Population Analysis & Breeding and Transfer Plan

Blue (Stanley) Crane (Anthropoides paradisea)
AZA Species Survival Plan®
Yellow Program

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PMC Population Management Center
Lincoln Park Zoo
ASSOCIATION OF ZOOS & AQUARIUMS

Executive Summary

Species Survival Plan® for the Blue Crane (*Anthropoides paradisea*)

The blue crane population at the time of final analysis is 61 (25.35.1) individuals at 22 AZA institutions and 2 non-AZA institutions. The Gruiformes Taxon Advisory Group (TAG) designated the blue (Stanley) crane to be managed as a Population Management Program (PMP) in their 2009 – 2012 Regional Collection Plan (RCP) with a target population size of 90 individuals. This population currently qualifies as a Yellow SSP Program.

Based on an analytical studbook with pedigree assumptions, the current blue crane population is descended from 16 founders with no potential founders remaining in the population. The current gene diversity of the descendant population is approximately 92%. This current gene diversity is equivalent to that of 6 - 7 unrelated animals (FGE=6.10). Long-term projections based on a growth rate of approximately 2.5% (lambda = 1.025) and a target size of 90, indicate that gene diversity will decline to approximately 81% over the next 100 years. When gene diversity falls below 90% of that in the founding population, it is expected that reproduction and survival may be increasingly compromised.

Demography

Current size of population (N) – Total (Males.Females.Unknown Sex)	61 (25.35.1)
Number of individuals excluded from management	2
Population size following exclusions	59 (23.35.1)
Target population size (Kt)	90
Mean generation time (years)	15.3
Historical/Potential population growth rate (lambda)	1.061 / 1.025

Genetics*

	Current	Potential
Current Founders	16	0
Founder genome equivalents (FGE)	6.10	10.27
Gene diversity (GD %)	91.81	95.13
Population mean kinship (MK)	0.0819	--
Mean inbreeding (F)	0.0049	--
Effective population size/census size ratio (Ne / N)	0.3195	--
Percentage of pedigree known before assumptions & exclusions	50.8	--
Percentage of pedigree known after assumptions & exclusions	68.90	--
Years To 90% Gene Diversity	11	--
Years to 10% Loss of Gene Diversity	<100	--
Gene Diversity at 100 Years From Present (%)	81.05	--
Assumptions used for genetic projections	λ = 1.025, Target size = 90	--

*based on analytical studbook.

Demographic analyses indicate that at least 5 hatches in the coming year are required to maintain the current population size. To achieve an annual population growth rate of approximately 2.5% (λ=1.025) and reach the target population size of 130 in 15 years, approximately 7 - 8 hatches are needed in the coming year.

Of special concern with this population is the high degree of unknownness. There are currently 29 individuals in the population with some degree of unknownness, of these animals, 14 have 100% unknown pedigree. At this time these animals have not been excluded from the potentially breeding population, however, breeding these individuals will perpetuate unknownness within the population. Institutions are highly encouraged to investigate the origins of their unknown pedigree animals in order to help determine relatedness and genetic importance of animals within the living population. In addition, the Program recommends any institutions interested in receiving this species to look within the managed population for individuals, contact the SSP Coordinator for more information.

Where possible, existing breeding groups were left together and breeding recommendations were prioritized to maintain or increase gene diversity through consideration of mean kinship (prioritizing breeding for low mean kinship animals and minimizing differences in sire and dam mean kinships), minimizing inbreeding, and avoiding perpetuation of pedigree unknownness. Institutions recommended to breed are expected to hold offspring for at least one year.

Summary Actions: The Program recommends 10 females for breeding. Institutions are recommended to produce one clutch from each recommended pairing, then contact the SSP Coordinator for additional recommendations. In addition, 8 transfers are recommended to facilitate new breeding or companion pairs or to meet institutional requests.

Table of Contents

Acknowledgments

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Cover Photo courtesy of Jim Dunster, Zoo Miami.

This plan was prepared and distributed with the assistance of the AZA Population Management Center in Chicago.
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Description of Population Status

Species Survival Plan® for the Blue Crane (Anthropoides paradisea)

Introduction: The blue crane population at the time of final analysis is 61 (25 males, 35 females, and 1 unknown sex) individuals at 22 AZA institutions and 2 non-AZA institutions. The Gruiformes Taxon Advisory Group (TAG) designated the blue (Stanley) crane to be managed as a Population Management Program (PMP) in their 2009 – 2012 Regional Collection Plan (RCP) with a target population size of 90 individuals. This population currently qualifies as a Yellow SSP Program.

Comprehensive genetic and demographic analyses of the blue crane population were performed in October 2011, resulting in the current breeding and transfer plan for this species. Analyses of the North American Blue Crane Studbook (current to August 2011) were performed during a meeting at Lincoln Park Zoo using PopLink 2.1, SPARKS 1.5, and PM2000 1.213. This is the first breeding and transfer plan for the blue (Stanley) crane. Recommendations proposed in a Yellow SSP Plan are non-binding; participation is voluntary.

Analytical Studbook: An analytical studbook was created for genetic analysis to incorporate assumptions regarding pedigree unknownness within the blue crane population (Appendix A). Assumptions were created for 8 individuals; however there is still a high degree of pedigree unknownness within the population which could not be solved at this time. Institutions are highly encouraged to investigate the origins of their unknown pedigree animals in order to help determine relatedness and genetic importance of animals within the living population.

Two individuals were excluded from the potentially breeding population, one due to their participation in an educational program and one due to aggressive behavior toward other birds (Appendix C).
With the application of these assumptions and exclusions, the population went from 51% pedigree known to approximately 69% known and consists of 59 (23.35.1) individuals.

Demography: Blue cranes were first seen in North American zoos in 1896. However, this species was not held in large numbers until the 1960s though the first captive hatch occurred in 1950. The blue crane population quickly grew from zoo breeding and importations from the wild and outside of North America, the population reached its peak size of 93 in 1984. Since this peak, the population has been experiencing periods of sharp decline and rapid increase mainly due to a decrease in the number of wild hatched animals in the population and varied rates of breeding success (Figures 1 and 2). Growth rates over the last 10 years have ranged from 0.867 – 1.073, with an overall decreasing average lambda (λ=0.980). However, over the last 5 years, the population's overall growth trend has been increasing by about 2% (λ=1.022).

