan tiger population has slightly higher GD, and there is a greater need for a managed captive program for this subspecies. Sumatran tigers are also managed by the European EEP, Australasian ASMP, Japanese JSMP and Indonesian PKBSI as part of the WAZA Sumatran Tiger Global Species Management Plan (GSMP). There is currently no secondary cooperatively managed regional program for Malayan tigers. Current opportunities for importation of additional founders are being explored for both tropical subspecies, both of which are Critically Endangered on the IUCN Red List.

The Malayan tiger population has made great progress in the past 20+ years, expanding from 10 animals in four institutions to 51 animals in 26 institutions. Although successful reproduction of tigers imported in 2003 significantly increased the genetic diversity of this population, periodic genetic supplementation with additional founders will be needed to ensure the maintenance of 90% gene diversity in the SSP population. The graph depicts one



scenario to meet program genetic goals, in which one founder pair is incorporated into the SSP population (with intensive genetic management of  $N_e/N = 0.3$  and high allele retention of 0.85) once every 25 years; other scenarios can be envisioned based on more or less intensive management, population growth, space availability, and the availability of new founders over time. The continued influx of wild-born orphaned or problem tigers into Malaysian zoos and government facilities, along with recent interest in *ex situ* management of this taxa in Malaysia, suggest that new founders may be available in the future. Meanwhile the SSP population represents an important genetic reservoir as insurance against the rapidly increasing extinction risk of the wild population. Four of the 9 SSP founders are not represented outside of the SSP. Other *ex situ* Malayan tiger populations (in Southeast Asian and European zoos) are not of verified origin and/or are not managed cooperatively to maintain gene diversity and minimize adaptation to captivity.

### Short-Term Breeding Plan

Eleven breedings were recommended for 2020-2021 (six carryover, five new). Given the probability of success of these pairs based on age, reproductive history and current location, ~5-6 offspring are expected, which would grow the population to about 54 tigers. At this time, three (1.2) tigers are designated as non-breeders due to age. Eleven transfers are needed for breeding, and two transfers are recommended to meet exhibition need and make space for breeding. Breeding (and banking sperm from) males at the top of the MK list is a high priority. Breeding and needed population growth is limited to some extent by available space within SSP holding institutions.

### ***Artificial Insemination and Genome Resource Banking***

The Tiger SSP has prioritized establishment of a Tiger Genome Resource Bank (GRB) and development of a reliable method for artificial insemination (AI) using frozen-thawed spermatozoa to support the sustainability of its managed populations. We are working with Dr. Jason Herrick and others at Omaha's Henry Doorly Zoo and Aquarium to test both non-surgical transcervical AI and surgical laparoscopic oviductal AI procedures, as well as to strategically bank and store semen samples as part of a multi-function Tiger GRB. No AI research will be conducted on Malayan tigers until these techniques have been refined and are more reliable. All adult male Malayan tigers are recommended for semen banking regardless of whether they have been banked previously. . The Tiger SSP thanks Omaha's Henry Doorly Zoo and Aquarium, Institute of Museum and Library Services, AZA's Conservation Grants Fund, and Point Defiance Zoo and Aquarium's Holly Reed Conservation Fund for supporting this work, and thus making it free for zoos to participate. A full research proposal is available upon request from the Tiger SSP Coordinator, Tara Harris (tharris@phoenixzoo.org).

### ***Genome Resource Bank Strategy***

A Genome Resource Bank (GRB) is an *ex situ* management strategy that can be used to meet population objectives and conservation goals for a species. Like a living population, a GRB can serve one or multiple roles, and its structure, management and use are determined by those goals. Using the decision process outlined in the *IUCN Guidelines for the Use of Ex Situ Management for Species Conservation*, the Tiger SSP reviewed the potential roles for a GRB for each tiger population, discussed the relative benefits, costs and feasibility of meeting those roles, and recommended the development of a GRB designed to meet those roles. The recommended GRBs (currently designated for gametes, primarily sperm) are similar for each of the three tiger populations (Amur, Sumatran and Malayan). While multiple GRBs are recommended for each population, none of these GRBs need to be physically separated; rather, centralized stored samples can be designated for different purposes.

Each tiger population will have the following GRBs, named and developed based on Ballou *et al.*:

**"National Reserve" GRB:** A permanent repository of sperm samples collected to maximize gene diversity in the GRB. This GRB serves as a genetic insurance population and should not be used except in emergency situations to resurrect the *ex situ* (or *in situ*) population. Assuming that cryopreserved samples remain viable, this GRB prevents further loss of genetic variation through genetic drift and further adaptation to captivity. Recommended for all three tiger populations.

**"Savings Account" GRB:** A source population for periodic genetic reinforcement of the *ex situ* (or *in situ*) population. Founder genomes and/or less common genetic lines are preserved to be used periodically but rarely (only when needed) to boost low gene diversity and reduce increasing inbreeding when critically needed. This GRB can be used to restore lost genetic variation and counteract inbreeding depression. Recommended for all three tiger populations.

**"Checking Account" GRB:** A GRB characterized by frequent additions (deposits) and withdrawals for its intended use. Currently the Amur and Sumatran tiger populations are designated for an Assisted Reproduction Technology (ART) Research GRB. Sperm samples are collected and used in ongoing research to improve AI success, a necessary advancement in order for any of the GRBs to meet their intended role. Once this research role is no longer needed, this frequent-use GRB may transition to one that can augment population management for use as part of the annual breeding plan.

