Population Analysis & Breeding and Transfer Plan

African Pygmy Falcon (*Polihierax semitorquatus*)
AZA Species Survival Plan®
Yellow Programs

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20 August 2018

PMC Population Management Center
LINCOLN PARK ZOO. ASSOCIATION OF ZOOS & AQUARIUMS
SAN DIEGO ZOO GLOBAL

This Animal Program is currently a Yellow SSP Program and recommendations proposed are non-binding – Participation is voluntary. Dispositions to non-AZA institutions should comply with each institution's acquisition/disposition policy.

Executive Summary

African Pygmy Falcon (*Polihierax semitorquatus)*

The current population of African pygmy falcon is 52 birds (26 males, 24 females, 2 unknown sexes) distributed among 17 AZA institutions. The Raptor Taxon Advisory Group has set the target size for this population to be 70 birds (2015 Regional Collection Plan). The African pygmy falcon program currently qualifies as a Yellow SPP Program (≥50 animals; <90% gene diversity for 100 years).

Genetic and demographic analyses of the North American Regional Studbook for African Pygmy Falcons (current to 01 June 2018) were performed using 2.4 and PMx 1.4.20170717 resulting in the current Breeding & Transfer Plan. Recommendations contained in this plan supersede those made by earlier plans.

Demography

Current Population Size (males.females.unknowns)	52 (26.24.2)
# Animals Excluded From Analyses	16 (9.6.1)
Population Size Following Exclusions	36 (17.18.1)
Target Population Size	70
Mean Generation Time (T; in years)	4.1
Projected Population Growth Rate (λ) – from life tables (Appendix C)	1.055
Historic Population Growth Rate (average λ 1988-2017)	1.06
Recent Population Growth Rate (average λ 2013-2017)	1.04

Genetics

	2018	Current Potential
Founders	17	0 additional
Founder Genome Equivalents (FGE)	4.55	9.32
Current Gene Diversity (GD %)	89.00	94.64
Population Mean Kinship (MK)	0.1100	-----
Mean Inbreeding (F)	0.1098	-----
% Pedigree Known Before / After Assumptions and Exclusions	100/100	-----
% Pedigree Certain Before / After Assumptions and Exclusions	100/100	-----
Effective Population Size / Census Size Ratio (Ne / N)	0.40	-----
Projections		
Years To 90% Gene Diversity	-----	-----
Years To 10% Loss of GD	21[c]	-----
Gene Diversity at 100 Years From Present (%)	56[c]	-----

[a]projections based on the current analytical population of 36 birds (λ = 1.055, T = 4.1 years, target size = 70 birds)

Demographic analyses suggest that recent reproductive rates must be at least minimally improved to both maintain and grow the population towards its long-term target size of 70 birds. From 2013-2017, the population averaged ~8 hatches per year; ~38 hatches are needed over the next three years (12 or 13 hatches per year) to maintain the population at its current size while ~50 hatches are needed (16 or 17 hatches per year) to grow the population at its projected 5.5% growth rate to a size of ~58 birds. Gene diversity in the analytical population is 89.00%, which is below the 90% threshold commonly thought to represent genetic vigor. Gene diversity is projected to decline to ~56% over the next 100 years if the analytical population grows at its projected growth rate of 5.5% to a target size of 70 birds. It is important to note however, that both current gene diversity and long-term diversity projections have notably improved since the last Breeding & Transfer Plan due to the import of eight birds in 2016. Current gene diversity may still continue to improve over the short-term as imports produce more offspring, because again beginning to decline over the long-term. Genetic management is focused on breeding animals with low and well-matched mean kinships, to better equalize founder representations. Some birds with high mean kinships are receiving breeding recommendations to help meet demographic goals and facilitate the retention of older founding lineages in the population. As with most AZA-managed programs, breeding recommendations also aim to limit inbreeding and minimize differences between sire and dam kinships.

Summary Actions: This is a 3-year plan (2018-2020). The Program recommends 13 females to breed. Fourteen transfers are intended to establish new pairs and meet institutional requests.

This Animal Program is currently a Yellow SSP Program and recommendations proposed are non-binding – Participation is voluntary. Dispositions to non-AZA institutions must comply with each institution's acquisition/disposition policy, in accordance with the AZA policy on Responsible Population Management.

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Cover Photo Credit: wildsidenaturetours.com

This plan was reviewed and distributed with the assistance of the Population Management Center.
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Description of Population Status

Introduction: The African pygmy falcon (*Polihierax semitorquatus*) is a small raptor found in northeast and southwest Africa. The species is one of the few bird species that are "obligate nest pirates", primarily occupying the nests of social weavers and white-headed buffalo weavers. In captivity, African pygmy falcons are a popular education species. The current, formally managed population of African pygmy falcons is 52 birds (26 males, 24 females, 2 unknown sexes) distributed among 17 AZA institutions. The Raptor Taxon Advisory Group has set the target size for this population to be 70 birds (2015 Regional Collection Plan). The African pygmy falcon program currently qualifies as a Yellow SPP Program (≥50 animals; <90% gene diversity for 100 years).

Genetic and demographic analyses of the North American Regional Studbook for African Pygmy Falcons (current to 01 June 2018) were performed using 2.4 and PMx 1.4.20170717, resulting in the current Breeding & Transfer Plan for this program. Recommendations contained in this plan supersede those made by earlier plans.

Conservation Status: IUCN Red List – Least Concern; USFWS – not listed; CITES – Appendix II

Exclusions and Pedigree Assumptions: The population size at the time of analyses was 52 birds (26 males, 24 females, 2 unknown sexes); the population's pedigree was 100% known/certain. Twelve education birds (7 males, 4 females, 1 unknown sex) were excluded from the potential breeding population, life table calculations and genetic analyses (Appendix D). An additional four birds (2 males, 2 females) were excluded from the potential breeding population and genetic analyses, but included in life table calculations, due to age (Appendix D). Following exclusions, the potential breeding population included 36 birds (17 males, 18 females, 1 unknown sex).