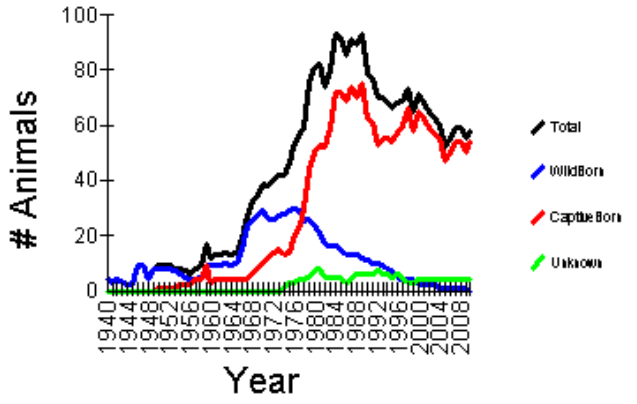

Figure 1. Census of the blue crane population in North America by hatch type, 1940 – 2010.

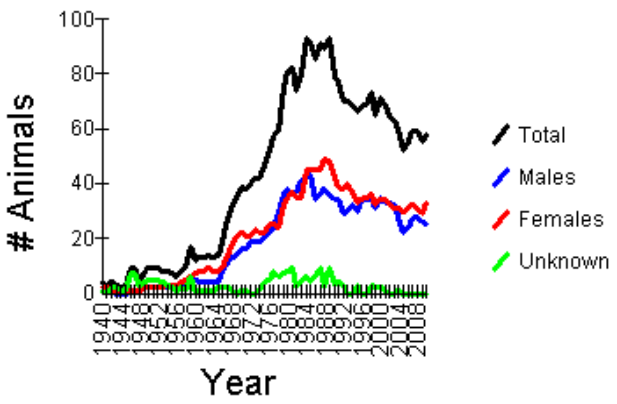

Figure 2. Census of black-crowned crane population in AZA by sex, 1940 – 2010.

Demographic projections estimate that to keep this population stable (0% growth); at least 5 hatches in the coming year are necessary. According to studbook data, the blue crane typically has 1 to 2 chicks per clutch. Over the past 10 years, the AZA population has had and average of approximately 6 chicks per year (2 – 11 hatches). A growth rate of 2.5% (λ= 1.025) appears reasonable based on the clutch averages, the space available for this species, and demand in the near future, requiring 7 - 8 hatches in the coming years and allowing the population to reach the target population size of 90 in approximately 15 years.

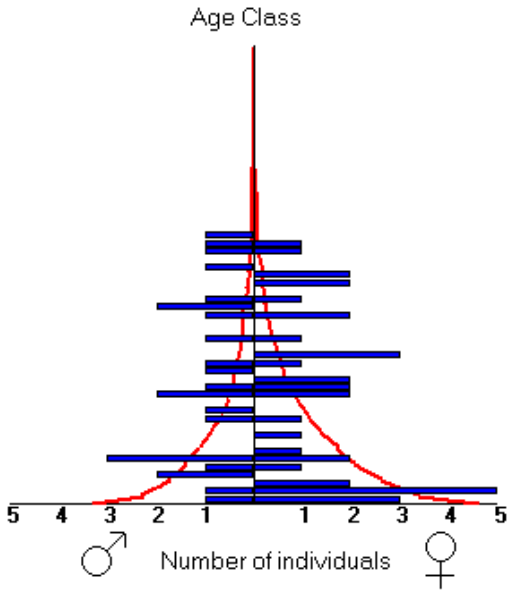

Figure 3. Age structure of the potentially breeding North American blue crane population 59 animals 23 males, 35 females, and 1 unknown sex) showing age classes 0 – 56.

The age structure of this population approximates a relatively stable distribution with a wide base of juveniles, though many of them are female, which will mature to reach the reproductive age classes (Figure 3). However, there are several empty age classes throughout the age structure. While gaps are expected in a long-lived species such as this, they could limit breeding until younger animals grow old enough to begin filling these gaps and breed. The Program should focus on producing a steady amount of hatches in order to continue a broad base of young animals and continue to fill of the breeding age classes in the future.

Based on studbook data from 1970 to present, juvenile mortality for the blue cranes is 35% for males and 32% for females (Appendix D). The oldest recorded male in the blue crane population lived to be 43 years old. The oldest female in the population is still living at 56 years old; though she was wild caught with a year age estimate. Both male and female blue crane have been recorded as breeding as young as 4 years of age. The oldest male in the population to have bred was 33 years old at the time of conception. The oldest female blue crane to breed was 37 years old at the time of the offspring's hatch (year age estimate).

GENETIC SUMMARY	Current	Potential
Current Founders	16	0
Founder genome equivalents (FGE)	6.10	10.27
Gene diversity (GD %)	91.81	95.13
Population mean kinship (MK)	0.0819	--
Mean inbreeding (F)	0.0049	--
Effective population size/census size ratio (Ne / N)	0.3195	--
Percentage of pedigree known before assumptions & exclusions	50.8	--
Percentage of pedigree known after assumptions & exclusions	68.90	--
Years To 90% Gene Diversity	11	--
Years to 10% Loss of Gene Diversity	<100	--
Gene Diversity at 100 Years From Present (%)	81.05	--
Assumptions used for genetic projections	λ = 1.025, Target size = 90	--

*Based on analytical studbook

Genetics: The potentially breeding blue crane population is descended from 16 founders with no additional potential founders remaining in the population (Figure 4). Current gene diversity in the population is approximately 92%, equivalent to that found in 6 – 7 unrelated individuals (FGE = 6.10). By pairing individuals from the founder lineages with fewer relatives (those with lower mean kinship values) and by pairing and recruiting potential founders, a large amount of this population's potential gene diversity (95% GD or 10 FGE) could be tapped into.

Long-term projections indicate that gene diversity would decrease to approximately 81% in 100 years (assuming growth rate of 1.025 and a target size of 90). When gene diversity falls below 90% of that in the founding population, it is expected that reproduction will be increasingly compromised by, among other factors, lower hatch weights, and greater neonatal mortality.

To retain gene diversity for a longer period of time and possibly recruit additional potential gene diversity, animals with low mean kinship values should be paired and prioritized for breeding in order to equalize the different founder lineages. Other strategies that could reduce the loss of gene diversity include; increasing the number of individuals breeding (Ne/N), growing the population at a faster rate, and acquiring founders.

