Population Analysis & Breeding and Transfer Plan

Demoiselle Crane (*Anthropoides virgo*) AZA Species Survival Plan® Yellow Program

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30 December 2013

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

Executive Summary
Demoiselle Crane (Anthropoides virgo)

The Demoiselle Crane population at the time of analyses consists of 66 animals (38.28.0) at 25 institutions (22 AZA and 3 non-AZA). The Gruiformes Taxon Advisory Group has designated this population as a PMP and set their target population size at 70 individuals in their 2009 Regional Collection Plan (RCP). Under AZA's sustainability designations this population currently qualifies as a Yellow SSP Program.

The current gene diversity in the population (based on extensive pedigree assumptions, with only 45% of the population with known pedigree) is 93.21% and is equivalent to the gene diversity found in about 8 unrelated individuals (FGE = 7.37). With a target size of 70 and a projected growth rate of 2.5%, gene diversity in 100 years is projected to be about 75%. When gene diversity falls below 90% of that in the founding population, as it already is for this population, it is expected that reproduction will be increasingly compromised by, among other factors, lower hatch weights, smaller clutch sizes, and greater neonatal mortality. Several management strategies could improve gene diversity retention in this population: improving the population growth rate, increasing the percentage of the population with known pedigree, increasing the effective population size (number of animals breeding), equalizing founder representation by using mean kinship to select breeding animals, and acquiring additional founders.

Demography

Current size of population (N) – Total (Males.Females.Unknown Sex)	66 (38.28.0)
Number of individuals excluded from the potentially breeding population	5 (3.2.0)
Population size following exclusions	61 (35.26.0)
Target population size (Kt) from Gruiformes TAG's 2009 RCP	70
Mean generation time (T; years)	15.4
Historical / Potential population growth rate (λ; lambda)	1.003/ 1.025

Genetics*

(*Genetic statistics calculated from an analytical studbook)	**Current**	**Potential**
Founders	16	5
Founder genome equivalents (FGE)	7.37	15.81
Gene diversity (GD %)	93.21	96.84
Population mean kinship (MK)	0.0679	-
Mean inbreeding (F)	0.0000	-
Percentage of pedigree known before assumptions and exclusions	6.3	-
Percentage of pedigree known after assumptions and exclusions	45.4	-
Effective population size/census size ratio (Ne / N)	0.1814	-
Years To 90% Gene Diversity	11	12
Years to 10% Loss of Gene Diversity	42	52
Gene Diversity at 100 Years From Present (%); Assuming Growth rate (λ) , Target size (Kt)	71.38 (λ= 1.025, Kt=70)	75.30 (λ= 1.025, Kt=90)

** Based on an analytical studbook with pedigree assumptions intended to estimate relatedness and inbreeding, but which may over- or under-estimate gene diversity. In addition, gene diversity is based on only the 50% of the population with known pedigree.*

To maintain this population at its current size of 66 individuals, approximately 5 - 6 hatches or imports are needed in the upcoming year. Approximately 7 - 8 hatches or imports are needed per year to grow the population to the target size of 70 (lambda = 1. 025) within the next 3 years.

Of special concern with this population is the high level of unknown pedigree, at this time 50% of the population's pedigree remains unknown. Gene diversity reported throughout the report is based on only the 50% of the population that can be traced back to wild lineages. To ensure the demographic and genetic health of the population in the future it is important for the Program to investigate pedigree of animals currently in the managed population as well as any animals that are brought into the population in the future.

Where possible, existing breeding pairs/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) and avoidance of inbreeding. Institutions recommended to breed are expected to hold their offspring for at least one year.

Summary Actions: The SSP recommends 18 females for breeding and 3 transfers to fulfill institutional needs or requests.

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Acknowledgments

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The Demoiselle SSP planning meeting was held at Lincoln Park Zoo in Chicago on 8 May 2013 and was attended by the following:

Sarah Schoenberg, Jacksonville Zoo
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Cover photo courtesy of: Ellen Gorrell, Bird Keeper, Toledo Zoo

This plan was prepared and distributed with the assistance of the Population Management Center in Chicago.
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Description of Population Status
Demoiselle Crane (Anthropoides virgo)

Introduction: The demoiselle crane population at the time of analyses consists of 66 animals (38.28.0) at 25 institutions (22 AZA and 3 non-AZA). This population currently qualifies as a Yellow SSP under AZA's sustainability designations, and the Gruiformes Taxon Advisory Group has set a target population size of 70 individuals in their 2009 Regional Collection Plan (RCP).

Comprehensive genetic and demographic analyses of this population were performed in May 2013 with follow-up analyses preformed in December 2013 resulting in this breeding and transfer plan, which is the first masterplan produced for this species. Analyses of the analytical version of the Demoiselle Crane Studbook, (current to 21 February 2013) were performed using PopLink 2.4 and PM2000 1.213.

Analytical Studbook: An analytical studbook was created for genetic analysis to incorporate assumptions regarding historic and current pedigree unknownness within the demoiselle crane population (Appendix A) With the application of these assumptions, the population went from 6.3% pedigree known to 45.4% known.

Due to the high amount of animals coming into the managed population from private institutions, it has been difficult to receive pedigree history of all these individuals. To ensure future genetic management and genetic health of the population, the Program recommends that all institutions investigate the pedigree of their current individuals and any individuals coming into the managed population.

Five individuals were excluded due to age (Appendix C), and the potentially breeding population following these exclusions is 61 individuals (35.26.0). One individual (411) was reported dead during the comment period and two new individuals were reported and are now included in the analyses (862 and 863)

Demography: The first demoiselle crane entered North America in 1903. The population began growing in the 1930s due to imported individuals and did not begin growing reliably from zoo hatched individuals until the 1960s. The population grew quickly after the zoo hatches began, reaching its peak size of 124 individuals in 1987 (Fig 1). However, the population has been declining since it reached this peak size. Currently the population is primarily maintained by imports from outside of the managed population, as well as a few hatches each year. Over the last 10 years, the demoiselle crane population has experienced a decline of 2.9% (lambda = 0.971), over the last 5 years the population has been declining at a slower rate (0.6%).

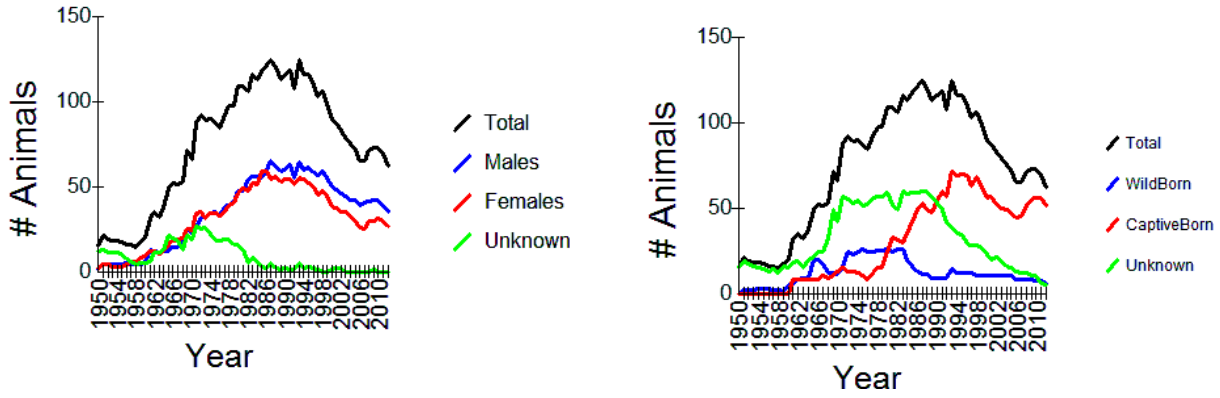

Figure 1. Census of the SSP population of demoiselle crane by sex (left) and origin (right) from 1950 to 2012.