Demography: Studbook records indicate that African pygmy falcons first appeared in current AZA facilities as early as 1929, but the species has only been consistently exhibited since 1987. Yearly population growth rates have varied considerably since that time (annual λ from 1988-2017 ranged from 0.83 to 1.90), but the general trend has been one of positive growth (Figure 1; average λ 1988-2017 = 1.06). Population growth has been primarily due to successful captive breeding, with the first captive hatch occurring in 1988 (Figure 2; average captive-hatched λ 1989-2017 = 1.15). Although the overall trend of population growth has been positive, there is some demographic concern due to the high fluctuation of yearly growth rates. This fluctuation has primarily been due to inconsistent reproduction; the number of yearly hatches from 1988 to 2017 ranged from 3 to 24. This suggests that, although there is a high potential for reproduction in this population, the population should be carefully managed to ensure that the appropriate number of breeding pairs are recommended each year to meet demographic goals. Eight birds were imported in 2016 to bolster the population's gene diversity and although their acquisition contributed to the recently observed population growth (Figure 1), captive reproduction in 2016 and 2017 also was notable with a total of 20 chicks produced across both years. Based on the current life tables (Appendix C), the potential breeding population has a projected growth rate of 5.5% per year (projected λ = 1.055).

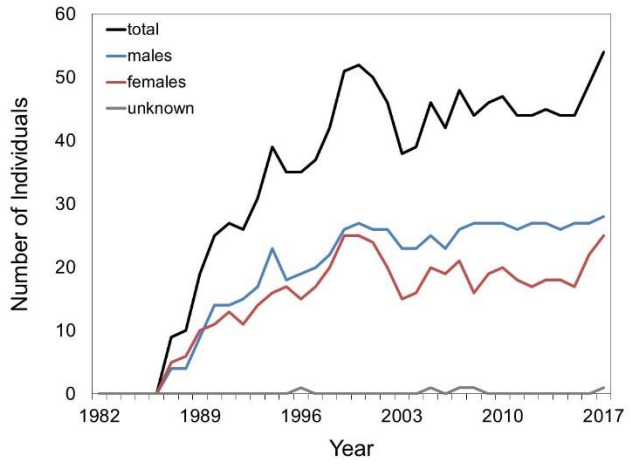

Figure 1. Census of African pygmy falcons (on 31 December) in current AZA facilities from 1982 to 2017, by sex.

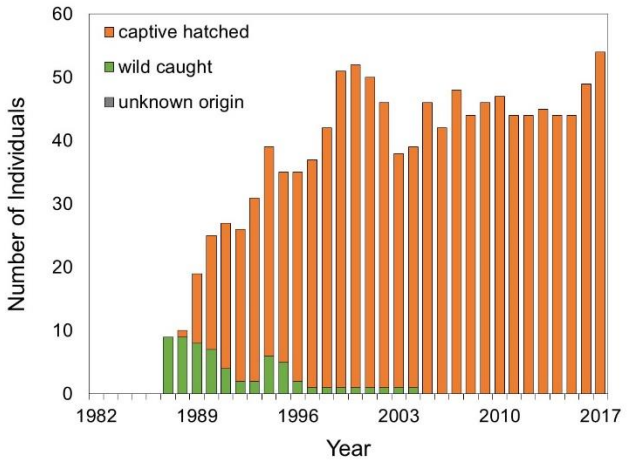

Figure 2. Census of African pygmy falcons (on 31 December) in current AZA facilities from 1982 to 2017, by hatch type.

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African pygmy falcons can live into their late teens or early twenties; the oldest recorded male in the studbook lived to 23 years of age (SB# 105) and the oldest recorded female lived to 20 years of age (SB# 97). Current life tables used for demographic analyses (Appendix C) indicate first-year mortality is 51% for males and 45% for females (Appendix C). Survival statistics (www.aza.org/species-survival-statistics) indicate that median life expectancy, assuming first-year survival, is 7.1 years (50% of animals die before these ages and 50% die after). Both sexes are reproductive at approximately one year of age. The oldest male on record to breed was 14 years of age at the time of conception (SB# 106) and the oldest female to produce offspring was 10 years of age (SB# 161). Females typically produce one or two chicks per clutch and can double or even triple-clutch during a calendar year if eggs are artificially incubated.

The age structure of the African pygmy falcon population is generally columnar and reasonably robust, with a fair number of birds in reproductive age classes (Figure 3a). However, inconsistent reproduction is highlighted by the number of empty or depauperate age classes throughout the age structure. A more demographically secure age structure would have a slightly pyramidal shape with more birds in the youngest age classes. The sex ratio in the population is currently slightly male-biased, with 1.08 males present for every female. Because this species is housed in monogamous breeding pairs, the rarer sex will limit reproduction. Although the breeding population represents only 69% of the total population, the age structure of that portion of the population still includes a notable number of birds in reproductive age classes (Figure 3b). The sex ratio in the breeding population is approximately equal but slightly female-biased, with 1.06 females present for every male.

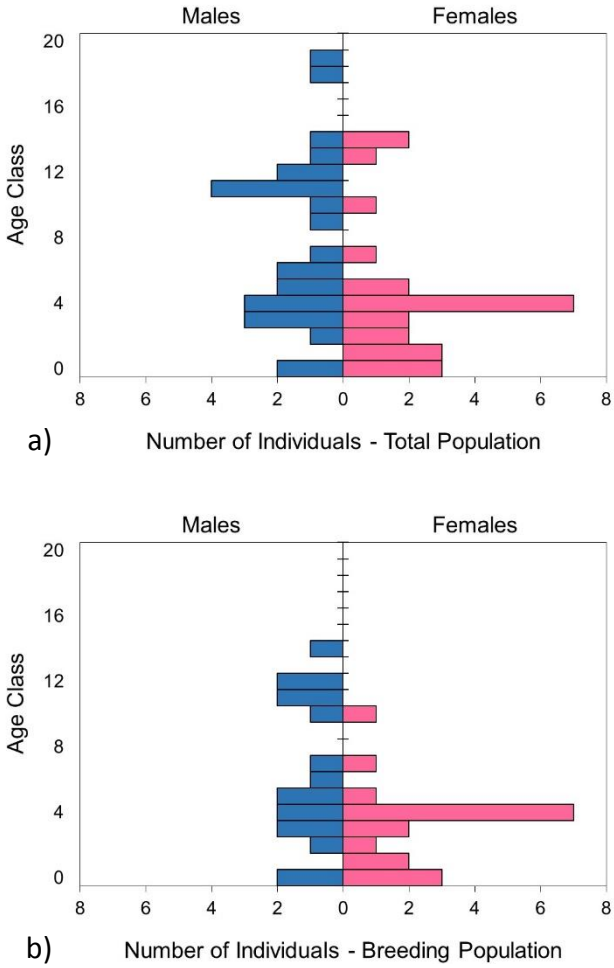

Figure 3. Age distribution of the a) total population and b) breeding population of African pygmy falcons. The total population includes 26 males, 24 females, and two unknown sexes (52 birds total). The breeding population includes 17 males, 18 females, and 1 unknown sex (36 birds total).