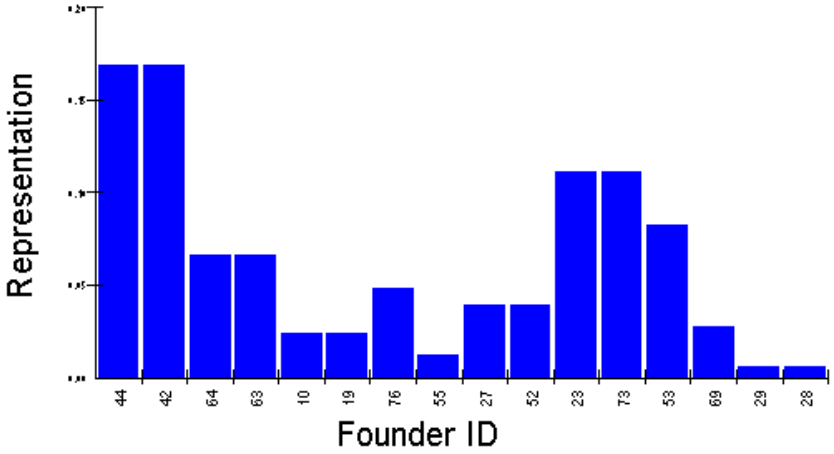

Figure 4. Founder representation graph illustrating the inequality of the 16 founder lineages represented in the current blue crane population.

Management Strategy: The current blue crane population is 61 (25 males, 35 females, and 1 unknown sex) individuals at 22 AZA institutions and 2 non-AZA institutions. The population is descended from 16 founders and gene diversity in the descendant population is approximately 81%. Demographic analyses indicate that at least 5 hatches in the coming year are required to maintain the current population size (lambda = 1.00). To increase the population to the target size of 90 in the next 15 years (lambda=1.025), approximately 7 -8 hatches are needed in the coming years.

Currently about 30% of the population's pedigree is unknown, including 14 individuals that have 100% unknown pedigree. At this time these animals have not been excluded from the breeding population, though breeding these individuals will perpetuate unknownness. It is recommended that institutions refrain from breeding these individuals where they are not recommended if possible and investigate the origins of these unknown pedigree animals in order to help determine relatedness and genetic importance of animals within the living population.

Pairings have been recommended with the consideration of mean kinship, maximum avoidance of inbreeding, differences in sire and dam mean kinships, and the needs of individual institutions in an attempt to maintain gene diversity for as long as possible. This is the first breeding and transfer plan for the Blue Crane Program.

1. Recommends 10 females for breeding.
    a. Recommends institutions contact the SSP Coordinator after each successful clutch. Breeding may be increased or decreased depending on the overall reproductive success across the population.
    b. Institutions recommended to breed are expected to hold offspring for at least 1 year.
    c. Offspring produced by non-recommended pairings will not be prioritized for placement.
    d. Several breeding pairs are currently mismatched or over-represented at this time; they are recommended to breed for demographic purposes. As a result these pairs may be repaired in the future as more suitable mates become available.

2. Recommends 8 transfers, 2 of which were pre-arranged prior to the planning meeting, within the Program to address institutional requests or to make new companion or breeding pairs.

3. Institutions interested in obtaining or placing blue cranes should contact the SSP Coordinator to coordinate transfers that will facilitate genetic and demographic stability.
    a. This species may be housed in mixed exhibits with other species, contact the SSP Coordinator with any questions.

4. Institutions are encouraged to investigate the origins of their unknown pedigree animals in order to help determine relatedness and genetic importance of animals within the living population.
    a. Animals coming from unknown sources, private breeders, or dealers often cannot be assumed to be unrelated to the zoo population. Institutions considering obtaining individuals from these sources should make every effort to determine pedigree information for the genetic health of the population.

SUMMARY OF BREEDING AND TRANSFER RECOMMENDATIONS

By Studbook ID

Institutions are asked contact the SSP Coordinator after each successful clutch.

ID	Location	Sex	Age	Disposition	Location	Breeding	With	Notes
138	SAN ANTON	M	33	HOLD	SAN ANTON	BREED WITH	448	Attempt artificial insemination.
153	WILD WRLD	M	32	HOLD	WILD WRLD	BREED WITH	179	
173	BUSCH TAM	F	31	HOLD	BUSCH TAM	BREED WITH	497	
179	WILD WRLD	F	32	HOLD	WILD WRLD	BREED WITH	153	
198	ATLANTA	M	29	HOLD	ATLANTA	BREED WITH	256	Genetically Valuable Pair. Attempt artificial insemination.
217	BREVARD	M	28	HOLD	BREVARD	DO NOT BREED		Excluded - Behavior
226	JACKSONVL	F	28	HOLD	JACKSONVL	BREED WITH	400	
236	EVANSVLLE	F	28	HOLD	EVANSVLLE	DO NOT BREED		100% Unknown Pedigree
249	BROWNSVIL	F	27	HOLD	BROWNSVIL	DO NOT BREED		
256	ATLANTA	F	27	HOLD	ATLANTA	BREED WITH	198	Genetically Valuable Pair. Attempt artificial insemination.
305	RIO GRAND	F	25	HOLD	RIO GRAND	DO NOT BREED		100% Unknown Pedigree
311	LITTLEROC	M	25	HOLD	LITTLEROC	DO NOT BREED		100% Unknown Pedigree
320	OMAHA	M	24	HOLD	OMAHA	BREED WITH	524	Genetically Valuable Pair. Attempt artificial insemination.
328	RIO GRAND	M	24	HOLD	RIO GRAND	DO NOT BREED		100% Unknown Pedigree
348	NZP-WASH	F	23	HOLD	NZP-WASH	BREED WITH	486	
373	HOUSTON	M	23	HOLD	HOUSTON	DO NOT BREED		100% Unknown Pedigree
374	HOUSTON	F	23	HOLD	HOUSTON	DO NOT BREED		100% Unknown Pedigree
400	JACKSONVL	M	20	HOLD	JACKSONVL	BREED WITH	226	Please determine viability of male, may repair in future.
411	EVANSVLLE	F	20	HOLD	EVANSVLLE	DO NOT BREED		100% Unknown Pedigree
431	GARDENCTY	F	18	SEND TO	DALLAS	DO NOT BREED		
434	METROZOO	F	18	HOLD	METROZOO	BREED WITH	438	
438	METROZOO	M	17	HOLD	METROZOO	BREED WITH	434	
442	BARABOO	F	18	SEND TO	SD-WAP	BREED WITH	471	
448	SAN ANTON	F	17	HOLD	SAN ANTON	BREED WITH	138	Attempt artificial insemination.
465	ST LOUIS	F	15	HOLD	ST LOUIS	DO NOT BREED		
471	SD-WAP	M	14	HOLD	SD-WAP	BREED WITH	442	
480	METRORICH	M	11	HOLD	METRORICH	DO NOT BREED		100% Unknown Pedigree
485	LITTLEROC	F	13	HOLD	LITTLEROC	DO NOT BREED		
486	NZP-WASH	M	13	HOLD	NZP-WASH	BREED WITH	348	
497	BUSCH TAM	M	31	HOLD	BUSCH TAM	BREED WITH	173	
517	WILD WRLD	M	10	HOLD	WILD WRLD	DO NOT BREED		
524	OMAHA	F	14	HOLD	OMAHA	BREED WITH	320	Genetically Valuable Pair. Attempt artificial insemination.
528	DISNEY AK	F	14	HOLD	DISNEY AK	BREED WITH	649	
536	WILD WRLD	F	13	HOLD	WILD WRLD	DO NOT BREED		
549	WILD WRLD	M	13	HOLD	WILD WRLD	DO NOT BREED		
600	DALLAS	F	8	HOLD	DALLAS	DO NOT BREED		
605	METRORICH	F	15	HOLD	METRORICH	DO NOT BREED		100% Unknown Pedigree
620	SAFARI W	F	10	HOLD	SAFARI W	DO NOT BREED		100% Unknown Pedigree
633	WILD WRLD	F	6	HOLD	WILD WRLD	DO NOT BREED		