Demographic projections estimate that to keep this population stable (0% growth); approximately 5 - 6 hatches in the coming year are necessary. According to studbook data, the demoiselle crane typically has 1 to 2 chicks per clutch. Over the past 10 years, the SSP population has had an average of approximately 4 chicks per year. 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 70 in approximately 3 years.

The age structure for the current potentially breeding population is somewhat pyramidal; however they are few younger animals and a number of empty age classes (Figure 3). There is also a male bias in the population which this could be problematic for this monogamous species in the future as there will not be enough females to make breeding pairs. 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 demoiselle crane is 29% for males and 33% for females (Appendix D). The oldest recorded male in the demoiselle crane population is still living at 47 years old (unknown first location and year age estimate). The oldest male without an age estimate, is currently living at 30 years old. The oldest female in the population died at 37 years old; though this female had an unknown hatch location and a year age estimate. The oldest female without any age estimates lived to 31 years old. Both male and female demoiselle crane has been recorded as breeding prior to 2 years of age, though most become reproductively mature around 3 years old. The oldest male in the population to have bred was 36 years old at the time of conception and the oldest female demoiselle crane to breed was 37 years old (both have year age estimates).

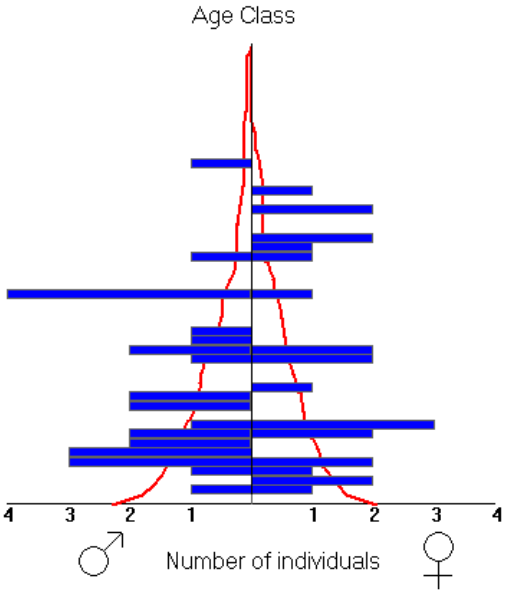

Fig 2. Age structure of the potentially breeding SSP demoiselle crane population 61 (35.26) individuals.

Genetics: These genetic statistics are based on an analytical studbook with extensive pedigree assumptions intended to estimate relatedness. However, these assumptions may over- or under-estimate gene diversity and inbreeding within the living population. In addition, assumptions could only be made for 50% of the population. Currently there are five additional potential founders remaining in the population. Gene diversity based on the proportion of the population that is known is currently at 93.21% and equivalent to that found in about 8 unrelated individuals (FGE = 7.37). Gene diversity at 100 years from present is estimated to be 71.38% according to projections based on growth rate of 2.5% and target population size of 70. When gene diversity falls below 90% of that in the founding population in some species, it is expected that reproduction will be increasingly compromised by, among other factors, lower hatch weights and greater juvenile mortality. Potential gene diversity could be maximized through equalization of founder representation (by breeding animals with low and well-matched mean kinship values), increasing the number of individuals breeding (Ne/N), and importing additional founders (Figure 5).

GENETIC SUMMARY*	Current	Potential
Founders	16	5
Founder genome equivalents (FGE)	7.37	15.81
Gene diversity (GD %)	93.21	96.84
Population mean kinship (MK)	0.0679	-
Mean inbreeding (F)	0.0000	-
Percentage of pedigree known before assumptions and exclusions	6.3	-
Percentage of pedigree known after assumptions and exclusions	45.4	-
Effective population size/census size ratio (Ne / N)	0.1814	-
Years To 90% Gene Diversity	11	12
Years to 10% Loss of Gene Diversity	42	52
Gene Diversity at 100 Years From Present (%); Assuming Growth rate (λ) , Target size (Kt)	71.38 (λ= 1.025, Kt=70)	75.30 (λ= 1.025, Kt=90)

** Based on an analytical studbook with pedigree assumptions intended to estimate relatedness and inbreeding, but which may over- or under-estimate gene diversity. In addition, gene diversity is based on only the 50% of the population with known pedigree.*

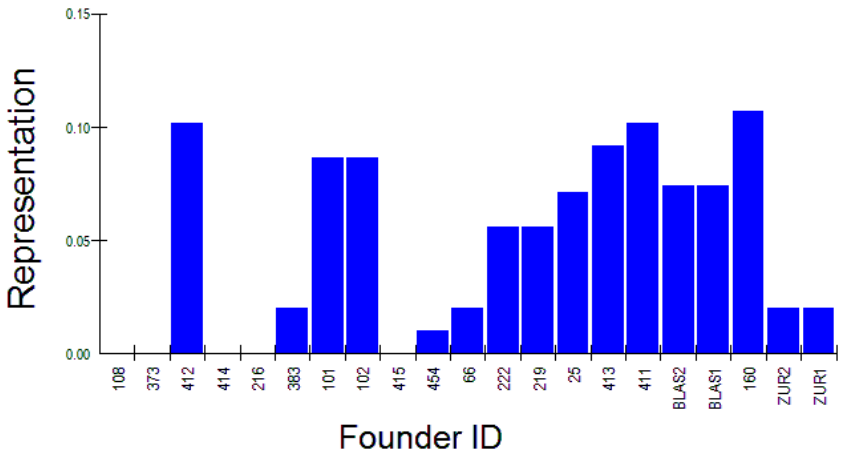

Figure 5. Founder representation graph illustrating the inequality of the 16 founder lineages represented in the current demoiselle crane population. Gene diversity in this population can be increased by equalizing these founder lineages through the use of mean kinship in making breeding pairs (prioritizing low mean kinship animals for breeding, and matching male & female mean kinships). Note that this graph only represents 50% of the population that has known pedigree.

Management Strategy:

The current demoiselle crane population is 66 (38 males, 28 females) individuals at 22 AZA institutions and 3 non-AZA institutions. The population is descended from 16 founders and gene diversity in the descendant population is approximately 93% (based on assumptions and only 45% of the population that has known pedigree). Demographic analyses indicate that at approximately 5-6 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 70 individuals in the next 5 years (lambda=1.025), approximately 7 - 8 hatches are needed in the coming years.

Where possible, 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 Demoiselle Crane SSP.

1. The SSP recommends 18 females for breeding.
    a. Institutions recommended to breed are expected to hold offspring for at least one year.
    b. 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 3 transfers within the Program to address institutional requests or to make new companion or breeding pairs.

3. Institutions interested in obtaining or placing demoiselle crane should contact the SSP Coordinator to coordinate transfers that will facilitate genetic and demographic stability.
    a. Contact the SSP coordinator prior to obtaining birds from outside of the currently managed population.

4. 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. Please contact the SSP Coordinator with any pedigree information found.