Demographic analyses based on current life tables indicate that ~38 hatches are needed over the next three years (12 or 13 hatches per year) to maintain the population at its current size of 52 birds. Approximately 50 hatches are needed over the next three years (16 or 17 hatches per year) for the breeding population to achieve its projected 5.5% growth rate and increase overall population size to ~58 birds (~20 birds are expected to experience morality and reproduction would add ~26 birds for an increase in total population size of ~6 birds). The population averaged ~8 hatches per year from 2013-2017, indicating that recent reproduction must be at least minimally improved to both maintain and grow the population towards its long-term target size of 70 birds. This may seem contradictory given the recent population growth observed (Figure 1), but it is important to note that some of the recent growth was due to the import of eight birds in 2016. Reproduction will continue to be closely monitored, and interim breeding recommendations adjusted as necessary, to facilitate demographic goals and fill space currently available for this species.

Genetics: The studbook pedigree indicates that the analytical African pygmy falcon population is descended from 17 founders with no potential founders still remaining (Figure 4). The import of eight birds in 2016 added 10 new founders to the population. The imports' parents, rather than the imports themselves, are population founders because the imports were captive-hatched to established breeding pairs (some imports were full-siblings and

originated from five clutches in total). The gene diversity of the population is 89.00%, which is equivalent to that found in four or five unrelated animals (FGE = 4.55). Typical AZA program goals include thresholds for tolerance of gene diversity loss over time; 90% gene diversity retention for 100 years is not an uncommon management goal. Decreases in gene diversity below 90% of that in the founding population have been associated with increasingly compromised reproduction by, among other factors, lower hatch weights, smaller clutch sizes, and greater neonatal mortality. Gene diversity in the analytical African pygmy falcon population is projected to decline to ~56% over the next 100 years if the population grows at its projected 5.5% growth rate (λ = 1.055) to a size of 70 birds. Although this is a notable improvement over previous projections (see table below), future imports will still be necessary to maintain long-term gene diversity due to the species' short generation length.

Genetics Summary

	2006	2010	2015	2018	Current Potential
Number of Founders	7	7	7	17	0 additional
Founder Genome Equivalents (FGE)	2.62	2.42	2.00	4.55	9.32
Gene Diversity Retained (%)	80.93	79.32	74.99	89.00	94.64
Population Mean Kinship	0.1907	0.2068	0.2501	0.1100	-----
Mean Inbreeding (F)	0.1226	0.1523	0.1701	0.1098	-----
% Known Pedigree Before/After Assumptions and Exclusions	100/100	100/100	100/100	100/100	-----
% Certain Pedigree Before/After Assumptions and Exclusions	100/100	100/100	100/100	100/100	-----
Effective Size / Census Size Ratio (Ne / N)	0.15	0.36	0.38	0.40	-----
Projections					
Years To 90% Gene Diversity	-----	-----	-----	-----	-----
Years To 10% Loss of GD	-----	-----	29[b]	21[c]	-----
Gene Diversity at 100 Years From Present (%)	-----	48[a]	48[b]	56[c]	-----

[a]projections based on the 2010 analytical population of 36 birds (λ = 1.04, T = 4.4 years, target size = 70 birds)
[b]projections based on the 2015 analytical population of 31 birds (λ = 1.07, T = 4.3 years, target size = 70 birds)
[c]projections based on the current analytical population of 36 birds (λ = 1.055, T = 4.1 years, target size = 70 birds)

The best genetic management strategy to maximize a population's long-term gene diversity retention is typically managed breeding targeted at equalizing founder representations, by breeding animals with low and well-matched mean kinships. Founder representations in the analytical African pygmy falcon population are currently skewed (Figure 4); more equal representations would retain more gene diversity. There are two primary factors contributing to the population's skewed founders representations. First, founders represented by recent imports are underrepresented because the imports have produced only a limited number of clutches to date; these representations should grow as the imports produce additional offspring. Second, representations among the population's older founding lineages have long been skewed because, prior to the imports, every living bird in the population was descended, at least in part, from #22 (the most overrepresented founder). Although it should now be possible to reduce the overall representation of #22 across the population, that founder will continue to be disproportionately represented among the population's older founding lineages. Although particular priority is being placed on breeding birds with low mean kinships (representative of underrepresented founders), some birds with higher mean kinships have received breeding recommendations to meet demographic goals and facilitate the retention of older founding lineages in the population. Some pairings will continue to produce

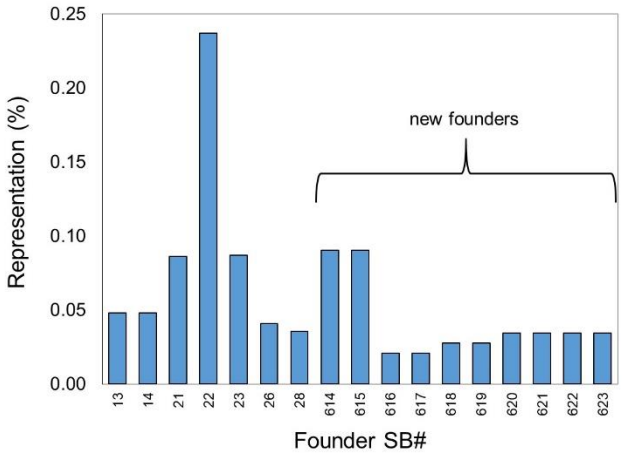

Figure 4. Distribution of founder representations in the analytical African pygmy falcon population. Those marked "new founders" represent eight birds imported in 2016.

offspring with high inbreeding coefficients, because it is not yet genetically beneficial to cross new and old founding lineages.

It is important to note that the current mean kinship in the population continues to be moderately high at a value of 0.1100. Half-siblings have a kinship of 0.125, which means that the average relationship across the population is just lower than that of second-order relatives. However, due to the recent imports and their successful reproduction, mean kinship has actually declined from the 0.2501 value reported in the previous Breeding & Transfer Plan. As the imports continue to breed, mean kinship is expected to further decline over the short-term before it again begins to increase over the long-term.