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

ID	Location	Sex	Age	Disposition	Location	Breeding	With	Notes
637	DREHER PA	M	5	HOLD	DREHER PA	DO NOT BREED		Excluded - Education
638	SD-WAP	F	5	HOLD	SD-WAP	DO NOT BREED		
639	SAFARI W	M	5	HOLD	SAFARI W	DO NOT BREED		
641	WILD WRLD	F	5	HOLD	WILD WRLD	DO NOT BREED		
644	WILD WRLD	M	4	HOLD	WILD WRLD	DO NOT BREED		
647	METRORICH	M	3	HOLD	METRORICH	DO NOT BREED		
648	BROWNSVIL	M	3	HOLD	BROWNSVIL	DO NOT BREED		
649	DISNEY AK	M	5	HOLD	DISNEY AK	BREED WITH	528	100% Unknown Pedigree
653	METRORICH	F	2	HOLD	METRORICH	DO NOT BREED		
654	SAFARI W	M	5	HOLD	SAFARI W	DO NOT BREED		100% Unknown Pedigree
655	METROZOO	F	1	HOLD	METROZOO	DO NOT BREED		
656	METROZOO	F	1	SEND TO	NORFOLK	DO NOT BREED		
658	SAFARI W	F	1	HOLD	SAFARI W	DO NOT BREED		
659	SAFARI W	M	1	HOLD	SAFARI W	DO NOT BREED		
661	METROZOO	F	0	SEND TO	BARABOO	DO NOT BREED		
663	SD-WAP	F	1	SEND TO	DES MOINE	DO NOT BREED		Pre-arranged transfer, prior to planning
664	NORFOLK	F	1	HOLD	NORFOLK	DO NOT BREED		100% Unknown Pedigree
667	METRORICH	F	2	HOLD	METRORICH	DO NOT BREED		
668	NZP-WASH	M	0	SEND TO	BARABOO	DO NOT BREED		Pre-arranged transfer, prior to planning
669	METROZOO	F	0	SEND TO	GARDENCTY	DO NOT BREED		
670	METROZOO	F	0	SEND TO	GARDENCTY	DO NOT BREED		
683	METRORICH	U	0	HOLD	METRORICH	DO NOT BREED		100% Unknown Pedigree

RECOMMENDATIONS BY INSTITUTION

ATLANTA

Zoo Atlanta
Atlanta, GA

Note: 198 and 256 are a genetically valuable paring, please attempt artificial insemination. Contact the SSP Coordinator with questions.

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
198	A10046	M	29	HOLD	ATLANTA	BREED WITH	256	Genetically Valuable Pair. Attempt artificial insemination.
256	A40024	F	27	HOLD	ATLANTA	BREED WITH	198	

BARABOO

International Crane Foundation
Baraboo, WI

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
442	040014	F	18	SEND TO	SD-WAP	BREED WITH	471	
668	215977	M	0	RECEIVE FROM	NZP-WASH	DO NOT BREED		Pre-arranged transfer, prior to planning
661	11B029	F	0	RECEIVE FROM	METROZOO	DO NOT BREED		

BREVARD

Brevard Zoo
Melbourne, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
217	2302	M	28	HOLD	BREVARD	DO NOT BREED		Excluded - Behavior

BROWNSVIL

Gladys Porter Zoo
Brownsville, TX

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
249	5445	F	27	HOLD	BROWNSVIL	DO NOT BREED		
648	10274	M	3	HOLD	BROWNSVIL	DO NOT BREED		

BUSCH TAM

Busch Gardens Tampa Bay
Tampa, FL

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
173	61818	F	31	HOLD	BUSCH TAM	BREED WITH	497	Existing demographic pair.
497	55177	M	31	HOLD	BUSCH TAM	BREED WITH	173	

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DALLAS

Dallas Zoo
Dallas, TX

Note: The Program will continue to seek an appropriate breeding male for this institution.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
431	B02032	F	18	RECEIVE FROM	GARDENCTY	DO NOT BREED		Potential future breeder.
600	_____	F	8	HOLD	DALLAS	DO NOT BREED		

DES MOINE

Blank Park Zoo of Des Moines
Des Moines, IA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
663	810204	F	1	RECEIVE FROM	SD-WAP	DO NOT BREED		Pre-arranged transfer, prior to planning

DISNEY AK

Disney's Animal Kingdom
Bay Lake, FL

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
528	981377	F	14	HOLD	DISNEY AK	BREED WITH	649	Demographic pairing.
649	080113	M	5	HOLD	DISNEY AK	BREED WITH	528	100% Unknown Pedigree. Demographic pairing.