Summary of Breeding and Transfer Recommendations

Sorted By Studbook ID

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
21	NORFOLK	211058	F	29	HOLD	NORFOLK	BREED WITH	422	
24	ALEXANDRI	99B005	M	16	HOLD	ALEXANDRI	BREED WITH	398	
25	ALEXANDRI	AV0082	M	40	HOLD	ALEXANDRI	DO NOT BREED		Excluded - Age
26	AUDUBON	747	F	35	HOLD	AUDUBON	DO NOT BREED		Excluded - Age
29	GARDENCTY	205044	M	16	HOLD	GARDENCTY	BREED WITH	862	
55	SAFARI W	208102	M	6	HOLD	SAFARI W	DO NOT BREED		
56	SAFARI W	208103	M	6	HOLD	SAFARI W	DO NOT BREED		
57	SAFARI W	208104	F	6	HOLD	SAFARI W	DO NOT BREED		
58	SAFARI W	208154	F	7	HOLD	SAFARI W	DO NOT BREED		
60	SAFARI W	210024	M	3	HOLD	SAFARI W	DO NOT BREED		
61	SAFARI W	210025	F	3	HOLD	SAFARI W	DO NOT BREED		
63	LOWRY	206275	M	3	HOLD	LOWRY	DO NOT BREED		
65	SAFARI W	210069	F	3	HOLD	SAFARI W	DO NOT BREED		
73	BATONROUG	10450	M	6	HOLD	BATONROUG	BREED WITH	93	
79	BUSCH TAM	60060	F	27	HOLD	BUSCH TAM	BREED WITH	264	
80	LOWRY	206244	F	3	HOLD	LOWRY	DO NOT BREED		
86	DREHER PA	201093	F	36	HOLD	DREHER PA	DO NOT BREED		Excluded - Age
93	BATONROUG	10390	F	26	HOLD	BATONROUG	BREED WITH	73	
97	KANSASCTY	203006	F	21	HOLD	KANSASCTY	DO NOT BREED		
108	SEDGWICK	1159	M	33	HOLD	SEDGWICK	BREED WITH	417	
116	REDWOOD	6316	F	30	HOLD	REDWOOD	DO NOT BREED		
160	METROZOO	A03029	M	43	HOLD	METROZOO	DO NOT BREED		Excluded - Age
164	SEDGWICK	12287	M	5	HOLD	SEDGWICK	DO NOT BREED		
166	SEDGWICK	12526	M	17	HOLD	SEDGWICK	DO NOT BREED		
168	TAUTPHAUS	93A025	M	21	HOLD	TAUTPHAUS	BREED WITH	169	
169	TAUTPHAUS	K0A032	F	15	HOLD	TAUTPHAUS	BREED WITH	168	
172	LOUISVILL	200137	M	47	HOLD	LOUISVILL	DO NOT BREED		Excluded - Age
216	BALTIMORE	980555	F	32	HOLD	BALTIMORE	BREED WITH	381	
223	METROZOO	A02470	F	25	HOLD	METROZOO	DO NOT BREED		
224	ORLANDO	DC2500	F	16	HOLD	ORLANDO	BREED WITH	225	
225	ORLANDO	DC2501	M	15	HOLD	ORLANDO	BREED WITH	224	
264	BUSCH TAM	63317	M	7	HOLD	BUSCH TAM	BREED WITH	463, 79	
266	TOLEDO	1148	M	14	HOLD	TOLEDO	BREED WITH	267	
267	TOLEDO	991542	F	15	HOLD	TOLEDO	BREED WITH	266	
349	ST FELICI	B00078	F	15	HOLD	ST FELICI	BREED WITH	386	
373	SD-WAP	801116	M	31	HOLD	SD-WAP	SEE NOTES		Potential founder - if possible, this male should be used as an AI candidate for next year
374	SD-WAP	804252	M	10	HOLD	SD-WAP	BREED WITH	375	
375	SD-WAP	808011	F	7	HOLD	SD-WAP	BREED WITH	374	
376	SD-WAP	808012	F	7	HOLD	SD-WAP	BREED WITH	379	
379	SD-WAP	895020	M	21	HOLD	SD-WAP	BREED WITH	376	
380	ALDERGROV	209093	M	4	HOLD	ALDERGROV	DO NOT BREED		
381	BALTIMORE	920563	M	21	HOLD	BALTIMORE	BREED WITH	216	
382	BARABOO	030013	M	25	HOLD	BARABOO	BREED WITH	383	

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	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
383	BARABOO	030012	F	30	HOLD	BARABOO	BREED WITH	382	
384	ST FELICI	A80090	M	5	HOLD	ST FELICI	BREED WITH	391	
386	ST FELICI	A90008	M	5	HOLD	ST FELICI	BREED WITH	349	
391	ST FELICI	A90012	F	6	HOLD	ST FELICI	BREED WITH	384	
394	WINNIPEG	C00450	M	11	HOLD	WINNIPEG	DO NOT BREED		
395	WINNIPEG	D00474	M	10	HOLD	WINNIPEG	DO NOT BREED		
396	WINNIPEG	E00199	M	9	HOLD	WINNIPEG	DO NOT BREED		
397	WINNIPEG	L00111	M	3	SEND TO	SAN ANTON	BREED WITH	416	
398	WINNIPEG	B00906	F	12	SEND TO	ALEXANDRI	BREED WITH	24	
~~411~~	~~WINNIPEG~~	~~000988~~	~~M~~	~~22~~	~~HOLD~~	~~WINNIPEG~~	~~BREED WITH~~	~~412~~	Reported dead during the comment period
412	WINNIPEG	000987	F	22	HOLD	WINNIPEG	BREED WITH	414 or 415	
414	WINNIPEG	000992	M	22	HOLD	WINNIPEG	BREED WITH	412	
415	WINNIPEG	000983	M	21	HOLD	WINNIPEG	BREED WITH	412	
416	SAN ANTON	D11003	F	2	HOLD	SAN ANTON	BREED WITH	397	
417	SEDGWICK	13659	F	2	HOLD	SEDGWICK	BREED WITH	108	
422	NORFOLK	211086	M	2	HOLD	NORFOLK	BREED WITH	21	
463	BUSCH TAM	55181	F	27	HOLD	BUSCH TAM	BREED WITH	264	
464	BUSCH TAM	64201	M	4	HOLD	BUSCH TAM	DO NOT BREED		
859	CENTRALPK	UNK	M	0	HOLD	CENTRALPK	DO NOT BREED		
860	CENTRALPK	UNK	M	0	HOLD	CENTRALPK	DO NOT BREED		
861	CENTRALPK	UNK	M	0	HOLD	CENTRALPK	DO NOT BREED		
862	BUSCH TAM	6544	F	1	SEND TO	GARDENCTY	BREED WITH	29	Pre-arranged transfer
863	LOWRY	206531	M	1	HOLD	LOWRY	DO NOT BREED		

Breeding and Transfer Recommendations by Institution

ALDERGROV

Greater Vancouver Zoo
Aldergrove, BC

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
380	209093	M	4	HOLD	ALDERGROV	DO NOT BREED		

ALEXANDRI

Alexandria Zoological Park
Alexandria, LA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
24	99B005	M	16	HOLD	ALEXANDRI	BREED WITH	398	
25	AV0082	M	40	HOLD	ALEXANDRI	DO NOT BREED		Excluded-Age
398	B00906	F	12	RECEIVE FROM	WINNIPEG	BREED WITH	24	

AUDUBON

Audubon Zoo
New Orleans, LA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
26	747	F	35	HOLD	AUDUBON	DO NOT BREED		Excluded-Age

BALTIMORE

Maryland Zoo in Baltimore
Baltimore, MD

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
216	980555	F	32	HOLD	BALTIMORE	BREED WITH	381	Potential founder
381	920563	M	21	HOLD	BALTIMORE	BREED WITH	216	

BARABOO

International Crane Foundation
Baraboo, WI

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
382	030013	M	25	HOLD	BARABOO	BREED WITH	383	
383	030012	F	30	HOLD	BARABOO	BREED WITH	382	