Management Strategy: The current, formally managed population of African pygmy falcons is 52 birds (26 males, 24 females, 2 unknown sexes) distributed among 17 AZA institutions. Demographic analyses suggest that recent reproductive rates must be at least minimally improved to both maintain and grow the population towards its long-term target size of 70 birds. From 2013-2017, the population averaged ~8 hatches per year; ~38 hatches are needed over the next three years (12 or 13 hatches per year) to maintain the population at its current size while ~50 hatches are needed (16 or 17 hatches per year) to grow the population at its projected 5.5% growth rate to a size of ~58 birds. Gene diversity in the analytical population is 89.00%, which is below the 90% threshold commonly thought to represent genetic vigor. Gene diversity is projected to decline to ~56% over the next 100 years if the analytical population grows at its projected growth rate of 5.5% to a target size of 70 birds. It is important to note however, that both current gene diversity and long-term diversity projections have notably improved since the last Breeding & Transfer Plan due to the import of eight birds in 2016. Current gene diversity may still continue to improve over the short-term as imports produce more offspring, because again beginning to decline over the long-term. Genetic management is focused on breeding animals with low and well-matched mean kinships, to better equalize founder representations. Some birds with high mean kinships are receiving breeding recommendations to help meet demographic goals and facilitate the retention of older founding lineages in the population. As with most AZA-managed programs, breeding recommendations also aim to limit inbreeding and minimize differences between sire and dam kinships. Some pairings will continue to produce offspring with markedly high inbreeding coefficients over the short-term, because it is not yet genetically beneficial to cross new and old founding lineages.

This is a 3-year plan (2018-2020). Although another full set of recommendations will not be produced until 2021, interim recommendations will continue to be made as needed. Please promptly report any hatches or deaths to the Program Coordinator, so that interim recommendations can be based on accurate population data. Recommendations contained in this plan supersede all previous recommendations.

At this time, the program:

1. **Recommends 13 females to breed.** Five proven females remain paired with compatible mates and eight females are with new or existing but unproven mates. Two additional post-reproductive females may receive interim recommendations to incubate if they produce eggs. Three females are awaiting genetically appropriate mates for pairing.

2. **Recommends 14 transfers to meet institutional needs and establish new breeding pairs.** One new institution will receive birds and five new breeding pairs will be established as part of these recommendations.

Summary of Breeding and Transfer Recommendations

ID	Location	Sex	Age	Disposition	Location	Breeding	With	Notes
164	FRANKLINP	M	19	SEND TO	STONEHAM	SEE NOTES		age exclusion
192	DENVER	M	18	HOLD	DENVER	DO NOT BREED		age exclusion
230	SANDIEGOZ	F	14	HOLD	SANDIEGOZ	DO NOT BREED		education
231	FRANKLINP	F	14	SEND TO	STONEHAM	SEE NOTES		age exclusion
239	SANDIEGOZ	M	14	SEND TO	PINOLA	BREED WITH	610	
245	HOUSTON	M	13	HOLD	HOUSTON	DO NOT BREED		education
505	LOUISVILL	M	12	HOLD	LOUISVILL	SEE NOTES		
518	LOUISVILL	F	13	HOLD	LOUISVILL	SEE NOTES		age exclusion
523	NATAVPGH	M	12	HOLD	NATAVPGH	DO NOT BREED		
532	SD-WAP	M	11	HOLD	SD-WAP	DO NOT BREED		education
538	MEMPHIS	M	11	SEND TO	KNOXVILLE	BREED WITH	632	
539	LOUISVILL	M	11	HOLD	LOUISVILL	DO NOT BREED		education
542	TOLEDO	M	11	HOLD	TOLEDO	DO NOT BREED		
543	DENVER	F	10	HOLD	DENVER	DO NOT BREED		
548	SD-WAP	M	9	HOLD	SD-WAP	DO NOT BREED		education
550	FRANKLINP	M	10	SEND TO	LOSANGELE	BREED WITH	583	
~~557~~	~~MEMPHIS~~	~~F~~	~~7~~					died
558	OKLAHOMA	M	7	HOLD	OKLAHOMA	BREED WITH	642	
570	STONEHAM	M	6	SEND TO	MEMPHIS	BREED WITH	604	
583	FRANKLINP	F	5	SEND TO	LOSANGELE	BREED WITH	550	
585	NATAVPGH	M	6	HOLD	NATAVPGH	DO NOT BREED		education
588	HOUSTON	M	5	HOLD	HOUSTON	BREED WITH	652	
590	FORTWORTH	M	5	HOLD	FORTWORTH	DO NOT BREED		
596	CINCINNAT	F	4	HOLD	CINCINNAT	DO NOT BREED		education
601	FRANKLINP	M	4	HOLD	FRANKLINP	DO NOT BREED		education
602	CINCINNAT	F	4	HOLD	CINCINNAT	BREED WITH	611	
604	STONEHAM	F	4	SEND TO	MEMPHIS	BREED WITH	570	
606	METROZOO	F	3	HOLD	METROZOO	BREED WITH	613	
609	KNOXVILLE	M	3	HOLD	KNOXVILLE	DO NOT BREED		education
610	PINOLA	F	3	HOLD	PINOLA	BREED WITH	239	
611	CINCINNAT	M	3	HOLD	CINCINNAT	BREED WITH	602	
613	METROZOO	M	2	HOLD	METROZOO	BREED WITH	606	
624	HOUSTON	M	3	HOLD	HOUSTON	BREED WITH	627	
625	DENVER	F	4	HOLD	DENVER	BREED WITH	630	
626	FRANKLINP	M	4	HOLD	FRANKLINP	BREED WITH	631	
627	HOUSTON	F	4	HOLD	HOUSTON	BREED WITH	624	
628	SANDIEGOZ	F	4	HOLD	SANDIEGOZ	BREED WITH	650	
629	SANDIEGOZ	F	4	HOLD	SANDIEGOZ	BREED WITH	647	
630	DENVER	M	4	HOLD	DENVER	BREED WITH	625	
631	FRANKLINP	F	4	HOLD	FRANKLINP	BREED WITH	626	
632	KNOXVILLE	F	2	HOLD	KNOXVILLE	BREED WITH	538	
633	FORTWORTH	F	2	HOLD	FORTWORTH	DO NOT BREED		education
641	RIO GRAND	UNK	1	HOLD	RIO GRAND	DO NOT BREED		education
642	FORTWORTH	F	1	SEND TO	OKLAHOMA	BREED WITH	558	
644	FRANKLINP	F	1	HOLD	FRANKLINP	DO NOT BREED		education
645	FRANKLINP	F	1	HOLD	FRANKLINP	SEE NOTES		
647	FRANKLINP	M	0	SEND TO	SANDIEGOZ	BREED WITH	629	
649	FRANKLINP	F	0	SEND TO	FORTWORTH	SEE NOTES		
650	DENVER	M	0	SEND TO	SANDIEGOZ	BREED WITH	628	
651	DENVER	F	0	SEND TO	FRANKLINP	SEE NOTES		
652	HOUSTON	F	0	HOLD	HOUSTON	BREED WITH	588	
653	DENVER	UNK	0	SEND TO	TBD			
654*	FORTWORTH	M		HOLD	FORTWORTH	DO NOT BREED		