DREHER PA

Palm Beach Zoo at Dreher Park
West Palm Beach, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
637	207023	M	5	HOLD	DREHER PA	DO NOT BREED		Excluded - Education

EVANSVLLE

Mesker Park Zoo
Evansville, IN

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
236	287245	F	28	HOLD	EVANSVLLE	DO NOT BREED		100% Unknown Pedigree
411	297108	F	20	HOLD	EVANSVLLE	DO NOT BREED		100% Unknown Pedigree

GARDENCTY

Lee Richardson Zoo
Garden City, KS

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
431	B02032	F	18	SEND TO	DALLAS	DO NOT BREED		Potential future breeder.
669	11B194	F	0	RECEIVE FROM	METROZOO	DO NOT BREED		
670	11B195	F	0	RECEIVE FROM	METROZOO	DO NOT BREED		

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HOUSTON

Houston Zoo, Inc.
Houston, TX

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
373	21485	M	23	HOLD	HOUSTON	DO NOT BREED		100% Unknown Pedigree
374	21486	F	23	HOLD	HOUSTON	DO NOT BREED		100% Unknown Pedigree

JACKSONVL

Jacksonville Zoo and Gardens
Jacksonville, FL

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
226	696087	F	28	HOLD	JACKSONVL	BREED WITH	400	
400	696086	M	20	HOLD	JACKSONVL	BREED WITH	226	Please determine viability of male, may repair in future.

LITTLEROC

Little Rock Zoological Gardens
Little Rock, AR

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
311	6885	M	25	HOLD	LITTLEROC	DO NOT BREED		100% Unknown Pedigree
485	6886	F	13	HOLD	LITTLEROC	DO NOT BREED		

METRORICH

Metro Richmond Zoo
Moseley, VA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
683	UNK	U	0	HOLD	METRORICH	DO NOT BREED		100% Unknown Pedigree
480	109076	M	11	HOLD	METRORICH	DO NOT BREED		100% Unknown Pedigree
605	109077	F	15	HOLD	METRORICH	DO NOT BREED		100% Unknown Pedigree
647	108065	M	3	HOLD	METRORICH	DO NOT BREED		
653	110052	F	2	HOLD	METRORICH	DO NOT BREED		
667	111002	F	2	HOLD	METRORICH	DO NOT BREED		

METROZOO

Zoo Miami
Miami, FL

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
434	B10080	F	18	HOLD	METROZOO	BREED WITH	438	Existing demographic pair.
438	97B063	M	17	HOLD	METROZOO	BREED WITH	434	
655	10B053	F	1	HOLD	METROZOO	DO NOT BREED		
656	10B144	F	1	SEND TO	NORFOLK	DO NOT BREED		
661	11B029	F	0	SEND TO	BARABOO	DO NOT BREED		
669	11B194	F	0	SEND TO	GARDENCTY	DO NOT BREED		
670	11B195	F	0	SEND TO	GARDENCTY	DO NOT BREED		

NORFOLK

Virginia Zoological Park
Norfolk, VA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
656	10B144	F	1	RECEIVE FROM	METROZOO	DO NOT BREED		
664	211028	F	1	HOLD	NORFOLK	DO NOT BREED		100% Unknown Pedigree

NZP-WASH

Smithsonian National Zoological Park
Washington, DC

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
348	211144	F	23	HOLD	NZP-WASH	BREED WITH	486	
486	215497	M	13	HOLD	NZP-WASH	BREED WITH	348	
668	215977	M	0	SEND TO	BARABOO	DO NOT BREED		Pre-arranged transfer, prior to planning

OMAHA

Omaha's Henry Doorly Zoo
Omaha, NE

Note: 320 and 524 are a genetically valuable paring, please attempt artificial insemination. Contact the SSP Coordinator with questions.

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
320	5191	M	24	HOLD	OMAHA	BREED WITH	524	Genetically Valuable Pair. Attempt artificial insemination.
524	11848	F	14	HOLD	OMAHA	BREED WITH	320	

RIO GRAND

Albuquerque Biological Park
Albuquerque, NM

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
305	B21832	F	25	HOLD	RIO GRAND	DO NOT BREED		100% Unknown Pedigree
328	B21831	M	24	HOLD	RIO GRAND	DO NOT BREED		100% Unknown Pedigree

SAFARI W

Safari West
Santa Rosa, CA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
620	204029	F	10	HOLD	SAFARI W	DO NOT BREED		100% Unknown Pedigree
639	207008	M	5	HOLD	SAFARI W	DO NOT BREED		
654	208122	M	5	HOLD	SAFARI W	DO NOT BREED		100% Unknown Pedigree
658	210062	F	1	HOLD	SAFARI W	DO NOT BREED		
659	210064	M	1	HOLD	SAFARI W	DO NOT BREED		

SAN ANTON

San Antonio Zoological Gardens & Aqua
San Antonio, TX

Note: Please attempt artificial insemination; contact the SSP Coordinator with questions.

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
138	820329	M	33	HOLD	SAN ANTON	BREED WITH	448	Attempt artificial insemination
448	951021	F	17	HOLD	SAN ANTON	BREED WITH	138	

SD-WAP

San Diego Zoo Safari Park
Escondido, CA

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
471	898228	M	14	HOLD	SD-WAP	BREED WITH	442	
638	807019	F	5	HOLD	SD-WAP	DO NOT BREED		
663	810204	F	1	SEND TO	DES MOINE	DO NOT BREED		Pre-arranged transfer, prior to planning
442	040014	F	18	RECEIVE FROM	BARABOO	BREED WITH	471	

ST LOUIS

Saint Louis Zoological Park
St. Louis, MO

The Program will continue to seek an appropriate breeding male for this female.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
465	980553	F	15	HOLD	ST LOUIS	DO NOT BREED		Genetically valuable

WILD WRLD

Wildlife World Zoo
Litchfield Park, AZ

The Program recommends contacting the SSP Coordinator after each successful clutch.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
153	273	M	32	HOLD	WILD WRLD	BREED WITH	179	
179	200	F	32	HOLD	WILD WRLD	BREED WITH	153	
517	7443	M	10	HOLD	WILD WRLD	DO NOT BREED		
536	6068	F	13	HOLD	WILD WRLD	DO NOT BREED		
549	6540	M	13	HOLD	WILD WRLD	DO NOT BREED		
633	7650	F	6	HOLD	WILD WRLD	DO NOT BREED		
641	7868	F	5	HOLD	WILD WRLD	DO NOT BREED		
644	8352	M	4	HOLD	WILD WRLD	DO NOT BREED		