BATONROUG

BREC's Baton Rouge Zoo

Baker, LA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
73	10450	M	6	HOLD	BATONROUG	BREED WITH	93	
93	10390	F	26	HOLD	BATONROUG	BREED WITH	73	

BUSCH TAM

Busch Gardens Tampa Bay

Tampa, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
79	60060	F	27	HOLD	BUSCH TAM	BREED WITH	264	
264	63317	M	7	HOLD	BUSCH TAM	BREED WITH	463, 79	
463	55181	F	27	HOLD	BUSCH TAM	BREED WITH	264	
464	64201	M	4	HOLD	BUSCH TAM	DO NOT BREED		Male is related to all females at BUSCH TAM, not recommended for breeding at this time.
862	65444	F	1	SEND TO	GARDENCTY	BREED WITH	29	Pre-arranged transfer

CENTRALPK

Central Park Zoo

New York, NY

Institutional Note: Please contact the SSP Coordinator with the local ID for these new individuals.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
859	UNK	M	0	HOLD	CENTRALPK	DO NOT BREED		
860	UNK	M	0	HOLD	CENTRALPK	DO NOT BREED		
861	UNK	M	0	HOLD	CENTRALPK	DO NOT BREED		

DREHER PA

Palm Beach Zoo at Dreher Park

West Palm Beach, FL

Institutional Note: The SSP is currently looking for placement for female #86.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
86	201093	F	36	HOLD	DREHER PA	DO NOT BREED		Excluded-Age This individual is available for placement

GARDENCTY

Lee Richardson Zoo
Garden City, KS

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
29	205044	M	16	HOLD	GARDENCTY	BREED WITH	862	
862	65444	F	1	RECEIVE FROM	BUSCH TAM	BREED WITH	29	Pre-arranged transfer

KANSASCTY

Kansas City Zoo
Kansas City, MO

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
97	203006	F	21	HOLD	KANSASCTY	DO NOT BREED		

LOUISVILL

Louisville Zoological Garden
Louisville, KY

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
172	200137	M	47	HOLD	LOUISVILL	DO NOT BREED		Excluded-Age

LOWRY

Tampa's Lowry Park Zoo
Tampa, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
63	206275	M	3	HOLD	LOWRY	DO NOT BREED		
80	206244	F	3	HOLD	LOWRY	DO NOT BREED		
863	206531	M	1	HOLD	LOWRY	DO NOT BREED		

METROZOO

Zoo Miami
Miami, FL

Institutional Note: The SSP will continue to look for a breeding male for this female.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
223	A02470	F	25	HOLD	METROZOO	DO NOT BREED		
160	A03029	M	43	HOLD	METROZOO	DO NOT BREED		Excluded-Age

NORFOLK

Virginia Zoological Park

Norfolk, VA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
21	211058	F	29	HOLD	NORFOLK	BREED WITH	422	
422	211086	M	2	HOLD	NORFOLK	BREED WITH	21	

ORLANDO

Sea World Orlando

Orlando, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
224	DC2500	F	16	HOLD	ORLANDO	BREED WITH	225	
225	DC2501	M	15	HOLD	ORLANDO	BREED WITH	224	

REDWOOD

Six Flags Discovery Kingdom

Vallejo, CA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
116	6316	F	30	HOLD	REDWOOD	DO NOT BREED		

SAFARI W

Safari West

Santa Rosa, CA

Institutional Note: Currently these individuals are listed as siblings and unknown pedigree in the studbook. Please contact the SSP coordinator to discuss potential breeding of these individuals.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
55	208102	M	6	HOLD	SAFARI W	DO NOT BREED		
56	208103	M	6	HOLD	SAFARI W	DO NOT BREED		
57	208104	F	6	HOLD	SAFARI W	DO NOT BREED		
58	208154	F	7	HOLD	SAFARI W	DO NOT BREED		
60	210024	M	3	HOLD	SAFARI W	DO NOT BREED		
61	210025	F	3	HOLD	SAFARI W	DO NOT BREED		
65	210069	F	3	HOLD	SAFARI W	DO NOT BREED		

SAN ANTON

San Antonio Zoological Gardens & Aqu

San Antonio, TX

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
416	D11003	F	2	HOLD	SAN ANTON	BREED WITH	397	
397	L00111	M	3	RECEIVE FROM	WINNIPEG	BREED WITH	416	

SD-WAP

San Diego Zoo's Safari Park

Escondido, CA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
373	801116	M	31	HOLD	SD-WAP	SEE NOTES		Potential founder - if possible, this male should be used as an AI candidate for next year.
374	804252	M	10	HOLD	SD-WAP	BREED WITH	375	
375	808011	F	7	HOLD	SD-WAP	BREED WITH	374	
376	808012	F	7	HOLD	SD-WAP	BREED WITH	379	
379	895020	M	21	HOLD	SD-WAP	BREED WITH	376	

SEDGWICK

Sedgwick County Zoo

Wichita, KS

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
108	1159	M	33	HOLD	SEDGWICK	BREED WITH	417	Potential founder
164	12287	M	5	HOLD	SEDGWICK	DO NOT BREED		
166	12526	M	17	HOLD	SEDGWICK	DO NOT BREED		
417	13659	F	2	HOLD	SEDGWICK	BREED WITH	108	

ST FELICI

Zoo Sauvage de St-Felicien

St-FÎ˜licien, Quebec

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
349	B00078	F	15	HOLD	ST FELICI	BREED WITH	386	
384	A80090	M	5	HOLD	ST FELICI	BREED WITH	391	
386	A90008	M	5	HOLD	ST FELICI	BREED WITH	349	
391	A90012	F	6	HOLD	ST FELICI	BREED WITH	384	

TAUTPHAUS

Tautphaus Park Zoo

Idaho Falls, ID

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
168	93A025	M	21	HOLD	TAUTPHAUS	BREED WITH	169	
169	K0A032	F	15	HOLD	TAUTPHAUS	BREED WITH	168	

TOLEDO

Toledo Zoological Gardens

Toledo, OH

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
266	1148	M	14	HOLD	TOLEDO	BREED WITH	267	
267	991542	F	15	HOLD	TOLEDO	BREED WITH	266	

WINNIPEG

Assiniboine Park Zoo

Winnipeg, Manitoba

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
394	C00450	M	11	HOLD	WINNIPEG	DO NOT BREED		
395	D00474	M	10	HOLD	WINNIPEG	DO NOT BREED		
396	E00199	M	9	HOLD	WINNIPEG	DO NOT BREED		
397	L00111	M	3	SEND TO	SAN ANTON	BREED WITH	416	
398	B00906	F	12	SEND TO	ALEXANDRI	BREED WITH	24	
~~411~~	~~000988~~	~~M~~	~~22~~	~~HOLD~~	~~WINNIPEG~~	~~BREED WITH~~	~~412~~	Reported dead during the comment period
412	000987	F	22	HOLD	WINNIPEG	BREED WITH	414 or 415	
414	000992	M	22	HOLD	WINNIPEG	BREED WITH	412	
415	000983	M	21	HOLD	WINNIPEG	BREED WITH	412	

Appendix A
Pedigree Assumptions

HYPOTHETICAL SPECIMENS

Studbook ID	Sire	Dam	Sex	First Location	Notes
BLAS1	WILD	WILD		UNKNOWN	Master Analytical Notes: Potential wild caught parent of 223.
BLAS2	WILD	WILD		UNKNOWN	Master Analytical Notes: Potential wild caught parent of 223.
MULT1	25	113		UNKNOWN	Master Analytical Notes: Potential sires at LAKEBUENA during the time this individual was hatched. No dams were present at this institution, leave as unknown.
ZUR1	WILD	WILD		UNKNOWN	Master Analytical Notes: Represents potential wild caught parents in Zurich
ZUR2	WILD	WILD		UNKNOWN	Master Analytical Notes: Represents potential wild caught parents in Zurich