While cryopreserved tiger sperm samples have been maintained at several SSP facilities for many years, 2017 marked the initiation of the Tiger SSP's new GRB strategy. All GRBs were formally initiated in 2017 and are in development as part of the artificial insemination research program.



## **Tiger SSP Conservation, Research, and Education Priorities and Activities**

### **Conservation**

In 2012, the Tiger SSP launched the Tiger Conservation Campaign to encourage zoos to raise awareness about the plight of wild tigers and funding for their conservation. Fewer than 4,000 tigers are thought to remain in the wild. The Amur, Sumatran, and Malayan tiger population managed by the Tiger SSP each number 500 or fewer in the wild.

The Tiger SSP has created a website ([www.tigercampaign.org](http://www.tigercampaign.org)) and Facebook page ([www.facebook.com/tigercampaign](https://www.facebook.com/tigercampaign)) for the campaign. Campaign materials for zoo professionals can be downloaded from the website, along with descriptions of the projects that the Tiger SSP is supporting. Promotional materials are also available from the Tiger SSP Coordinator.

As of mid-2020, the Tiger Conservation Campaign has collected over \$1.4 million for on-the-ground tiger conservation efforts in Russia, Malaysia, and Indonesia. The Tiger SSP thanks all of the zoos that have supported the campaign thus far, and encourages all institutions with tigers to contribute to wild tiger conservation, either through the Tiger Conservation Campaign or a reputable wildlife conservation organization.

### **Education**

The current education priority for the Tiger SSP is to create event kits that participating institutions can use to engage audiences, encourage them to care about tigers, and inspire them to act.

Current educational resources can be found at [www.tigercampaign.org](http://www.tigercampaign.org) and obtained from the Tiger SSP Coordinator ([tharris@phoenixzoo.org](mailto:tharris@phoenixzoo.org)).

### **Research**

Research priorities for the Tiger SSP include:

- Improving the success of assisted reproduction techniques in tigers;
- Modeling lifetime female breeding strategies, to improve sustainability; and
- Finding safe, effective, and reversible contraception options for tigers, and understanding the effects of existing contraceptives on reproductive potential in tigers

Regarding contraception in tigers, note that the following statement was approved by the Tiger SSP Management Group at the 2010 Tiger SSP meeting, and remains in effect:

*"The Tiger SSP recognizes that hormonal implants (e.g., deslorelin and MGA) can be an effective management tool for contraception and management of aggression. However, there is cause for concern about their effects on reproductive potential. This affects breeding recommendations and the SSP's ability to effectively manage tiger populations. Therefore, the SSP believes caution is warranted. We recommend that institutions wishing to implant studbook-registered tigers (i.e., generics excluded) request approval from the Tiger SSP management committee before chemically contracepting female or male tigers. Each request will be reviewed and considered on a case-by-case basis."*

## Tigers Outside of AZA Member Institutions

### *Within North America*

Any pure Malayan tigers in North America that are outside of AZA member facilities would fall into one of two categories:

- 1) tigers for which ancestry can be traced with high confidence back to wild-caught founders (all known pedigreed Malayan tigers are currently registered in the *AZA Malayan Tiger Regional Studbook*);
- 2) tigers for which their pedigree is not known or traceable back to either founders or studbook-registered tigers, meaning that their relationship (kinship) to tigers in the SSP is not known.

There are three (2.1) studbook-registered Malayan tigers at one non-AZA member facility (ROSAMOND). One of these males is being transferred to an AZA member institution. This facility has participated actively in the SSP in the past.

Given the paucity of Malayan tigers that have been exported from Malaysia and Singapore, it is unlikely that any additional pure Malayan tigers exist unrecorded in North America. If such tigers were to be discovered and taxonomically confirmed via molecular genetic analysis, it is likely that they would derive from the same founder lines as currently exist in the SSP.

### *Outside of North America*

A small population of Malayan tigers is held by several European zoos. These tigers share the same genetic founders as the SSP and/or incorporate some uncertainty in their pedigree and origin. These tigers are not considered to be of value to the SSP program at this time.

Malayan tigers are held by zoos in Malaysia and Singapore, with only a portion of these recorded in ZIMS. Additional Malayan tigers may be held in government facilities in Malaysia. Some of these tigers are related to the SSP, while others are believed to be unrelated. Such tigers held in Southeast Asia are the appropriate potential source for any new founders to the SSP program in the future.

### **Report Citations:**

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Wilting, A. et al. 2015. Planning tiger recovery: Understanding intraspecific variation for effective conservation. *Sci. Adv.* 26 June 2015.