Appendix A
Pedigree Assumptions

ANALYTICAL DATA FOR TRUE SPECIMENS

Studbook ID	Field	True	Overlay	Notes
198	Dam	UNK	64	Master Analytical Notes: 63 and 64 were the only successful breeding pair recorded at GLENDALE at the time of hatch.
	Sire	UNK	63	
269	Dam	UNK	64	Master Analytical Notes: 63 and 64 were the only successful breeding pair recorded at GLENDALE at the time of hatch.
	Sire	UNK	63	
442	Dam	UNK	164	Master Analytical Notes: The only possible dam at FOR BIRDS during the time of conception was 164. Possible sires include 189 and 164; neither are living or having living decedents. 164 is a full sibling to dam, so chose 189 as potential sire.
	Sire	UNK	363	
497	Dam	UNK	44	Master Analytical Notes: "Between 1979 and 1984 eggs from NZP-Wash pair #42/44 were transported to NZP-CRC for hatching and rearing" (as per previous studbook keeper). All animals coming to NZP-CRC around this time are assumed to be from the pair at NZP-WASH.
	Sire	UNK	42	
63	Dam	UNK	WILD	Master Analytical Notes: This individual has a birth as the first record (at SAN ANTON), however SAN ANTON was not breeding at this time, and during this time (1/1/1968) animals were still being imported into the population from the wild. It is assumed this animal is unrelated to the population and was wild caught.
	Sire	UNK	WILD	
64	Dam	UNK	WILD	Master Analytical Notes: This individual has a birth as the first record (at SAN ANTON), however SAN ANTON was not breeding at this time, and during this time (1/1/1968) animals were still being imported into the population from the wild. It is assumed this animal is unrelated to the population and was wild caught.
	Sire	UNK	WILD	
69	Dam	UNK	WILD	Master Analytical Notes: This animal was brought into the population from an unknown first location in 1968 (estimate). Due to the time and location of importation this individual is considered wild caught.
	Sire	UNK	WILD	
76	Dam	UNK	WILD	Master Analytical Notes: This animal was brought into the population from an unknown first location in 1970 (estimate). Due to the time and location of importation this individual is considered wild caught.
	Sire	UNK	WILD	

Appendix B
Summary of Data Exports

Project: XXBLUECRANE
Report compiled under Population Management 2000, version 1.213
10:34:53 AM, 10/20/2011
Comments:
Date to be used for calculations: 10/20/2011

Demographic data from: C:\Users\kmarti\Documents\PopLink\PopLink Databases\BlueCrane\mXXBlueCrane.prn and C:\Users\kmarti\Documents\PopLink\PopLink Databases\BlueCrane\fXXBlueCrane.prn

Genetic data from: C:\Users\kmarti\Documents\PopLink\PopLink Databases\BlueCrane\XXBlueCrane.ped

Studbook information:
Data exported on: 10/20/2011
Data compiled by:
Contact info:
Data current thru: 8/10/2011 10:24:00 AM
Scope of data:

Demographic filter conditions:
Locations = N.AMERICA During 1/1/1970 - 10/20/2011 Status = Living

Genetic filter conditions:
Locations = N.AMERICA
As of 10/20/2011
Status = Living

Appendix C
Animals Excluded from the Genetic Analysis

Studbook ID	Institution	Sex	Age	Reason for Exclusion
217	BREVARD	M	28	Behavior, aggressive
637	DEHER PA	M	5	Education

Individual 474 was reported dead prior to planning. 683 was added during drafting. 651 was reported as LTF during the comment period.

Appendix D
Life Tables

Males

Age (x)	*Qx*	*Px*	*lx*	*Mx*	*Vx*	*Ex*	*Risk(Qx)*	*Risk(Mx)*
0	0.350	0.650	1.000	0.000	1.212	13.042	214.800	152.000
1	0.120	0.880	0.650	0.000	1.735	16.260	102.800	94.800
2	0.040	0.960	0.572	0.000	2.004	16.633	84.100	81.900
3	0.090	0.910	0.549	0.010	2.271	16.711	80.500	75.600
4	0.030	0.970	0.500	0.120	2.554	16.739	73.400	71.500
5	0.030	0.970	0.485	0.110	2.659	16.226	69.000	68.500
6	0.060	0.940	0.470	0.100	2.829	15.939	66.100	63.300
7	0.080	0.920	0.442	0.100	3.109	16.058	60.200	56.400
8	0.020	0.980	0.407	0.180	3.362	15.872	52.500	51.600
9	0.080	0.920	0.398	0.200	3.550	15.650	49.400	47.000
10	0.070	0.930	0.367	0.250	3.839	15.841	44.700	43.200
11	0.100	0.900	0.341	0.320	4.156	16.210	38.300	36.500
12	0.020	0.980	0.307	0.270	4.335	16.217	33.000	32.600
13	0.060	0.940	0.301	0.330	4.488	15.848	31.300	30.500
14	0.040	0.960	0.283	0.630	4.641	15.634	26.700	26.700
15	0.080	0.920	0.271	0.420	4.521	15.562	25.000	24.200
16	0.040	0.960	0.250	0.730	4.628	15.505	23.000	23.000
17	0.050	0.950	0.240	0.790	4.326	15.187	21.400	20.500
18	0.000	1.000	0.228	0.440	3.847	14.560	20.400	20.400
19	0.050	0.950	0.228	0.750	3.704	13.908	21.000	20.700
20	0.050	0.950	0.216	0.500	3.296	13.587	19.100	18.800
21	0.000	1.000	0.205	0.770	3.042	12.919	18.000	18.000
22	0.000	1.000	0.205	0.460	2.408	11.919	18.000	18.000
23	0.000	1.000	0.205	0.260	2.065	10.919	16.800	16.800
24	0.000	1.000	0.205	0.570	1.913	9.919	14.700	14.700
25	0.070	0.930	0.205	0.280	1.476	9.242	14.100	14.000
26	0.150	0.850	0.191	0.520	1.422	9.246	13.000	11.900
27	0.000	1.000	0.162	0.150	1.040	8.973	11.000	11.000
28	0.100	0.900	0.162	0.300	0.993	8.393	10.200	9.200
29	0.240	0.760	0.146	0.240	0.881	8.868	8.200	7.100
30	0.180	0.820	0.111	0.430	0.865	10.011	5.600	5.200
31	0.000	1.000	0.091	0.280	0.511	10.000	4.000	4.000
32	0.000	1.000	0.091	0.000	0.245	9.000	3.100	3.100
33	0.000	1.000	0.091	0.260	0.260	8.000	2.100	2.100
34	0.000	1.000	0.091	0.000	0.000	7.000	2.000	2.000
35	0.000	1.000	0.091	0.000	0.000	6.000	2.000	2.000
36	0.000	1.000	0.091	0.000	0.000	5.000	2.000	2.000
37	0.000	1.000	0.091	0.000	0.000	4.000	2.000	2.000
38	0.000	1.000	0.091	0.000	0.000	3.000	2.000	2.000
39	0.500	0.500	0.091	0.000	0.000	2.667	2.000	1.800
40	0.000	1.000	0.046	0.000	0.000	2.500	1.000	1.000
41	0.000	1.000	0.046	0.000	0.000	1.500	1.000	1.000
42	1.000	0.000	0.046	0.000	0.000	1.000	1.000	0.900
43	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