*M654 was added during plan development and has not yet been included in summary statistics or analyses

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Recommendations By Institution

CINCINNAT

Cincinnati Zoo & Botanical Garden
Cincinnati, OH

Institutional Notes: M611 x F602 was established as a breeding pair in 2016; they last produced chicks in 2017. This pair is currently recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
596	213090	F	4	HOLD	CINCINNAT	DO NOT BREED		education
602	216061	F	4	HOLD	CINCINNAT	BREED WITH	611	
611	216006	M	3	HOLD	CINCINNAT	BREED WITH	602	

DENVER

Denver Zoological Gardens
Denver, CO

Institutional Notes: M192 x F543 is unlikely to breed due to age; neither bird has ever produced offspring. M630 x F625 is a proven breeding pair that last produced offspring in 2018; please contact the SSP Coordinator following each clutch to re-confirm this pair's breeding recommendation. Please request a transfer recommendation for 653 when sex is confirmed.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
192	A01085	M	18	HOLD	DENVER	DO NOT BREED		age exclusion
543	A10122	F	10	HOLD	DENVER	DO NOT BREED		
625	A16265	F	4	HOLD	DENVER	BREED WITH	630	
630	A16264	M	4	HOLD	DENVER	BREED WITH	625	
650	A17259	M	0	SEND TO	SANDIEGOZ	BREED WITH	628	
651	A18009	F	0	SEND TO	FRANKLINP	SEE NOTES		
653	A18092	UNK	0	SEND TO	TBD			

FORTWORTH

Fort Worth Zoological Park
Ft Worth, TX

Institutional Notes: The SSP recommendations re-pairing this father-daughter pair. M590 is currently the most genetically over-represented male in the population (has highest mk), while F649 is very genetically valuable and the offspring of recent imports. M590 and F649 should not be bred. F649 is a high priority for pairing as soon as a genetically suitable mate is available. Please advise the SSP Coordinator if you need an interim recommendation for M654.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
590	208460	M	5	HOLD	FORTWORTH	DO NOT BREED		
633	209494	F	2	HOLD	FORTWORTH	DO NOT BREED		education
642	209875	F	1	SEND TO	OKLAHOMA	BREED WITH	558	
649	F17449	F	0	RECEIVE FROM	FRANKLINP	SEE NOTES		
654*		M		HOLD	FORTWORTH	DO NOT BREED		

*M654 was added during plan development and has not yet been included in summary statistics or analyses

FRANKLINP

Zoo New England / Franklin Park Zoo
Boston, MA

Institutional Notes: M164 x F231 is a proven pair that last produced chicks in 2012; this pair is likely post-reproductive and recommended to transfer to STONEHAM for exhibit. M550 x F583 is a proven pair that last produced chicks in 2016; this genetically overrepresented pair is recommended for transfer to establish more genetically valuable pairs at this facility. M626 x F631 is a proven breeding pair that last produced offspring in 2017; please contact the SSP Coordinator following each clutch to re-confirm this pair's breeding recommendation. F645 and F651 will be paired for breeding as soon as genetically appropriate mates are available. F649 is also intended to be paired at FORTWORTH as soon as a genetically appropriate mate is available.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
164	99A433	M	19	SEND TO	STONEHAM	SEE NOTES		age exclusion
231	A07413	F	14	SEND TO	STONEHAM	SEE NOTES		age exclusion
550	A07458	M	10	SEND TO	LOSANGELE	BREED WITH	583	
583	F12506	F	5	SEND TO	LOSANGELE	BREED WITH	550	
601	F14417	M	4	HOLD	FRANKLINP	DO NOT BREED		education
626	A16508	M	4	HOLD	FRANKLINP	BREED WITH	631	
631	A16509	F	4	HOLD	FRANKLINP	BREED WITH	626	
644	F17412	F	1	HOLD	FRANKLINP	DO NOT BREED		education
645	F17427	F	1	HOLD	FRANKLINP	SEE NOTES		
647	F17445	M	0	SEND TO	SANDIEGOZ	BREED WITH	629	
649	F17449	F	0	SEND TO	FORTWORTH	SEE NOTES		
651	A18009	F	0	RECEIVE FROM	DENVER	SEE NOTES		

HOUSTON

Houston Zoological Gardens
Houston, TX

Institutional notes: M588 x F652 is a new breeding pair; neither bird has yet produced offspring. This pair has very mis-matched mks (F652 is more genetically valuable), but are recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation. M624 x F627 is a proven breeding pair that last produced offspring in 2017; please contact the SSP Coordinator following each clutch to re-confirm this pair's breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
245	21377	M	13	HOLD	HOUSTON	DO NOT BREED		education
588	27924	M	5	HOLD	HOUSTON	BREED WITH	652	
624	31266	M	3	HOLD	HOUSTON	BREED WITH	627	
627	31267	F	4	HOLD	HOUSTON	BREED WITH	624	
652	32040	F	0	HOLD	HOUSTON	BREED WITH	588	

KNOXVILLE

Knoxville Zoo
Knoxville, TN

Institutional notes: M538 x F632 is a new breeding pair; M538 is a proven breeder that last produced offspring in 2015. This pair is recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
609	5128	M	3	HOLD	KNOXVILLE	DO NOT BREED		education
632	5317	F	2	HOLD	KNOXVILLE	BREED WITH	538	
538	22491	M	11	RECEIVE FROM	MEMPHIS	BREED WITH	632	

LOSANGELE

Los Angeles Zoo
Los Angeles, CA

Institutional notes: M550 x F583 is a proven pair that last produced chicks in 2016. This pair is currently recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
550	A07458	M	10	RECEIVE FROM	FRANKLINP	BREED WITH	583	
583	F12506	F	5	RECEIVE FROM	FRANKLINP	BREED WITH	550	

LOUISVILL

Louisville Zoological Garden
Louisville, KY

Institutional Notes: M505 x F518 are likely post-reproductive; neither bird has ever produced offspring. If this pair happens to produce eggs, please contact the SSP Coordinator for an interim recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
505	202284	M	12	HOLD	LOUISVILL	SEE NOTES		
518	202147	F	13	HOLD	LOUISVILL	SEE NOTES		age exclusion
539	202421	M	11	HOLD	LOUISVILL	DO NOT BREED		education