## Summary of Breeding and Transfer Plan (Malayan Tiger)

### 2020 – 2021 BREEDING PAIRS (N=11)

MALE				FEMALE				BREEDING	STATUS
SB#	LOCAL ID	AGE	CURRENT LOCATION	SB#	LOCAL ID	AGE	CURRENT LOCATION	LOCATION	
311	65439	7	BUSCH TAM	347or 348	117004/ 117005	3	CINCINNAT	BATONROUG	New
315	205403	6	SEATTLE	274	201033	12	EL PASO	EL PASO	New
245	103264	15	LOWRY	322	M00560	6	ALEXANDRI	LOWRY	New
300	M17001	9	ABQBIOPK	276	M15054	12	NY BRONX	NY BRONX	New
241	206088	15	FRESNO	273	16189	12	TULSA	TULSA	New
309	65437	7	BUSCH TAM	332	M16001	4	NY BRONX	BUSCH TAM	Carryover
331	535	5	ROSAMOND	342	218080	3	DREHER PA	DICKERSON	Carryover
280	4380	11	KNOXVILLE	310	817373	7	JACKSONVL	JACKSONVL	Carryover
279	4379	11	KNOXVILLE	320	5297	6	KNOXVILLE	KNOXVILLE	Carryover
288	207020	10	SEATTLE	333	M16002	4	NY BRONX	SEATTLE	Carryover
278	17824	11	TULSA	328	17235	6	TULSA	TULSA	<sup>1</sup> Carryover

<sup>1</sup> 0.2 born 8Dec20

### TRANSFERS REQUIRED FOR BREEDING (N=11)

SB#	LOCAL ID	SEX	AGE	CURRENT LOCATION	TRANSFER TO	NOTES	STATUS
241	206088	M	15	FRESNO	TULSA	For breeding	<sup>2</sup> New
300	M17001	M	9	ABQBIOPK	NY BRONX	For breeding	New
311	65439	M	7	BUSCH TAM	BATONROUG	For breeding	New
315	205403	M	6	SEATTLE	EL PASO	For breeding	<sup>2</sup> New
322	M00560	F	6	ALEXANDRI	LOWRY	For breeding	New
347or 348	117004/ 117005	F	3	CINCINNAT	BATONROUG	For breeding	New
280	4380	M	11	KNOXVILLE	JACKSONVL	For breeding	Carryover
331	535	M	5	ROSAMOND	DICKERSON	For breeding	Carryover
332	M16001	F	4	NY BRONX	BUSCH TAM	For breeding	Carryover
333	M16002	F	4	NY BRONX	SEATTLE	For breeding	<sup>2</sup> Carryover
342	218080	F	3	DREHER PA	DICKERSON	For breeding	Carryover

<sup>2</sup> transferred in Fall 2020 or early 2021

### TRANSFERS REQUIRED FOR MANAGEMENT / EXHIBITION / FUTURE BREEDING (N=2)

SB#	LOCAL ID	SEX	AGE	CURRENT LOCATION	TRANSFER TO	NOTES
287	210390	M	10	FORTWORTH	LUFKIN	<sup>2</sup> Future breeding
299	6651	M	9	DICKERSON	ABQBIOPK	For exhibition

<sup>2</sup> transferred in Fall 2020

**Malayan Tiger FINAL Breeding and Transfer Plan for each specimen (grouped by current holding institution)**

SB #	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
300	ABQBIOPK	M17001	Male	9	SendTo	NY BRONX	Breed	276	New recommendation
60	ALEXANDRI	M00338	Male	21	Hold		DoNotBreed		Permanent non-breeder
322	ALEXANDRI	M00560	Female	6	SendTo	LOWRY	Breed	245	New recommendation
272	ATASCADER	M09018	Male	12	Hold		DoNotBreed		
316	AUDUBON	19M009	Male	6	Hold		DoNotBreed		
216	BATONROUG	10651	Male	16	Hold		DoNotBreed		
309	BUSCH TAM	65437	Male	7	Hold		Breed	332	Carryover recommendation
311	BUSCH TAM	65439	Male	7	SendTo	BATONROUG	Breed	347348	New recommendation
346	CINCINNAT	117003	Female	3	Hold		DoNotBreed		
347	CINCINNAT	117004	Female	3	SendTo	BATONROUG	Breed	311	Send one of these two females to BATONROUGE for breeding with 311
348	CINCINNAT	117005	Female	3	Hold		DoNotBreed		
299	DICKERSON	6651	Male	9	SendTo	ABQBIOPK	DoNotBreed		For exhibition
281	DREHER PA	216105	Male	11	Hold		DoNotBreed		
289	DREHER PA	217055	Female	10	Hold		DoNotBreed		
342	DREHER PA	218080	Female	3	SendTo	DICKERSON	Breed	331	Carryover rec w/male from ROSAMOND
376	DREHER PA	220016	Male	0	Hold		DoNotBreed		
377	DREHER PA	220017	Female	0	Hold		DoNotBreed		
378	DREHER PA	220018	Female	0	Hold		DoNotBreed		
274	EL PASO	201033	Female	12	Hold		Breed	315	New recommendation
287	FORTWORTH	210390	Male	10	SendTo	LUFKIN	DoNotBreed		For future breeding; <i>Addendum: transferred 11Nov20</i>
241	FRESNO	206088	Male	15	SendTo	TULSA	Breed	273	New rec; <i>Addendum: transf. 14Jan21</i>
298	HOUSTON	30586	Male	7	Hold		DoNotBreed		
301	JACKSONVL	813360	Male	9	Hold		DoNotBreed		
310	JACKSONVL	817373	Female	7	Hold		Breed	280	Carryover recommendation
314	JNGLARY F	13C109	Male	6	Hold		DoNotBreed		
279	KNOXVILLE	4379	Male	11	Hold		Breed	320	Carryover recommendation
280	KNOXVILLE	4380	Male	11	SendTo	JACKSONVL	Breed	310	Carryover Recommendation