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

r = 0.0583, lambda = 1.0600, T = 14.63, N = 23.50

Females

Age (x)	Qx	Px	lx	Mx	Vx	Ex	Risk(Qx)	Risk(Mx)
0	0.320	0.680	1.000	0.000	1.190	14.484	206.400	150.300
1	0.080	0.920	0.680	0.000	1.625	17.351	101.500	96.700
2	0.060	0.940	0.626	0.000	1.855	17.590	80.600	78.900
3	0.070	0.930	0.588	0.010	2.105	17.740	76.000	72.700
4	0.040	0.960	0.547	0.100	2.353	17.725	73.700	72.100
5	0.070	0.930	0.525	0.180	2.529	17.693	70.500	67.200
6	0.030	0.970	0.488	0.100	2.626	17.585	62.800	61.400
7	0.020	0.980	0.474	0.140	2.749	17.011	60.600	59.700
8	0.070	0.930	0.464	0.190	2.898	16.761	58.700	56.000
9	0.040	0.960	0.432	0.260	3.042	16.688	53.400	52.500
10	0.060	0.940	0.414	0.210	3.107	16.510	48.300	46.900
11	0.020	0.980	0.390	0.170	3.203	16.167	47.300	46.300
12	0.080	0.920	0.382	0.200	3.387	15.960	46.400	45.200
13	0.020	0.980	0.351	0.280	3.564	15.768	40.800	39.800
14	0.080	0.920	0.344	0.220	3.667	15.540	37.700	36.100
15	0.060	0.940	0.317	0.280	3.934	15.642	32.200	31.100
16	0.030	0.970	0.298	0.270	4.062	15.339	30.000	29.500
17	0.000	1.000	0.289	0.310	4.085	14.561	28.100	28.100
18	0.040	0.960	0.289	0.330	4.087	13.838	25.600	24.600
19	0.000	1.000	0.277	0.460	4.070	13.105	25.000	25.000
20	0.080	0.920	0.277	0.300	3.989	12.610	24.000	23.300
21	0.100	0.900	0.255	0.380	4.300	12.752	21.000	20.000
22	0.050	0.950	0.229	0.400	4.503	12.723	18.900	18.600
23	0.000	1.000	0.218	0.250	4.468	12.031	16.100	16.100
24	0.130	0.870	0.218	0.460	4.786	11.798	15.700	15.000
25	0.080	0.920	0.190	0.620	5.139	12.089	13.000	13.000
26	0.000	1.000	0.175	0.580	5.003	11.571	12.000	12.000
27	0.000	1.000	0.175	0.700	4.693	10.571	9.900	9.900
28	0.000	1.000	0.175	0.640	4.236	9.571	8.100	8.100
29	0.000	1.000	0.175	1.080	3.816	8.571	8.000	8.000
30	0.120	0.880	0.175	0.610	3.088	8.054	8.000	7.500
31	0.330	0.670	0.154	0.820	3.363	9.024	6.100	4.900
32	0.000	1.000	0.103	1.320	3.363	10.000	3.100	3.100
33	0.000	1.000	0.103	0.580	2.168	9.000	3.000	3.000
34	0.000	1.000	0.103	0.770	1.685	8.000	3.000	3.000
35	0.000	1.000	0.103	0.390	0.971	7.000	3.000	3.000
36	0.000	1.000	0.103	0.390	0.616	6.000	3.000	3.000
37	0.000	1.000	0.103	0.240	0.240	5.000	2.400	2.400
38	0.000	1.000	0.103	0.000	0.000	4.000	2.000	2.000
39	0.000	1.000	0.103	0.000	0.000	3.000	2.000	2.000
40	0.000	1.000	0.103	0.000	0.000	2.000	2.000	2.000
41	0.500	0.500	0.103	0.000	0.000	1.333	2.000	1.800
42	1.000	0.000	0.051	0.000	0.000	1.000	1.000	0.600
43	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000

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

r = 0.0592, lambda = 1.0610, T = 15.96, N = 36.50

Appendix E
Ordered Mean Kinship

Note: These lists are current to October 2011 and values are subject to change with any hatch, death, import, export, inclusion, exclusion, or changes in pedigree or pedigree assumptions. Unknown sexed animals are shown on both lists.

Population MK = 0.0819

Males

ID	MK	%known	Age	Location
320	0.028	100.0	24	OMAHA
517	0.040	100.0	10	WILD WRLD
198	0.040	100.0	29	ATLANTA
400	0.080	100.0	20	JACKSONVL
471	0.083	100.0	14	SD-WAP
549	0.086	100.0	13	WILD WRLD
644	0.086	100.0	4	WILD WRLD
668	0.089	100.0	0	NZP-WASH
497	0.093	100.0	31	BUSCH TAM
486	0.096	100.0	13	NZP-WASH
138	0.099	100.0	33	SAN ANTON
153	0.105	100.0	32	WILD WRLD
647	0.115	75.0	4	METRORICH
648	0.115	75.0	4	BROWNSVIL
639	0.119	75.0	5	SAFARI W
659	0.123	37.5	1	SAFARI W
438	0.136	50.0	18	METROZOO
654	0.500	0.0	5	SAFARI W
328	0.500	0.0	24	RIO GRAND
480	0.500	0.0	11	METRORICH
683	0.500	0.0	U0	METRORICH
311	0.500	0.0	25	LITTLEROC
373	0.500	0.0	23	HOUSTON
649	0.500	0.0	5	DISNEY AK