ANALYTICAL DATA FOR TRUE SPECIMENS

Studbook ID	Field	True	Overlay	Notes
101	Dam	UNK	WILD	Master Analytical Notes: Animal came in prior to first North American zoo hatch and CHASE B is a known importer of birds. Assume Wild caught.
	Sire	UNK	WILD	
102	Dam	UNK	WILD	Master Analytical Notes: Animal came in prior to first North American zoo hatch and CHASE B is a known importer of birds. Assume Wild caught.
	Sire	UNK	WILD	
216	Dam	UNK	WILD	Master Analytical Notes: Hatched in RUSSIA, all other animals coming from Russia at this time were wild caught. Assume unrelated to the current population, wild caught.
	Sire	UNK	WILD	
219	Dam	UNK	WILD	Master Analytical Notes: Animal came in prior to first North American zoo hatch and FERNDALE is a known importer. Assume Wild caught.
	Sire	UNK	WILD	
222	Dam	UNK	WILD	Master Analytical Notes: Animal came in prior to first North American zoo hatch. No other animals with living or with offspring from MIAMI RARE. Assume Wild caught.
	Sire	UNK	WILD	
223	Dam	UNK	BLAS2	Master Analytical Notes: Individual came from BLASKO D, only one other individual came from this location (died, no offspring). Assume unrelated to the current population.
	Sire	UNK	BLAS1	
25	Dam	UNK	WILD	Master Analytical Notes: Individual says "hatched" at NOLAN in 1973, prior to this species being bred in zoos. Assume wild caught.
	Sire	UNK	WILD	
269	Dam	UNK	ZUR2	Master Analytical Notes: Animal was hatched in Zurich Zoo, assume unrelated to current population with wild caught parents.
	Sire	UNK	ZUR1	
383	Dam	UNK	WILD	Master Analytical Notes: Individual was hatched at MEGGETT (Dixie plantation), private facility. Few animals came from this location (dead, with no offspring), assume unrelated to the living population.
	Sire	UNK	WILD	
413	Dam	UNK	WILD	Master Analytical Notes: Came from HENDEE, this private imported may wild caught birds throughout the 1980s. All other animals from HENDEE have died with no living offspring. Assume this female is unrelated to the living population.
	Sire	UNK	WILD	
415	Dam	UNK	WILD	Master Analytical Notes: Transferred from LA COMTE, all animals coming to this location at that time were wild caught in Russia. Assume this animal was unrelated to the living population.
	Sire	UNK	WILD	
454	Dam	UNK	WILD	Master Analytical Notes: Individual came from PAP VIENN, a private petting zoo prior to first hatch in N.AMERICA. Only one other animal came from this location (died, with no offspring). Assume wild caught.
	Sire	UNK	WILD	
463	Sire	UNK	MULT1	Master Analytical Notes: MULT1 potential sires at LAKEBUENA during the time this individual was hatched. No dams were present at this institution, leave as unknown.
79	Sire	UNK	MULT1	Master Analytical Notes: MULT1 potential sires at LAKEBUENA during the time this individual was hatched. No dams were present at this institution, leave as unknown.

Appendix B
Summary of Data Exports

Project: XXDemiCrane 2013B
Report compiled under Population Management 2000, version 1.213
9:29:43 AM, 5/30/2013

Comments: With the Central Park animals added in

Date to be used for calculations: 5/30/2013

Demographic data from: C:\Users\KMarti.LPZ_DOMAIN\Documents\PopLink\PopLink Databases\CraneDemo\mXXCraneDemo.prn and C:\Users\KMarti.LPZ_DOMAIN\Documents\PopLink\PopLink Databases\CraneDemo\fXXCraneDemo.prn

Genetic data from: C:\Users\KMarti.LPZ_DOMAIN\Documents\PopLink\PopLink Databases\CraneDemo\XXCraneDemo.ped

Studbook information:
Data exported on: 5/30/2013
Data compiled by: Sarah Schoenberg
Contact info: Sarah Schoenberg sarahhrpz@gmail.com
Data current thru: 2/21/2013
Scope of data: North America

Demographic filter conditions:
Locations = N.AMERICA During 1/1/1970 - 5/30/2013 Status = Living

Genetic filter conditions: Association = DemiCrane.FED As of 5/30/2013 Status = Living

Appendix C
Animals Excluded from the Genetic Analysis

Studbook ID	Location	Sex	Age	Reason for Exclusion
172	LOUISVILL	M	47	Age
160	METROZOO	M	43	Age
86	DREHER PA	F	36	Age
25	ALEXANDRI	M	40	Age
26	AUDUBON	F	35	Age

Appendix D
Life Tables

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

Males

Age (x)	Qx	Px	lx	Mx	Vx	Ex	Risk (Qx)	Risk (Mx)
0	0.290	0.710	1.000	0.000	182.400	138.600	0	0.290
1	0.100	0.900	0.710	0.000	137.000	129.200	1	0.100
2	0.090	0.910	0.639	0.040	130.200	124.000	2	0.090
3	0.070	0.930	0.581	0.050	119.100	115.500	3	0.070
4	0.050	0.950	0.541	0.040	110.300	106.900	4	0.050
5	0.010	0.990	0.514	0.080	101.300	101.000	5	0.010
6	0.060	0.940	0.509	0.170	97.000	94.700	6	0.060
7	0.060	0.940	0.478	0.070	87.700	84.600	7	0.060
8	0.070	0.930	0.449	0.070	83.500	80.300	8	0.070
9	0.090	0.910	0.418	0.110	79.700	77.700	9	0.090
10	0.030	0.970	0.380	0.100	71.600	69.900	10	0.030
11	0.040	0.960	0.369	0.150	68.300	66.300	11	0.040
12	0.040	0.960	0.354	0.130	65.000	63.600	12	0.040
13	0.020	0.980	0.340	0.110	61.000	60.300	13	0.020
14	0.040	0.960	0.333	0.160	59.100	56.800	14	0.040
15	0.040	0.960	0.320	0.180	55.800	54.000	15	0.040
16	0.110	0.890	0.307	0.180	52.200	49.400	16	0.110
17	0.060	0.940	0.273	0.150	44.400	43.200	17	0.060
18	0.070	0.930	0.257	0.140	41.000	39.800	18	0.070
19	0.110	0.890	0.239	0.160	38.000	36.100	19	0.110
20	0.060	0.940	0.213	0.200	34.000	32.200	20	0.060
21	0.050	0.950	0.200	0.240	28.200	27.300	21	0.050
22	0.000	1.000	0.190	0.120	26.500	26.500	22	0.000
23	0.150	0.850	0.190	0.170	26.400	24.200	23	0.150
24	0.180	0.820	0.161	0.040	22.000	20.400	24	0.180
25	0.120	0.880	0.132	0.050	16.100	14.600	25	0.120
26	0.000	1.000	0.116	0.290	14.000	14.000	26	0.000
27	0.140	0.860	0.116	0.060	14.000	13.400	27	0.140
28	0.000	1.000	0.100	0.070	12.000	12.000	28	0.000
29	0.000	1.000	0.100	0.270	12.000	12.000	29	0.000
30	0.090	0.910	0.100	0.070	11.500	10.800	30	0.090
31	0.000	1.000	0.091	0.320	10.000	10.000	31	0.000
32	0.200	0.800	0.091	0.090	10.000	8.700	32	0.200
33	0.000	1.000	0.073	0.340	7.100	7.100	33	0.000
34	0.140	0.860	0.073	0.270	7.000	6.100	34	0.140
35	0.200	0.800	0.063	0.000	5.100	4.100	35	0.200
36	0.000	1.000	0.050	0.400	4.000	4.000	36	0.000
37	0.000	1.000	0.050	0.000	4.000	4.000	37	0.000
38	0.000	1.000	0.050	0.000	4.000	4.000	38	0.000
39	0.000	1.000	0.050	0.000	4.000	4.000	39	0.000
40	0.000	1.000	0.050	0.000	3.100	3.100	40	0.000
41	0.000	1.000	0.050	0.000	3.000	3.000	41	0.000
42	0.330	0.670	0.050	0.000	3.000	2.400	42	0.330
43	0.000	1.000	0.034	0.000	1.100	1.100	43	0.000
44	0.000	1.000	0.034	0.000	1.000	1.000	44	0.000
45	0.000	1.000	0.034	0.000	1.000	1.000	45	0.000
46	0.000	1.000	0.034	0.000	1.000	1.000	46	0.000
47	0.000	1.000	0.034	0.000	0.100	0.100	47	0.000
48	1.000	0.000	0.034	0.000	0.000	0.000	48	1.000
r = 0.0052 lambda = 1.0052 T = 15.77 N = 34.00								