SB #	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
320	KNOXVILLE	5297	Female	6	Hold		Breed	279	Carryover recommendation
215	LITTLEROC	6549	Male	16	Hold		DoNotBreed		
317	LITTLEROC	7380	Female	6	Hold		DoNotBreed		
243	LOWRY	103209	Female	15	Hold		DoNotBreed		Female likely too old to breed <i>Addendum: died 20Nov20</i>
245	LOWRY	103264	Male	15	Hold		Breed	322	New recommendation
65	LUFKIN	10353	Female	20	Hold		DoNotBreed		Permanent non-breeder; <i>Addendum: died 16Jan21</i>
260	MANHATTAN	201537	Male	13	Hold		DoNotBreed		
261	MANHATTAN	201536	Male	13	Hold		DoNotBreed		
303	NORFOLK	213009	Male	9	Hold		DoNotBreed		
337	NORFOLK	216000	Male	4	Hold		DoNotBreed		
338	NORFOLK	216001	Male	4	Hold		DoNotBreed		
276	NY BRONX	M15054	Female	12	Hold		Breed	300	New recommendation
332	NY BRONX	M16001	Female	4	SendTo	BUSCH TAM	Breed	309	Carryover recommendation
333	NY BRONX	M16002	Female	4	SendTo	SEATTLE	Breed	288	Carryover recommendation; <i>Addendum: transf. 26Sept20</i>
331	ROSAMOND	535	Male	5	SendTo	DICKERSON	Breed	342	Carryover recommendation; send to <i>DICKERSON for breeding</i>
302	SANDIEGOZ	511041	Male	9	Hold		DoNotBreed		
319	SANDIEGOZ	515031	Male	6	Hold		DoNotBreed		
321	SANDIEGOZ	515032	Male	6	Hold		DoNotBreed		
288	SEATTLE	207020	Male	10	Hold		Breed	333	Carryover recommendation
315	SEATTLE	205403	Male	6	SendTo	EL PASO	Breed	274	New recommendation; <i>Addendum: transf. 21Oct20</i>
273	TULSA	16189	Female	12	Hold		Breed	241	New recommendation
278	TULSA	17824	Male	11	Hold		Breed	328	Carryover recommendation
328	TULSA	17235	Female	6	Hold		Breed	278	Carryover recommendation; <i>Addendum: 0.2 born 8Dec20</i>
326	YULEE	193301	Male	6	Hold		DoNotBreed		
327	YULEE	193302	Male	6	Hold		DoNotBreed		

## Malayan Tiger FINAL Breeding and Transfer Plan (by institution, alphabetical by Species360 mnemonic)

### ABQBIOPK

Albuquerque Biological Park

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
300	ABQBIOPK	M17001	Male	9	SendTo	NY BRONX	Breed	276	New recommendation

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
299	DICKERSON	6651	Male	9	Receive	ABQBIOPK	DoNotBreed		For exhibition

### ALEXANDRI

Alexandria Zoological Park

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
60	ALEXANDRI	M00338	Male	21	Hold		DoNotBreed		Permanent non-breeder
322	ALEXANDRI	M00560	Female	6	SendTo	LOWRY	Breed	245	New recommendation

### ATASCADER

Charles Paddock Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
272	ATASCADER	M09018	Male	12	Hold		DoNotBreed		

### AUDUBON

Audubon Nature Institute

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
316	AUDUBON	19M009	Male	6	Hold		DoNotBreed		

**BATONROUG**

Baton Rouge Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
216	BATONROUG	10651	Male	16	Hold		DoNotBreed		

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
311	BUSCH TAM	65439	Male	7	Receive	BATONROUG	Breed	347/ 348	New recommendation
347 or 348	CINCINNAT	117004 or 117005	Female	3	Receive	BATONROUG	Breed	311	New recommendation; receive one of these two females

**BUSCH TAM**

Busch Gardens Tampa Bay

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
309	BUSCH TAM	65437	Male	7	Hold		Breed	332	Carryover recommendation
311	BUSCH TAM	65439	Male	7	SendTo	BATONROUG	Breed	347/ 348	New recommendation

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
332	NY BRONX	M16001	Female	4	Receive	BUSCH TAM	Breed	309	Carryover recommendation

**CINCINNAT**

Cincinnati Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
346	CINCINNAT	117003	Female	3	Hold		DoNotBreed		
347	CINCINNAT	117004	Female	3	SendTo / Hold	BATONROUG	Breed	311	Send one of these two females to BATONROUG for breeding
348	CINCINNAT	117005	Female	3			DoNotBreed		



**DICKERSON**

Dickerson Park Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
299	DICKERSON	6651	Male	9	SendTo	ABQBIOPK	DoNotBreed		For exhibition

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
331	ROSAMOND	535	Male	5	Receive	DICKERSON	Breed	342	Carryover recommendation
342	DREHER PA	218080	Female	3	Receive	DICKERSON	Breed	331	Carryover recommendation

**DREHER PA**

Palm Beach Zoo at Dreher Park

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
281	DREHER PA	216105	Male	11	Hold		DoNotBreed		
289	DREHER PA	217055	Female	10	Hold		DoNotBreed		
342	DREHER PA	218080	Female	3	SendTo	DICKERSON	Breed	331	Carryover recommendation
376	DREHER PA	220016	Male	0	Hold		DoNotBreed		
377	DREHER PA	220017	Female	0	Hold		DoNotBreed		
378	DREHER PA	220018	Female	0	Hold		DoNotBreed		