Females

ID	MK	%known	Age	Location
173	0.031	100.0	31	BUSCH TAM
442	0.039	100.0	18	BARABOO
256	0.040	100.0	27	ATLANTA
465	0.040	100.0	15	ST LOUIS
226	0.053	100.0	28	JACKSONVL
179	0.055	100.0	32	WILD WRLD
431	0.059	100.0	18	GARDENCTY
524	0.059	100.0	14	OMAHA
667	0.068	100.0	2	METRORICH
448	0.068	100.0	17	SAN ANTON
348	0.069	100.0	23	NZP-WASH
528	0.080	100.0	14	DISNEY AK
641	0.086	100.0	5	WILD WRLD
633	0.086	100.0	6	WILD WRLD
536	0.086	100.0	13	WILD WRLD
653	0.089	100.0	2	METRORICH
249	0.090	100.0	27	BROWNSVIL
485	0.090	100.0	13	LITTLEROC
434	0.098	100.0	18	METROZOO
663	0.103	87.5	1	SD-WAP
600	0.115	75.0	8	DALLAS
670	0.115	75.0	0	METROZOO
669	0.115	75.0	0	METROZOO
661	0.115	75.0	1	METROZOO
656	0.115	75.0	1	METROZOO
655	0.115	75.0	2	METROZOO
638	0.117	75.0	6	SD-WAP
658	0.123	37.5	1	SAFARI W
411	0.500	0.0	20	EVANSVLLE
236	0.500	0.0	28	EVANSVLLE
374	0.500	0.0	23	HOUSTON
683	0.500	0.0	U0	METRORICH
605	0.500	0.0	15	METRORICH
664	0.500	0.0	1	NORFOLK
305	0.500	0.0	25	RIO GRAND
620	0.500	0.0	10	SAFARI W

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

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 Program – A Red Program has a population size of fewer than 50 animals. If the Taxon Advisory Group (TAG) recommends this species in their Regional Collection Plan (RCP), a Red Program will have an official AZA Regional Studbook but will not be required to produce a formal Breeding and Transfer Plan on a regular basis. 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 Acquisition and Disposition Policy, and well as 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 a 11% per year increase; lambda of .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.

Mx, **Fecundity** – The average number of same-sexed young born to animals in that age class. Because SPARKS is typically using relatively small sample sizes, SPARKS calculates 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

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.
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").

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).

FOKE, First Order Kin Equivalents – The number of first-order kin (siblings or offspring) that would contain the number of copies of an individuals alleles (identical by descent) as are present in the captive-born population. Thus an offspring or sib contributes 1 to FOKE; each grand-offspring contributes 1/2 to FOKE; each cousin contributes 1/4 to FOKE. FOKE = 4*N*MK, in which N is the number of living animals in the captive population.

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 Contribution -- Number of copies of a founder's genome that are present in the living descendants. Each offspring contributes 0.5, each grand-offspring contributes 0.25, etc.

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 Genome Surviving – The sum of allelic retentions of the individual founders (i.e., the product of the mean allelic retention and the number of founders).

Founder Representation -- Proportion of the genes in the living, descendant population that are derived from that founder. I.e., proportional Founder Contribution.

GU, Genome Uniqueness – Probability that an allele sampled at random from an individual is not present, identical by descent, in any other living individual in the population. GU-all is the genome uniqueness relative to the entire population. GU-Desc is the genome uniqueness relative to the living non-founder, descendants.

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.

Kinship Value (KV) – The weighted mean kinship of an animal, with the weights being the reproductive values of each of the kin. The mean kinship value of a population predicts the loss of gene diversity expected in the subsequent generation if all animals were to mate randomly and all were to produce the numbers of offspring expected for animals of their age.

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.

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.

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
James Balance	ATLANTA - Zoo Atlanta, Atlanta, GA	jballance@zooatlanta.org
Bryant Tarr	BARABOO - International Crane Foundation, Baraboo, WI	btarr@savingcranes.org
Michelle Smurl	BREVARD - Brevard Zoo, Melbourne, FL	Msmurl@brevardzoo.org
Colette Adams	BROWNSVIL - Gladys Porter Zoo, Brownsville, TX	cadams@gpz.org
Laura Wittish	BUSCH TAM - Busch Gardens, Tampa, FL	Laura.V.Wittish@BuschGardens.com
Susan Greer	DALLAS - Dallas Zoo, Dallas, TX	susan.greer@dallaszoo.com
Lori Grady	DISNEY AK - Disney's Animal Kingdom/The Living Seas, Bay Lake, FL	Lori.Grady@disney.com
keith Lovett	DREHER PA - Palm Beach Zoo at Dreher Park, West Palm Beach, FL	klovett@palmbeachzoo.org
Sue Lindsey	EVANSVLLE - Mesker Park Zoo, Evansville, IN	slindsey@meskerparkzoo.com
Kristi Newland	GARDENCTY - Lee Richardson Zoo, Garden City, KS	knewland@garden-city.org
Hannah Bailey	HOUSTON - Houston Zoo, Inc., Houston, TX	hbailey@houstonzoo.org
Donna Bear Hull	JACKSONVL - Jacksonville Zoo and Gardens, Jacksonville, FL	bear-hulld@jacksonvillezoo.org
Noel Snyder	LITTLEROC - Little Rock Zoological Gardens, Little Rock, AR	zoozs@comcast.net
Jim Andelin	METRORICH - Metro Richmond Zoo, Moseley, VA	jmrzoo@gmail.com
Craig Pelke	NORFOLK - Virginia Zoological Park, Norfolk, VA	craig.pelke@norfolk.gov
Jim Dunster	METROZOO - Miami Metrozoo, Miami, FL	JDUN@miamidade.gov
Sara Hallager	NZP-WASH - Smithsonian National Zoological Park, Washington, DC	hallagers@si.edu
Stephanie Huettner	OMAHA - Omaha's Henry Doorly Zoo, Omaha, NE	stephanieh@omahazoo.com
Peter Shannon	RIO GRAND - Albuquerque Biological Park, Albuquerque, NM	pshannon@cabq.gov
Kimberly Robertson	SAFARI W - Safari West, Santa Rosa, CA	krobertson@safariwest.com
Josef San Miguel	SAN ANTON - San Antonio Zoological Gardens & Aqua, San Antonio, TX	curbirds@sazoo-aq.org
Michael Mace	SANDIEGOZ - Zoological Society of San Diego, San Diego, CA	mmace@sandiegozoo.org
Mike Macek	ST LOUIS - Saint Louis Zoological Park, St. Louis, MO	macek@stlzoo.org
Jack Ewert	WILD WRLD - Wildlife World Zoo, Litchfield Park, AZ	jackewert@wildlifeworld.com

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