Females

Age (x)	Qx	Px	lx	Mx	Vx	Ex	Risk (Qx)	Risk (Mx)
0	0.330	0.670	1.000	0.000	165.100	119.800	0	0.330
1	0.100	0.900	0.670	0.000	119.100	110.800	1	0.100
2	0.070	0.930	0.603	0.040	116.000	111.900	2	0.070
3	0.110	0.890	0.561	0.110	107.700	101.500	3	0.110
4	0.050	0.950	0.499	0.060	97.200	93.700	4	0.050
5	0.030	0.970	0.474	0.100	93.900	92.700	5	0.030
6	0.060	0.940	0.460	0.110	90.400	87.800	6	0.060
7	0.110	0.890	0.432	0.110	82.700	80.200	7	0.110
8	0.030	0.970	0.385	0.120	74.500	73.300	8	0.030
9	0.080	0.920	0.373	0.160	73.100	71.000	9	0.080
10	0.010	0.990	0.343	0.170	68.200	67.700	10	0.010
11	0.030	0.970	0.340	0.110	67.900	66.700	11	0.030
12	0.050	0.950	0.330	0.160	65.100	64.000	12	0.050
13	0.070	0.930	0.313	0.130	59.600	56.500	13	0.070
14	0.050	0.950	0.291	0.100	53.900	52.300	14	0.050
15	0.090	0.910	0.277	0.180	49.200	46.100	15	0.090
16	0.060	0.940	0.252	0.120	42.400	40.600	16	0.060
17	0.040	0.960	0.237	0.110	39.500	39.100	17	0.040
18	0.030	0.970	0.227	0.130	38.000	37.000	18	0.030
19	0.030	0.970	0.220	0.050	37.000	36.200	19	0.030
20	0.060	0.940	0.214	0.050	36.000	34.300	20	0.060
21	0.050	0.950	0.201	0.130	33.200	32.700	21	0.050
22	0.130	0.870	0.191	0.230	31.500	29.100	22	0.130
23	0.040	0.960	0.166	0.260	26.300	25.700	23	0.040
24	0.120	0.880	0.159	0.170	25.000	23.800	24	0.120
25	0.190	0.810	0.140	0.260	21.400	19.300	25	0.190
26	0.120	0.880	0.114	0.050	16.100	15.200	26	0.120
27	0.170	0.830	0.100	0.290	12.000	11.500	27	0.170
28	0.000	1.000	0.083	0.170	10.000	10.000	28	0.000
29	0.000	1.000	0.083	0.000	10.000	10.000	29	0.000
30	0.120	0.880	0.083	0.420	8.100	7.900	30	0.120
31	0.000	1.000	0.073	0.000	7.000	7.000	31	0.000
32	0.000	1.000	0.073	0.140	6.100	6.100	32	0.000
33	0.000	1.000	0.073	0.140	6.000	6.000	33	0.000
34	0.000	1.000	0.073	0.000	6.000	6.000	34	0.000
35	0.240	0.760	0.073	0.240	4.200	3.400	35	0.240
36	0.000	1.000	0.056	0.400	2.100	2.100	36	0.000
37	0.500	0.500	0.056	0.000	2.000	1.700	37	0.500
38	0.000	1.000	0.028	0.000	1.000	1.000	38	0.000
39	0.000	1.000	0.028	0.000	1.000	1.000	39	0.000
40	1.000	0.000	0.028	0.000	1.000	0.300	40	1.000
41	1.000	0.000	0.000	0.000	0.000	0.000	41	1.000
42	1.000	0.000	0.000	0.000	0.000	0.000	42	1.000
43	1.000	0.000	0.000	0.000	0.000	0.000	43	1.000
44	1.000	0.000	0.000	0.000	0.000	0.000	44	1.000
45	1.000	0.000	0.000	0.000	0.000	0.000	45	1.000
46	1.000	0.000	0.000	0.000	0.000	0.000	46	1.000
47	1.000	0.000	0.000	0.000	0.000	0.000	47	1.000
48	1.000	0.000	0.000	0.000	0.000	0.000	48	1.000

r = 0.0017 lambda = 1.0017 T = 15.19 N = 25.00

Appendix E
Ordered Mean Kinship List

Note: This list is current to February 2013 and based on an analytical studbook with pedigree assumptions. Values are subject to change with any hatch, death, import, export, inclusion, or exclusion. Unknown sex individuals appear on both the male and female sides of the mean kinship list.

Population MK = 0.0662

Males					Females				
ID	**MK**	**%known**	**Age**	**Location**	**ID**	**MK**	**%known**	**Age**	**Location**
08	0.000	100.0	0	SEDGWICK	216	0.000	100.0	32	BALTIMORE
373	0.000	100.0	0	SD-WAP	383	0.010	100.0	30	BARABOO
414	0.000	100.0	0	WINNIPEG	349	0.039	50.0	15	ST FELICI
415	0.000	100.0	21	WINNIPEG	412	0.049	100.0	0	WINNIPEG
381	0.016	75.0	21	BALTIMORE	398	0.059	100.0	12	WINNIPEG
374	0.020	50.0	10	SD-WAP	93	0.060	100.0	26	BATONROUG
225	0.037	100.0	15	ORLANDO	116	0.060	100.0	30	REDWOOD
380	0.039	25.0	4	ALDERGROV	224	0.064	100.0	16	ORLANDO
384	0.039	25.0	5	ST FELICI	223	0.064	100.0	25	METROZOO
411	0.049	100.0	0	WINNIPEG	169	0.068	100.0	15	TAUTPHAUS
24	0.058	100.0	16	ALEXANDRI	463	0.082	50.0	27	BUSCH TAM
394	0.059	100.0	11	WINNIPEG	267	0.083	100.0	15	TOLEDO
395	0.059	100.0	10	WINNIPEG	416	0.087	100.0	2	SAN ANTON
396	0.059	100.0	9	WINNIPEG	417	0.087	100.0	2	SEDGWICK
397	0.059	100.0	3	WINNIPEG	80	0.091	75.0	3	LOWRY
166	0.064	100.0	17	SEDGWICK	79	0.097	50.0	27	BUSCH TAM
29	0.068	100.0	16	GARDENCTY	21	0.500	0.0	0	NORFOLK
266	0.072	100.0	14	TOLEDO	61	0.500	0.0	3	SAFARI W
264	0.078	100.0	7	BUSCH TAM	65	0.500	0.0	3	SAFARI W
164	0.087	100.0	5	SEDGWICK	57	0.500	0.0	6	SAFARI W
422	0.091	75.0	2	NORFOLK	391	0.500	0.0	6	ST FELICI
464	0.091	75.0	4	BUSCH TAM	58	0.500	0.0	7	SAFARI W
55	0.500	0.0	6	SAFARI W	375	0.500	0.0	7	SD-WAP
56	0.500	0.0	6	SAFARI W	376	0.500	0.0	7	SD-WAP
60	0.500	0.0	3	SAFARI W	97	0.500	0.0	21	KANSASCTY
63	0.500	0.0	3	LOWRY					
73	0.500	0.0	0	BATONROUG					
168	0.500	0.0	21	TAUTPHAUS					
379	0.500	0.0	21	SD-WAP					
382	0.500	0.0	25	BARABOO					
386	0.500	0.0	5	ST FELICI					
859	0.500	0.0	0	CENTRALPK					
860	0.500	0.0	0	CENTRALPK					
861	0.500	0.0	0	CENTRALPK					