**EL PASO**

El Paso Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
274	EL PASO	201033	Female	12	Hold		Breed	315	New recommendation

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
315	SEATTLE	205403	Male	6	Receive	EL PASO	Breed	274	New recommendation; <i>Addendum: transf. 21Oct20</i>

**FORTWORTH**

Fort Worth Zoological Park

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
287	FORTWORTH	210390	Male	10	SendTo	LUFKIN	DoNotBreed		Future breeder; <i>Addendum: transf. 11Nov20</i>

**FRESNO**

Fresno Chaffee Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
241	FRESNO	206088	Male	15	SendTo	TULSA	Breed	273	New recommendation; <i>Addendum: transferred 14Jan21</i>

**HOUSTON**

Houston Zoo, Inc.

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
298	HOUSTON	30586	Male	7	Hold		DoNotBreed		

**JACKSONVL**

Jacksonville Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
301	JACKSONVL	813360	Male	9	Hold		DoNotBreed		
310	JACKSONVL	817373	Female	7	Hold		Breed	280	Carryover recommendation

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
280	KNOXVILLE	4380	Male	11	Receive	JACKSONVL	Breed	310	Carryover recommendation

**JNGLARY F**

Naples Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
314	JNGLARY F	205401	Male	6	Hold		DoNotBreed		

**KNOXVILLE**

Zoo Knoxville

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
279	KNOXVILLE	4379	Male	11	Hold		Breed	320	Carryover recommendation
280	KNOXVILLE	4380	Male	11	SendTo	JACKSONVL	Breed	310	Carryover recommendation
320	KNOXVILLE	5297	Female	6	Hold		Breed	279	Carryover recommendation

**LITTLEROC**

Little Rock Zoological Gardens

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
215	LITTLEROC	6549	Male	16	Hold		DoNotBreed		
317	LITTLEROC	7380	Female	6	Hold		DoNotBreed		

**LOWRY**

Zoo Tampa at Lowry Park

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
243	LOWRY	103209	Female	15	Hold		DoNotBreed		Likely too old to breed; <i>Addendum: died 20Nov20</i>
245	LOWRY	103264	Male	15	Hold		Breed	322	New recommendation

*Animals planned to be moved to this institution:*

322	ALEXANDRI	M00560	Female	6	Receive	LOWRY	Breed	245	New recommendation
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**LUFKIN**

Ellen Trout Zoo

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
65	LUFKIN	10353	Female	20	Hold		DoNotBreed		Permanent non-breeder <i>Addendum: died 16Jan21</i>

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
287	FORTHWORTH	210390	Male	10	Receive	LUFKIN	DoNotBreed		Future breeder; <i>Addendum: transf. 11Nov20</i>

**MANHATTAN**

Sunset Zoological Park

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
260	MANHATTAN	201537	Male	13	Hold		DoNotBreed		
261	MANHATTAN	201536	Male	13	Hold		DoNotBreed		

**NORFOLK**

Virginia Zoological Park

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
303	NORFOLK	213009	Male	9	Hold		DoNotBreed		
337	NORFOLK	216000	Male	4	Hold		DoNotBreed		
338	NORFOLK	216001	Male	4	Hold		DoNotBreed		

## NY BRONX

### Bronx Zoo/Wildlife Conservation Society

#### *Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
276	NY BRONX	M15054	Female	12	Hold		Breed	300	New recommendation
332	NY BRONX	M16001	Female	4	SendTo	BUSCH TAM	Breed	309	Carryover recommendation
333	NY BRONX	M16002	Female	4	SendTo	SEATTLE	Breed	288	Carryover recommendation; <i>Addendum: transf. 26Sept20</i>

#### *Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
300	ABQBIOPK	M17001	Male	9	Receive	NY BRONX	Breed	276	New recommendation

## SANDIEGOZ

### San Diego Zoo

#### *Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
302	SANDIEGOZ	511041	Male	9	Hold		DoNotBreed		
319	SANDIEGOZ	515031	Male	6	Hold		DoNotBreed		
321	SANDIEGOZ	515032	Male	6	Hold		DoNotBreed		

## SEATTLE

### Woodland Park Zoo

#### *Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
288	SEATTLE	207020	Male	10	Hold		Breed	333	Carryover recommendation
315	SEATTLE	205403	Male	6	SendTo	EL PASO	Breed	274	New recommendation; <i>Addendum: transf. 21Oct20</i>

#### *Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
333	NY BRONX	M16002	Female	4	Receive	SEATTLE	Breed	288	Carryover recommendation; <i>Addendum: transf. 26Sept20</i>

**TULSA**

Tulsa Zoo &amp; Living Museum

*Animals currently at the institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
273	TULSA	16189	Female	12	Hold		Breed	241	New recommendation
278	TULSA	17824	Male	11	Hold		Breed	328	Carryover recommendation
328	TULSA	17235	Female	6	Hold		Breed	278	Carryover recommendation; <i>Addendum: 0.2 born 8Dec20</i>

*Animals planned to be moved to this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
241	FRESNO	206088	Male	15	Receive	TULSA	Breed	273	New recommendation; <i>Addendum: transferred 14Jan21</i>