MEMPHIS

Memphis Zoological Garden & Aquarium
Memphis, TN

Institutional Notes: M570 x F604 was established as a breeding pair in 2014; neither bird has yet produced offspring. Both birds are current genetically over-represented and closely related, but have been given a breeding recommendation to bolster demography and help maintain current historical founding lineages in the population. This pair is recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
538	22491	M	11	SEND TO	KNOXVILLE	BREED WITH	632	
~~557~~	~~23244~~	~~F~~	~~7~~					died
570	F11411	M	6	RECEIVE FROM	STONEHAM	BREED WITH	604	
604	F14461	F	4	RECEIVE FROM	STONEHAM	BREED WITH	570	

METROZOO

Miami Metrozoo
Miami, FL

Institutional Notes: M613 x F606 was established as a pair in 2017; neither bird has yet produced offspring. Both birds are current genetically over-represented and closely related, but have been given a breeding recommendation to bolster demography and help maintain current historical founding lineages in the population. This pair is recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
606	15B298	F	3	HOLD	METROZOO	BREED WITH	613	
613	17B092	M	2	HOLD	METROZOO	BREED WITH	606	

NATAVPGH

National Aviary in Pittsburgh
Pittsburgh, PA

Institutional Notes: The SSP is continuing to search for a replacement female to pair with M523 (previously recommended F557 recently died). An interim transfer recommendation will be made when a suitable mate becomes available.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
523	8460	M	12	HOLD	NATAVPGH	DO NOT BREED		
585	8233	M	6	HOLD	NATAVPGH	DO NOT BREED		education
~~557~~	~~23244~~	~~F~~	~~7~~	~~RECEIVE FROM~~	~~MEMPHIS~~			died

OKLAHOMA

Oklahoma City Zoological Park
Oklahoma City, OK

Breeding Notes: M558 X F642 is a new breeding pair; M558 last produced offspring with a different mate in 2016. Both birds are current genetically over-represented and closely related, but have been given a breeding recommendation to bolster demography and help maintain current historical founding lineages in the population. This pair is recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
558	771525	M	7	HOLD	OKLAHOMA	BREED WITH	642	
642	209875	F	1	RECEIVE FROM	FORTWORTH	BREED WITH	558	

PINOLA

Pinola Conservancy
Shreveport, AL

Breeding Notes: M239 X F610 is a new breeding pair; neither bird has yet produced offspring and M239 is likely post-reproductive. If breeding behavior is observed, this pair is recommended to produce one successful clutch (at least one chick surviving to fledge) over the next three years. Please contact the SSP Coordinator after producing one clutch for a possible interim breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
610	unknown	F	3	HOLD	PINOLA	BREED WITH	239	
239	804131	M	14	RECEIVE FROM	SANDIEGOZ	BREED WITH	610	

RIO GRAND

Albuquerque Biological Park
Albuquerque, NM

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
641	B17007	UNK	1	HOLD	RIO GRAND	DO NOT BREED		education

SANDIEGOZ

Zoological Society of San Diego
San Diego, CA

Institutional Notes: M647 x F629 and M650 x F628 are new breeding pairs; none of the birds have yet produced offspring and all are genetically under-represented and high priorities for breeding; please contact the SSP Coordinator following each clutch to re-confirm this pair's breeding recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
230	404003	F	14	HOLD	SANDIEGOZ	DO NOT BREED		education
239	804131	M	14	SEND TO	PINOLA	BREED WITH	610	
628	216534	F	4	HOLD	SANDIEGOZ	BREED WITH	650	
629	216533	F	4	HOLD	SANDIEGOZ	BREED WITH	647	
647	F17445	M	0	RECEIVE FROM	FRANKLINP	BREED WITH	629	
650	A17259	M	0	RECEIVE FROM	DENVER	BREED WITH	628	

SD-WAP

San Diego Wild Animal Park
Escondido, CA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
532	807255	M	11	HOLD	SD-WAP	DO NOT BREED		education
548	408059	M	9	HOLD	SD-WAP	DO NOT BREED		education

STONEHAM

Stone Zoo
Boston, MA

Institutional Notes: M164 x F231 is a proven pair that last produced chicks in 2012; this pair is likely post-reproductive and recommended to transfer to STONEHAM for exhibit. If this pair happens to produce eggs, please contact the SSP Coordinator for an interim recommendation.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
570	F11411	M	6	SEND TO	MEMPHIS	BREED WITH	604	
604	F14461	F	4	SEND TO	MEMPHIS	BREED WITH	570	
164	99A433	M	19	RECEIVE FROM	FRANKLINP	SEE NOTES		age exclusion
231	A07413	F	14	RECEIVE FROM	FRANKLINP	SEE NOTES		age exclusion

TOLEDO

Toledo Zoological Gardens
Toledo, OH

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
542	5834	M	11	HOLD	TOLEDO	DO NOT BREED		

Appendix A
Analytical Assumptions

No pedigree assumptions were necessary.

The following LTF animals with unknown birth date estimates were given 'year' birth date estimates so that PMx would correctly exclude them from the genetic selection: 24

Molecular work was conducted to investigate the relationships of eight birds imported in 2016 (SB#s 624-631). The imported birds were the offspring of five breeding pairs at the Universeum Science Center in Sweden (GOTEBORGS). At the time of import, the colony at the Universeum Science Center had a minimum of five breeding pairs (likely more) which were descended from nine breeding pairs from Tanzania. Empirical allele sharing coefficients estimated from SNP data suggested the following full-sibling clutches to be more closely related to each other than to other clutches: 624/625/626 x 628/629 and 631 x 628/629. The SSP has avoided pairing birds from putatively related clutches. In other situations, an assumption estimating the kinships of putatively related clutches to be 0.0625 (first-cousins) would have been made. In this case, that assumption would have had no impact on breeding recommendations because the current inbreeding cutoff for recommended breeding pairs (based on the population's average mean kinship) was 0.1100. An assumption of first-cousins for the putatively related clutches should be re-evaluated for the next Breeding & Transfer Plan.