Appendix F
Descriptive Survival Statistics Report

Demoiselle Crane Studbook(Anthropoides virgo)
North America Studbook
Studbook data current as of 2/21/2013

Compiled by
Sarah Schoenberg
sarahhrpz@gmail.com

PopLink Studbook filename: CraneDemo + PMC2013B
PopLink User Who Exported Report: kmarti
Date of Export: 7/24/2013
Data Filtered by: Association = DemiCrane.FED AND StartDate = 1/1/1970 AND EndDate = 7/24/2013
PopLink Version: 2.4

REPORT OVERVIEW:

Based on this analysis, if a Demoiselle Crane survives to its first birthday, its median life expectancy is 9.9 years. 67.1% of Demoiselle Crane survive to their first birthday. The maximum longevity observed for Demoiselle Crane is 47.2 years. Please see the body of the report for more details.

BACKGROUND ON ANALYSES:

These analyses were conducted using animals that lived during the period 1 January 1970 to 24 July 2013 at institutions within DemiCrane. The analyses mainly focus on survival statistics from 1 year (e.g. excluding any individuals that did not survive past their first birthday). These statistics most accurately reflect typical survival for animals which can be seen on exhibit in zoos and aquariums.

This report summarizes survival records of individuals housed at zoological facilities for a specific geographic range and time period; these records trace an individual's history from birth or entry into the population to death, exit out of the population, or the end of the time period. As such, this history only reflects standard practices - including management, husbandry, and acquisition/disposition practices - for the specified time period and geographic range. Thus, the report contents should be viewed with some caution as they may not reflect current zoo and aquarium management techniques or practices. Moreover, for long-lived species, these parameters may also be expected to change as a population's age structure changes. For example, if the population has not been maintained in zoos and aquariums long enough to have many adults living into old age, median life expectancy will likely be an underestimate until more data accrue in older age classes. Thus, users of these reports should recognize that the results produced will likely vary over time or depending on the subset of data selected.

Although for many species, including humans, survival statistics often differ for males and females, for these analyses male and female statistics were not statistically different[1]; these results therefore include pooled data from males, females, and unknown sex individuals.

SUMMARY OF ANALYSES:

SURVIVAL STATISTICS

The dataset used for analysis includes partial or full lifespans of 312 individuals, 198 (63.5%) of which had died by 24 July 2013.

If a Demoiselle Crane survives to its first birthday, its **median life expectancy**[2] is **9.9 years of age**. Given the quality of the data - how many animals are in the database and how many have died - there is a 95% chance that the true median falls between 8.2 and 13.3 years of age (i.e., these are the 95% confidence limits). Only 25% of Demoiselle Crane can be expected to survive to be 22.6 years or older.

First-year (infant) survival[3] for Demoiselle Crane is 0.67. The year after birth/hatching is a period of relatively low survival for many species and life histories.

The **maximum longevity**[4] observed for Demoiselle Crane is **47.2 years**; this longevity record is based on an individual which was CENSORED as of the analysis end date (studbook number 172, sex = Male, origin = Unknown, birth date estimate = Year).[5]

The correct interpretation of these statistics is that, if it survives the first year of life, the 'typical' Demoiselle Crane will live 9.9 years; that half of all Demoiselle Crane can be expected to die before they reach 9.9 and half will live longer than 9.9; that only 25% of all Demoiselle Crane can be expected to live 22.6 years; and that it is rare but possible for Demoiselle Crane to live 47.2 years.

The median life expectancy, confidence interval, first-year survival, and maximum longevity may change as more data are accumulated, the population's age structure changes, or management practices change.

To put these statistics in perspective, median life expectancy from age one for people in the United States is 77.5 years and the maximum longevity (documented worldwide) is 122 years[6].

DATA QUALITY

The PopLink Survival Tool uses five data quality measures to determine whether data are robust enough to make reliable estimates of key survival parameters. **This population passed all of the following data quality tests:**

1. Can the median life expectancy be calculated?
2. Is the sample size (number of individuals at risk) greater than 20 individuals at the median?
3. Is the 95% Confidence Interval (CI) bounded?
4. Is the sample size in the first age class of analysis (e.g. the first day of analysis) greater than 30 individuals?
5. Is the length of the 95% CI < 33% of the maximum longevity?

For more specific details on this population's results for these data quality tests, click on the Data Quality Table tab.

PopLink data validation has never been run; if errors are present in this studbook, they may affect the data in this analysis.

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[1] Statistical significance was determined by comparing 84% confidence intervals around median life expectancy for males and females, with 35 unknown sex individuals proportionally incorporated into the analysis. For this population, overlapping confidence intervals indicated that data could be pooled. See the PopLink manual for more details.

[2] The statistics analyzed for this report (median life expectancy, 95% confidence limits, and age to which 25% of individuals survive) exclude any individuals who did not survive to their first birthday; these individuals are excluded because this Report is focused on providing median survival estimates for the typical individual that survives the vulnerable infant stage. In other words, this report answers the question, 'how long is this species expected to live once it has reached its first birthday?' For this studbook, 95 individuals died before their first birthday and were excluded from these analyses.

For all animals that survive to their first birthday, 50% will die before the median life expectancy in this report and 50% die after. Another way to describe this is that the median life expectancy is the age that divides the 'young' and 'old' animals. Note that the median life expectancy obtained from population management software (PM2000, PMx, ZooRisk) or from life tables in Breeding and Transfer Plans (e.g. where Lx = 0.5) will be lower because it includes these individuals that did not survive to their first birthday in order to project the correct number of births needed. See the PopLink manual for more details.

[3]For reference, first-year survival is provided. For this studbook and the selected demographic window, 95 individuals did not survive to their first birthday and were excluded from the estimates provided above (median life expectancy, 95% confidence limits, and age to which 25% of individuals survive).

[4] Maximum longevity is the age of the oldest known individual for this species, living or dead. It is not necessarily the biological maximum age, but only reflects the individuals included in the dataset.

[5] Censored individuals are individuals whose deaths have not been observed as of the end of the analysis window, including individuals who 1) are still alive as of the end date, 2) exited the geographic window before the end date (through transfer or release), or 3) were lost-to-follow up before the end date.