**YULEE**

White Oak Conservation Center

*Animals currently at this institution:*

SB#	Location	Local ID	Sex	Age	Disposition	New Location	Breeding	With	Notes
326	YULEE	193301	Male	6	Hold		DoNotBreed		
327	YULEE	193302	Male	6	Hold		DoNotBreed		

## Malayan Tiger MK List – 18 August 2020

(*Boldface indicates recommended breeding pairs*)

### MALES\*

SB#	MK	Location	Age	#Offspr
<b>278</b>	<b>0.0749</b>	<b>TULSA</b>	<b>11</b>	
<b>279</b>	<b>0.0749</b>	<b>KNOXVILLE</b>	<b>11</b>	
<b>280</b>	<b>0.0749</b>	<b>KNOXVILLE</b>	<b>11</b>	
<b>245</b>	<b>0.0807</b>	<b>LOWRY</b>	<b>15</b>	<b>4</b>
281	0.0817	DREHER PA	11	3
<b>241</b>	<b>0.0879</b>	<b>FRESNO</b>	<b>15</b>	<b>5</b>
<b>309</b>	<b>0.0889</b>	<b>BUSCH TAM</b>	<b>7</b>	
<b>311</b>	<b>0.0889</b>	<b>BUSCH TAM</b>	<b>7</b>	
287	0.0954	FORTWORTH	10	
<b>288</b>	<b>0.0954</b>	<b>SEATTLE</b>	<b>10</b>	
376	0.1000	DREHER PA	0	
299	0.1032	DICKERSON	9	
<b>300</b>	<b>0.1032</b>	<b>ABQBIOPK</b>	<b>9</b>	
301	0.1032	JACKSONVL	9	
260	0.1048	MANHATTAN	13	
261	0.1048	MANHATTAN	13	
314	0.1061	JNGLARY F	6	
<b>315</b>	<b>0.1061</b>	<b>SEATTLE</b>	<b>6</b>	
316	0.1061	AUDUBON	6	
272	0.1068	ATASCADER	12	
302	0.1068	SANDIEGOZ	9	
319	0.1068	SANDIEGOZ	6	
321	0.1068	SANDIEGOZ	6	
216	0.1074	BATONROUG	16	4
298	0.1077	HOUSTON	7	
326	0.1077	YULEE	6	
327	0.1077	YULEE	6	
303	0.1120	NORFOLK	9	2
215	0.1152	LITTLEROC	16	4
337	0.1154	NORFOLK	4	
338	0.1154	NORFOLK	4	

### FEMALES\*\*

SB#	MK	Location	Age	LastRepro
346	0.0828	CINCINNAT	3	
347	0.0828	CINCINNAT	3	
348	0.0828	CINCINNAT	3	
<b>332</b>	<b>0.0856</b>	<b>NY BRONX</b>	<b>4</b>	
<b>333</b>	<b>0.0856</b>	<b>NY BRONX</b>	<b>4</b>	
<b>276</b>	<b>0.0879</b>	<b>NY BRONX</b>	<b>12</b>	<b>Jan-16</b>
<b>342</b>	<b>0.0889</b>	<b>DREHER PA</b>	<b>3</b>	
<b>322</b>	<b>0.0942</b>	<b>ALEXANDRI</b>	<b>6</b>	
<b>310</b>	<b>0.0967</b>	<b>JACKSONVL</b>	<b>7</b>	<b>Feb-17</b>
377	0.1000	DREHER PA	0	
378	0.1000	DREHER PA	0	
<b>317</b>	<b>0.1061</b>	<b>LITTLEROC</b>	<b>6</b>	
<b>274</b>	<b>0.1068</b>	<b>EL PASO</b>	<b>12</b>	
<b>320</b>	<b>0.1068</b>	<b>KNOXVILLE</b>	<b>6</b>	
<b>328</b>	<b>0.1077</b>	<b>TULSA</b>	<b>6</b>	
289	0.1084	DREHER PA	10	May-20
<b>273</b>	<b>0.1172</b>	<b>TULSA</b>	<b>12</b>	<b>Aug-14</b>

\*Male 331 not included (currently at non-AZA facility); would be top ranked male

\*\*Female 243 not included (likely post reproductive); addendum: died 20Nov20



## APPENDIX A. Analysis filters and assumptions

### Studbook export filters for genetic and demographic analyses

Project Comments: PMx analysis based on ZIMS for Studbooks data; for preliminary masterplanning for 2020

Primary data file

Data File Name: zims.zims

Studbook Name: Tiger, Malayan (*Panthera tigris jacksoni*)

Exported On: 2020-06-25

Software version: ZIMS for Studbooks 3.0

Current Through: 2020-06-25\* (no data changes between this date and 2020-08-19)

Compiled By: Kathy Traylor

Scope: AZA

Dates: 1990-01-01 to 2020-06-25

Location: North America

Date used for calculations: 08/19/2020

## APPENDIX B. Animals excluded from genetic analysis

SB# 60	Male	ALEXANDRI	Excluded due to age and reproductive status
SB# 65	Female	LUFKIN	Excluded; <i>Addendum: died 16Jan21</i>
SB# 243	Female	LOWRY	Excluded; <i>Addendum: died 20Nov20</i>

All remaining 48 animals were included in the genetic analysis. Excluded animals are considered to be permanent non-breeders. Genetically valuable individuals may still be approved for breeding attempts or gamete banking but are not expected to produce offspring.