Appendix B
Summary of Data Exports

Report compiled under PopLink V. 2.4 and PMx 1.4.20170717
Project: FalconPygmy_June2018
Created: 2018-06-19

Studbook information:
Data compiled by: Nicole LaGreco
Data current thru: 01 June 2018
Scope of data: North America

Primary data file:
FalconPygmy_June2018.ped
Filter conditions:
Dates: 1988-01-01 to 2018-06-19
Locations: N.AMERICA

Moves data files:
FalconPygmy _June2018genetics.csv
FalconPygmy _June2018demog.csv
Filter conditions:
Dates: 1988-01-01 to 2018-06-19
Locations: N.AMERICA

There are 62 hatches to unknown parents or parents with unknown ages that have been added in proportion to known aged parents. This is 23% of KNOWN hatches (329 total hatches).

Non-AZA Institutions: none

Appendix C
Life Tables

MALES											
Age	**Px**	**Mid Px**	**Qx**	**Risk Qx**	**Lx**	**Mid Lx**	**Mx**	**Risk Mx**	**Ex**	**Vx**	**Cx**
0	0.49	0.61	0.51	87.8	1.00	0.75	0.08	87.8	---	1.34	0.19
1	0.85	0.88	0.15	69.2	0.49	0.46	0.36	69.2	---	2.13	0.11
2	0.92	0.90	0.08	63.7	0.42	0.40	0.16	63.7	---	2.07	0.10
3	0.88	0.90	0.12	57.2	0.39	0.36	0.48	57.2	---	2.17	0.08
4	0.92	0.90	0.08	48.8	0.34	0.33	0.28	48.8	---	1.93	0.07
5	0.89	0.90	0.11	40.5	0.31	0.30	0.45	40.5	---	1.89	0.06
6	0.92	0.91	0.08	36.1	0.28	0.27	0.37	36.1	---	1.64	0.06
7	0.89	0.89	0.11	32.3	0.26	0.24	0.19	32.3	---	1.45	0.05
8	0.89	0.90	0.11	27.3	0.23	0.22	0.36	27.3	---	1.46	0.04
9	0.92	0.94	0.08	24.9	0.20	0.19	0.34	24.9	---	1.26	0.04
10	0.96	0.95	0.04	23.1	0.19	0.18	0.19	23.1	---	1.01	0.03
11	0.95	0.91	0.05	19.0	0.18	0.17	0.30	19.0	---	0.88	0.03
12	0.88	0.86	0.12	16.2	0.17	0.16	0.23	16.2	---	0.65	0.03
13	0.85	0.83	0.15	11.5	0.15	0.14	0.33	11.5	---	0.51	0.02
14	0.80	0.66	0.20	9.0	0.13	0.11	0.23	9.0	---	0.23	0.02
15	0.50	0.61	0.50	6.8	0.10	0.08	0.00	6.8	---	0.00	0.01
16	0.85	0.87	0.15	4.0	0.05	0.05	0.00	4.0	---	0.00	0.01
17	0.89	0.79	0.11	3.7	0.04	0.04	0.00	3.7	---	0.00	0.01
18	0.68	0.70	0.32	2.2	0.04	0.03	0.00	2.2	---	0.00	0.00
19	0.74	0.85	0.26	1.4	0.03	0.02	0.00	1.4	---	0.00	0.00
20	1.00	1.00	0.00	0.0	0.02	0.02	0.00	0.0	---	0.00	0.00
21	---	---	---	---	---	---	---	---	---	---	---

Px = survival; Qx = mortality; lx = cumulative survivorship; Mx = fecundity
Ex = life expectancy; Vx = reproductive value; Cx = stable age distribution
At Risk (Qx and Mx) = number of animals corresponding values are estimated from
r = 0.043; lambda = 1.044; T = 4.7

Ex not calculated because oldest male in demographic selection (SB# 164) is still living.
Qx for age class 20 changed to 1.0 for all analyses, with no notable impact.

FEMALES											
Age	**Px**	**Mid Px**	**Qx**	**Risk Qx**	**Lx**	**Mid Lx**	**Mx**	**Risk Mx**	**Ex**	**Vx**	**Cx**
0	0.55	0.65	0.45	95.7	1.00	0.77	0.01	95.7	4.98	1.29	0.24
1	0.83	0.86	0.17	71.7	0.55	0.50	0.47	71.7	6.16	2.09	0.15
2	0.90	0.86	0.10	64.0	0.45	0.43	0.33	64.0	6.00	1.97	0.12
3	0.82	0.85	0.18	55.3	0.41	0.37	0.44	55.2	5.82	1.99	0.10
4	0.88	0.88	0.12	40.6	0.33	0.31	0.46	40.6	5.70	1.93	0.08
5	0.89	0.91	0.11	33.7	0.29	0.28	0.66	33.7	5.31	1.74	0.07
6	0.94	0.87	0.06	29.7	0.26	0.25	0.83	29.7	4.73	1.24	0.06
7	0.79	0.76	0.21	26.4	0.24	0.22	0.25	26.4	4.31	0.50	0.05
8	0.72	0.69	0.28	17.9	0.19	0.17	0.21	17.9	4.36	0.35	0.04
9	0.65	0.70	0.35	13.5	0.14	0.11	0.11	13.4	4.86	0.20	0.02
10	0.78	0.85	0.22	9.2	0.09	0.08	0.14	9.2	5.53	0.14	0.02
11	0.93	0.94	0.07	8.0	0.07	0.07	0.00	8.0	5.35	0.00	0.01
12	0.94	0.97	0.06	7.1	0.07	0.06	0.00	7.1	4.65	0.00	0.01
13	1.00	0.83	0.00	6.3	0.06	0.06	0.00	6.3	3.77	0.00	0.01
14	0.67	0.67	0.33	4.2	0.06	0.05	0.00	4.2	3.33	0.00	0.01
15	0.67	0.80	0.33	2.9	0.04	0.03	0.00	2.9	3.49	0.00	0.01
16	1.00	0.81	0.00	2.0	0.03	0.03	0.00	2.0	3.11	0.00	0.00
17	0.61	0.69	0.39	2.0	0.03	0.02	0.00	2.0	2.62	0.00	0.00
18	0.81	0.90	0.19	1.1	0.02	0.02	0.00	1.1	2.35	0.00	0.00
19	1.00	0.50	0.00	1.0	0.01	0.01	0.00	1.0	1.50	0.00	0.00
20	0.00	0.00	1.00	0.0	0.01	0.01	0.00	0.0	1.00	0.00	0.00

Px = survival; Qx = mortality; lx = cumulative survivorship; Mx = fecundity
Ex = life expectancy; Vx = reproductive value; Cx = stable age distribution
At Risk (Qx and Mx) = number of animals corresponding values are estimated from
r = 0.064; lambda = 1.066; T = 3.6