[6] Median life expectancy for people is estimated from: Xu, Jiaquan, Kochanek KD, Murphy SL, and Tejada-Vera B. 2007. Deaths: Final Data for 2007. National vital statistics reports; vol 58 no 19. Hyattsville, MD: National Center for Health Statistics. Jeanne Calment of France was the oldest documented and fully validated human and died at 122 years and 164 days; from: http://www.grg.org/Adams/Tables.htm. Accessed August 9, 2007

Appendix G
Husbandry Profile for the Demoiselle Crane
Anthropoides virgo

Species Manager: Sarah Schoenberg, Jacksonville Zoo and Gardens

sarahhrpz@gmail.com

Description: The Demoiselle Crane stands about three feet tall and can weigh between four to seven pounds, making this the smallest crane species. The head and neck are black and the head does not have the typical patches of bare, red skin seen on other crane species. Extending from the base of the short bill to the nape is a light, gray feathered area with long, pure white feather plumes stretching from behind the eye to behind the head. The lower neck feathers are long and pointed and hand below the breast. The inner secondaries are long and ashy gray. The eyes are reddish-orange in color and the legs and toes are black. The sexes are monomorphic though the males tend to be slightly larger. Juveniles are a pale, ashy gray in color with almost white heads.

Distribution: Demoiselle Cranes occur in over forty-seven countries. The population is made up of six main populations: three eastern populations occur in eastern Asia, Kazakhstan/central Asia, and Kalmykia and three remnant populations occurring near the Black Sea, the Atlas plateau of northern Africa, and Turkey.

Status: The population is stable over all, ranging from 200,000 to 240,000 and climbing. The IUCN Red List has the Demoiselle Crane listed as least concern.

AZA Classification: Yellow SSP. The current North American population is 64 individuals (37.27.0) at 22 AZA institutions and 3 non-AZA participating institutions. There are several more private institutions with thriving breeding programs that have yet to be contacted at time of publication of this document.

Foods and Feeding: Primary diet includes plant materials, insects, peanuts, beans, cereal grains, and small animals, making this an omnivorous crane. In captivity, cranes are generally fed a commercially manufactured pellet diet, supplemented with feeder bugs such as crickets and mealworms and ground meat (beef or horse). Other items added could be vegetables and greens.

Housing and General Environmental Considerations: The height minimum needed to house most crane species is eight feet. Vinyl coated mesh is preferred so as to cause less damage to the feathers of the bird. Mesh size should not exceed 2” by 2”. The pen is recommended to be deeper then wide to allow the birds a comfortable space away from viewers. This crane can handle temperatures down to freezing; recommend shelter with an additional heat source for lower temperatures. Facilities with harsh weather in winter months may be advised to bring indoors for winter months.

Reproduction: The nest area is normally found in vegetation of sufficient height to conceal the nesting bird but short enough to allow them to look out. Small pebbles and some thin bedding may be gathered for nesting material, but the eggs are generally laid directly on the ground. Two eggs are laid and incubated by the female for 27-29 days. Males will defend the nest. Fledging occurs between 55-65 days which is the shortest of any crane species.

Health Management: As a group, once cranes survive to age one, they are hardy, generally trouble free, and long lived birds. That said, cranes are prone to trauma, self-inflected, from enclosure mate, during introductions for pairing, as well as general catch up for routine husbandry procedures. The Gruidae TAG veterinary advisor recommends annual pre-breeding cycle EEE vaccine be administered and to test birds for WNV titers levels, vaccinate or revaccinate if indicated.

Conservation Actions: Habitat loss and degradation are the biggest threats to Demoiselle Cranes. The International Crane Federation (ICF) has worked with the Crane Hunters Association of Pakistan to provide avicultural and resource management training in the U.S. ICF has also worked with the World Wildlife Fund Pakistan on crane hunting and water issues. ICF is also working on assessing the status and population of wintering Demoiselle Cranes in Sudan.

Appendix H
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 an 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 individual's 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 I
Directory of Institutional Representatives

Contact Name (IR)	Institution	Email	Phone
Menita Prasad	ALDERGROV - Greater Vancouver Zoo, Aldergrove, BC	menitap@gvzoo.com	604-856-6825 ext 32
Lisa Laskoski	ALEXANDRI - Alexandria Zoological Park, Alexandria, LA	Lisa.Laskoski@cityofalex.com	318-441-6835
Carolyn Atherton	AUDUB SSC - Freeport-McMoran Audubon Sp Srvl Ctr., New Orleans, LA	catherton@audubooninstitute.org	
Jennifer Kottyan	BALTIMORE - The Maryland Zoo in Baltimore, Baltimore, MD	jen.kottyan@marylandzoo.org	443-552-5331
Bryant Tarr	BARABOO - International Crane Foundation, Baraboo, WI	btarr@savingcranes.org	608-356-9462 ext 154
Sam Winslow	BATONROUG - BREC's Baton Rouge Zoo, Baker, LA	SWinslow@brzoo.org	225-775-3877
Stacy Spurlock	BUSCH TAM - Busch Gardens Tampa Bay, Tampa, FL	stacy.spurlock@buschgardens.com	813-987-5078
Susan Cardillo	CENTRALPK – Central Park Zoo, New York, NY	scardillo@wcs.org	212-439-6503
Jan Steele	DREHER PA - Palm Beach Zoo at Dreher Park, West Palm Beach, FL	jsteele@palmbeachzoo.org	561-833-7130 ext 224
Katy Cussen	FORTWORTH – Fort Worth Zoological Park, TX	kcussen@fortworthzoo.org	817-759-7170
Kristi Newland	GARDENCTY - Lee Richardson Zoo, Garden City, KS	Kristi.Newland@gardencityks.us	620-276-1230
Timothy Steinmetz	KANSASCTY - Kansas City Zoo, Kansas City, MO	timsteinmetz@fotzkc.org	816-513-4670
Gary Michael	LOUISVILL - Louisville Zoological Garden, Louisville, KY	Gary.Michael@louisvilleky.gov	
Julie Tomita	LOWRY - Tampa's Lowry Park Zoo, Tampa, FL	julie.tomita@lowryparkzoo.com	813-935-8552
Jim Dunster	METROZOO - Zoo Miami, Miami, FL	jdun@miamidade.gov	305-251-0400
Roger Sweeney	NORFOLK - Virginia Zoological Park, Norfolk, VA	roger.sweeney@norfolk.gov	757-441-2374 ext 255
Sherry Branch	ORLANDO - Sea World Orlando, Orlando, FL	Sherry.Branch@SeaWorld.com	407-363-2361
Kristin Wasson	REDWOOD - Six Flags Marine World, Vallejo, CA	kWasson@sftp.com	707-556-5212
Kimberly Robertson	SAFARI W - Safari West, Santa Rosa, CA	krobertson@safariwest.com	707-541-7340
Josef San Miguel	SAN ANTON - San Antonio Zoological Gardens & Aqua, San Antonio, TX	curbirds@sazoo.org	210-734-7184 ext 1350
Michael Mace	SD-WAP - San Diego Zoo Safari Park, Escondido, CA	Mmace@sandiegozoo.org	760-738-5077
Scott Newland	SEDGWICK - Sedgwick County Zoo, Wichita, KS	snewland@scz.org	316-266-8324
Brigitte Mercier	ST FELICI - Zoo Sauvage de St-Felicien Zoo, St-Felicien, Quebec	brigitte.mercier@zoosauvage.org	

Contact Name (IR)	Institution	Email	Phone
Beth Rich	TAUTPHAUS - Tautphaus Park Zoo, Idaho Falls, ID	BCRich@idahofallszoo.org	208-612-8401
Robert Webster Jr.	TOLEDO - Toledo Zoological Gardens, Toledo, OH	robert.webster@toledozoo.org	419-389-6403 ext 2008
Jenith Dack	WINNIPEG - Assiniboine Park Zoo, Winnipeg, Manitoba	jdack@assiniboinepark.ca	