## APPENDIX C. Life Tables

### MALES (model data)

Age (yrs)	Px	Mid Px	Qx	Risk Qx	Lx	Mid Lx	Mx	Risk Mx	Vx
0	0.832	0.900	0.168	53.9	1.00	0.92	0	53.9	1.01
1	0.981	0.981	0.019	53.0	0.83	0.82	0	53.0	1.25
2	0.981	0.981	0.019	52.6	0.82	0.81	0	52.6	1.32
3	0.981	0.981	0.019	52.6	0.80	0.79	0	52.6	1.40
4	0.981	0.981	0.019	52.8	0.79	0.78	0.041	52.8	1.48
5	0.981	0.978	0.019	51.5	0.77	0.76	0.041	51.5	1.51
6	0.974	0.974	0.026	45.1	0.76	0.75	0.163	45.1	1.56
7	0.974	0.987	0.026	38.7	0.74	0.73	0.100	38.7	1.48
8	1	1.000	0.000	37.0	0.72	0.72	0.204	37.0	1.47
9	1	1.000	0.000	32.9	0.72	0.72	0.204	32.9	1.31
10	1	1.000	0.000	30.2	0.72	0.72	0.204	30.2	1.14
11	1	1.000	0.000	26.1	0.72	0.72	0.078	26.1	0.97
12	1	0.947	0.000	24.0	0.72	0.72	0.078	24.0	0.93
13	0.895	0.895	0.105	19.9	0.72	0.68	0.311	19.9	0.88
14	0.895	0.895	0.105	18.1	0.64	0.51	0.353	18.1	0.67
15	0.895	0.877	0.105	15.2	0.58	0.54	0.353	15.2	0.35
16	0.857	0.769	0.143	8.9	0.51	0.48	0	8.9	0
17	0.667	0.667	0.333	6.9	0.44	0.37	0	6.9	0
18	0.667	0.600	0.333	5.6	0.29	0.25	0	5.6	0
19	0.500	0.500	0.500	2.8	0.20	0.15	0	2.8	0
20	0.500	0.333	0.500	2.0	0.10	0.07	0	2.0	0
21	0	0	1	2.0	0.05	0.02	0	0.2	0
22	0	0	1	0	0	0	0	0	0
23	0	0	1	0	0	0	0	0	0

$r=0.035$ ;  $\lambda=1.036$ ;  $R_0=1.446$ ;  $T=10.5$ ;  $N_{20}=42$

Px = survival; Qx = mortality; Lx = cumulative survivorship; Mx = fecundity; Vx = expected future reproduction

**FEMALES (model data)**

Age (yrs)	Px	Mid Px	Qx	Risk Qx	Lx	Mid Lx	Mx	Risk Mx	Vx
0	0.828	0.895	0.172	38.4	1.00	0.91	0	38.4	1.01
1	0.976	0.976	0.024	41.0	0.83	0.82	0	41.0	1.26
2	0.976	0.975	0.024	41.0	0.81	0.80	0	41.0	1.34
3	0.973	0.973	0.027	38.9	0.79	0.78	0.109	38.9	1.43
4	0.973	0.986	0.027	36.1	0.77	0.76	0.219	36.1	1.41
5	1.000	1.000	0.000	35.8	0.75	0.75	0.235	35.8	1.27
6	1.000	0.982	0.000	32.8	0.75	0.75	0.252	32.8	1.07
7	0.964	0.945	0.036	29.1	0.75	0.73	0.265	29.1	0.85
8	0.926	0.926	0.074	27.6	0.72	0.69	0.252	27.6	0.63
9	0.926	0.922	0.074	26.1	0.67	0.64	0.172	26.1	0.43
10	0.918	0.918	0.082	22.7	0.62	0.59	0.077	22.7	0.29
11	0.918	0.927	0.082	20.8	0.57	0.54	0.104	20.8	0.24
12	0.938	0.938	0.063	17.4	0.52	0.51	0.077	17.4	0.15
13	0.938	0.938	0.063	15.4	0.49	0.47	0.052	15.4	0.08
14	0.938	0.968	0.063	13.9	0.46	0.44	0.030	13.9	0.03
15	1.000	1.000	0.000	12.4	0.43	0.43	0	12.4	0
16	1.000	0.958	0.000	12.0	0.43	0.43	0	12.0	0
17	0.917	0.827	0.083	11.6	0.43	0.41	0	11.6	0
18	0.729	0.728	0.271	9.3	0.39	0.34	0	9.3	0
19	0.727	0.674	0.273	6.2	0.29	0.25	0	6.2	0
20	0.600	0.600	0.400	2.6	0.21	0.17	0	2.6	0
21	0.600	0.563	0.400	1.3	0.13	0.10	0	1.3	0
22	0.500	0.333	0.500	1.0	0.08	0.06	0	1.0	0
23	0	0	1	0	0.04	0.02	0	0	0

$r=0.038$ ;  $\lambda=1.039$ ;  $R_0=1.286$ ;  $T=6.6$ ;  $N_{20}=42$

Px = survival; Qx = mortality; Lx = cumulative survivorship; Mx = fecundity; Vx = expected future reproduction