Appendix D

Individuals Excluded from Genetic Analyses

Studbook ID	Location	Sex	Age	Reason for Exclusion
164	FRANKLINP	M	19	advanced age
192	DENVER	M	18	advanced age
230	SANDIEGOZ	F	14	education
231	FRANKLINP	F	14	advanced age
245	HOUSTON	M	13	education
518	LOUISVILL	F	13	advanced age
532	SD-WAP	M	11	education
539	LOUISVILL	M	11	education
548	SD-WAP	M	9	education
585	NATAVPGH	M	6	education
596	CINCINNAT	F	5	education
601	FRANKLINP	M	4	education
609	KNOXVILLE	M	3	education
633	FORTWORTH	F	2	education
641	RIO GRAND	UNK	1	education
644	FRANKLINP	F	1	education

Appendix E

Ordered Mean Kinships

Note: This list is current to June 2018 and based on an analytical studbook. Values are subject to change with any birth, death, import, export, inclusion, or exclusion. **Average Population MK = 0.1100**

MALES					FEMALES				
SB#	**MK**	**% Known**	**Age**	**Location**	**SB#**	**MK**	**% Known**	**Age**	**Location**
630	0.0347	100	4	DENVER	628	0.0208	100	4	SANDIEGOZ
624	0.0556	100	3	HOUSTON	629	0.0208	100	4	SANDIEGOZ
647	0.0556	100	0	FRANKLINP	627	0.0208	100	4	HOUSTON
650	0.0556	100	0	DENVER	631	0.0347	100	4	FRANKLINP
653	0.0556	100	0	DENVER	652	0.0451	100	0	HOUSTON
626	0.0625	100	4	FRANKLINP	645	0.0556	100	1	FRANKLINP
239	0.1122	100	14	SANDIEGOZ	649	0.0556	100	0	FRANKLINP
523	0.1301	100	12	NATAVPGH	651	0.0556	100	0	DENVER
505	0.1369	100	12	LOUISVILL	653	0.0556	100	0	DENVER
570	0.1455	100	6	STONEHAM	625	0.0625	100	4	DENVER
542	0.1553	100	11	TOLEDO	632	0.1406	100	2	KNOXVILLE
550	0.1553	100	10	FRANKLINP	543	0.1455	100	10	DENVER
538	0.1589	100	11	MEMPHIS	583	0.1550	100	5	FRANKLINP
558	0.1600	100	7	OKLAHOMA	602	0.1605	100	4	CINCINNAT
613	0.1650	100	2	METROZOO	604	0.1605	100	4	STONEHAM
588	0.1709	100	5	HOUSTON	606	0.1605	100	3	METROZOO
611	0.1709	100	3	CINCINNAT	642	0.1650	100	1	FORTWORTH
590	0.1764	100	5	FORTWORTH	610	0.1709	100	3	PINOLA
					~~557~~	~~0.1719~~	~~100~~	~~7~~	~~MEMPHIS~~

Appendix F

Definitions

Management Terms

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 Non–Member Participation 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 institutions is voluntary.

Red Species Survival Plan® (Red SSP) Program – A Red SSP has a population size of greater than 20 but fewer than 50 animals, at least three AZA member institutions, and a published studbook. Animal Programs that manage species designated as Extinct in the Wild, Critically Endangered, or Endangered (IUCN) do not need to meet minimum population size and number of participating institution criteria to be designated as an SSP Program. Red Program participation by AZA institutions is voluntary.

Full Participation – AZA policy stating that all AZA accredited institutions 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 institutional 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 institutions 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 http://www.aza.org/board-policies/.

Demographic Terms

Age Distribution – A two-way classification showing the numbers or percentages of individuals in various age and sex classes.

Ex, Life Expectancy – 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. Lambda can be based on life-table calculations (the expected lambda) or from observed changes in population size from year to year. A lambda of 1.11 means an 11% per year increase; lambda of 0.97 means a 3% decline in size per year.

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.

Mx, **Fecundity** – The average number of same-sexed young born to animals in that age class. Because studbooks typically have relatively small sample sizes, studbook software calculate Mx as 1/2 the average number of young 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 one time period; is conditional on an individual being alive at the beginning of the time period. Alternatively, the proportion of individuals which survive from the beginning of one age class to the next.

Qx, Mortality – Probability that an individual of age *x* dies during time period. 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.

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

Genetic Terms

Allele Retention – The probability that a gene present in a founder individual exists in the living, descendant population.

Current Gene Diversity (GD) -- The proportional gene diversity (as a proportion of the source population) is the probability that two alleles from the same locus sampled at random from the population will not be identical by descent. Gene diversity is calculated from allele frequencies, and is the heterozygosity expected in progeny produced by random mating, and if the population were in Hardy-Weinberg equilibrium.

Effective Population Size (Inbreeding 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 gene 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 gene frequency drift is measured in the current generation).

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 wild-caught individuals (founders) that would produce 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 -- Proportion of the genes in the living, descendant population that are derived from that founder.

Inbreeding Coefficient (F) -- Probability that the two alleles at a genetic locus are identical by descent from an ancestor common to both parents. The mean inbreeding coefficient of a population will be the proportional decrease in observed heterozygosity relative to the expected heterozygosity of the founder population.

Mean Kinship (MK) – The mean kinship coefficient between an animal and all animals (including itself) in the living, captive-born population. The mean kinship of a population is equal to the proportional loss of gene diversity of the descendant (captive-born) population relative to the founders and is also the mean inbreeding coefficient of progeny produced by random mating. Mean kinship is also the reciprocal of two times the founder genome equivalents: MK = 1 / (2 * FGE). MK = 1 - GD.

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

Prob Lost – Probability that a random allele from the individual will be lost from the population in the next generation, because neither this individual nor any of its relatives pass on the allele to an offspring. Assumes that each individual will produce a number of future offspring equal to its reproductive value, Vx.

Appendix G

Directory of Institutional Representatives

Contact Name (IR)	Institution	Email Address
Jennifer Gainer	CINCINNAT Cincinnati Zoo & Botanical Gardens	jennifer.gainer@cincinnatizoo.org
Mary Jo Willis	DENVER Denver Zoological Gardens	mjwillis@denverzoo.org
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Erica Farrell	FRANKLINP Zoo New England / Franklin Park Zoo	efarrell@zoonewengland.com
Hannah Bailey	HOUSTON Houston Zoological Gardens	hbailey@houstonzoo.org
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