## **APPENDIX D. Institutional Representatives**

### **ABQBIOPK**

Albuquerque Biological Park  
903 10<sup>th</sup> St SW  
Albuquerque, NM 87102  
Institutional Representative: Lynn Tupa (ltupa@cabq.gov)

### **ALEXANDRI**

#### **Alexandria Zoological Park**

3016 Masonic Drive, PO Box 71  
Alexandria, LA 71309  
Institutional Representative: Lisa Laskoski (Lisa.Laskoski@cityofalex.com)

### **ATASCADER**

#### **Charles Paddock Zoo**

9305 Pismo St.  
Atascadero, CA 93422  
Institutional Representative: Alan Baker (abaker@atascadero.org)

### **AUDUBON**

#### **Audubon Nature Institute**

6500 Magazine St.  
New Orleans, LA 70118  
Institutional Representative: Amanda Turnbull (aturnbull@auduboninstitute.org)

### **BATONROUG**

#### **BREC's Baton Rouge Zoo**

3601 Thomas Rd.  
Baton Rouge, LA 70807  
Institutional Representative: Paige Wiggins (pwiggins@brzoo.org)

### **BUSCH TAM**

#### **Busch Gardens**

3605 Bougainvillea Ave.  
Tampa, FL 33612  
Institutional Representative: Jay Duncan (Jay.Duncan@BuschGardens.com)

### **CINCINNAT**

#### **Cincinnati Zoo & Botanical Garden**

3400 Vine St.  
Cincinnati, OH 45220-1399  
Institutional Representative: Christina Gorsuch (christina.gorsuch@cincinnati-zoo.org)

**DICKERSON****Dickerson Park Zoo**

3043 North Fort

Springfield, MO 65803-1079

Institutional Representative: Kesha Schreiber (kschreib@springfieldmo.gov)

**DREHER PA****Palm Beach Zoo at Dreher Park**

1301 Summit Blvd.

West Palm Beach, FL 33405-3035

Institutional Representative: Michael Terrell (mterrell@palmbeachzoo.org)

**EL PASO****El Paso Zoo**

4001 East Paisano

El Paso, TX 79905-4223

Institutional Representative: Griselda Martinez (martinezgx@elpasotexas.gov)

**FORTWORTH****Fort Worth Zoological Park**

1989 Colonial Parkway

Ft Worth, TX 76110

Institutional Representative: Kurt Giesler (kgiesler@fortworthzoo.org)

**FRESNO****Fresno Chaffee Zoo**

894 W. Belmont Ave.

Fresno, CA 93728-2891

Institutional Representative: Lyn Myers (lmyers@fresnochaffeezoo.com)

**HOUSTON****Houston Zoological Gardens**

1513 Cambridge St.

Houston, TX 77030

Institutional Representative: Kevin Hodge (khodge@houstonzoo.org)

**JACKSONVL****Jacksonville Zoo and Gardens**

370 Zoo Parkway

Jacksonville, FL 32218

Institutional Representative: Craig Miller (millerc@jacksonvillezoo.org)

**JNGLARY F****Naples Zoo**

1590 Goodlette Rd. N.

Naples, FL 34102

Institutional Representative: Elizabeth Johnson (ejohnson@napleszoo.org)

**KNOXVILLE****Zoo Knoxville**

PO Box 6040

Knoxville, TN 37914

Institutional Representative: Petty Grieve (pgrieve@zooknoxville.org)

**LITTLE ROC****Little Rock Zoo**

1 Jonesboro Drive

Little Rock, AR 72205

Institutional Representative: Debbie Thompson (dthompson@littlerock.org)

**LOWRY****Zoo Tampa at Lowry Park**

1101 W. Sligh Ave.

Tampa, FL 33604-4756

Institutional Representative: Angela Belcher (angela.belcher@lowryparkzoo.com)

**LUFKIN****Ellen Trout Zoo**

402 Zoo Circle

Lufkin, TX 75904

Institutional Representative: Celia Falzome (cfalzome@ellentrouzoo.com)

**MANHATTAN****Sunset Zoological Park**

2333 Oak Drive

Manhattan, KS 66502-3824

Institutional Representative: Kirk Nemechek (nemechek@cityofmhk.com)

**NORFOLK****Virginia Zoo**

3500 Granby St.

Norfolk, VA 23504

Institutional Representative: Jill Tarrant (jill.tarrant@norfolk.gov)

**NY BRONX****Bronx Zoo/Wildlife Conservation Society**

2300 Southern Blvd.

Bronx, NY 10460-1099

Institutional Representative: Colleen McCann (cmccann@wcs.org)

**SANDIEGOZ****San Diego Zoological Garden**

P.O. Box 551

San Diego, CA 92112-0551

Institutional Representative: Curby Simerson (csimerson@sandiegozoo.org)

**SEATTLE****Woodland Park Zoo**

601 N 59th St

Seattle, WA 98103-5858

Institutional Representative: Kim Szawan (Kim.Szawan@Zoo.org)

**TULSA****Tulsa Zoological Park**

5701 E. 36<sup>th</sup> St. N

Tulsa, OK 74115

Institutional Representative: Jordan Piha (jpiha@tulsazoo.org)

**YULEE****White Oak Conservation Center**

581705 White Oak Road

Yulee, FL. 32097

Institutional Representative: Karen Meeks (kmeeks@white-oak.org)