Population Analysis & Breeding and Transfer Plan

Red-crowned Crane (*Grus japonensis*)
AZA Species Survival Plan®
Yellow Program

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PMC Population Management Center

Lincoln Park Zoo

ASSOCIATION OF ZOOS & AQUARIUMS

Executive Summary

Red-crowned Crane (*Grus japonensis*) SSP®

The Gruiformes Taxon Advisory Group has set a target population size for this species of 75 specimens (2009 RCP). The current population is 76 specimens.

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 birth weights, smaller clutch sizes, and greater neonatal mortality. Given the current gene diversity, this population will likely remain above the 90% level for 44 years; gene diversity at 100 years is expected to be about 82%. Strategies to extend time to 90% gene diversity include equalization of founder representation, increase in target size, and addition of new founders.

Demography

Current size of population (N) - Total (Males, Females, Unknown)	76(31.45.0)
# animals excluded from management	0
Population size following exclusions	76
Target population size	75
Mean generation time (yrs)	13.24
Historic/Projected population growth rate (lambda)	1.026

Genetics*

*Genetic statistics calculated from the analytical studbook	***Current***	***Potential***
Founders	36	1
Founder genome equivalents (FGE)	14.72	22.24
Gene diversity retained (GD%)	96.60	97.75
Population mean kinship (MK)	0.0340	
Mean inbreeding (F)	0.0025	
Percentage of pedigree known before assumptions and exclusions	100	
Percentage of pedigree known after assumptions and exclusions	100	
Effective population size/census size ratio (Ne / N)	0.33	
Years To 90% Gene Diversity	44	
Years to 10% Loss of Gene Diversity	74	
Gene Diversity at 100 Years From Present (%) Assuming λ = 1.026, Target size = 75	82	

As with most SSP populations, pairings are prioritized to maintain or increase gene diversity through considerations of mean kinship, avoidance of inbreeding, differences in sire and dam mean kinships, and the degree of uncertainty within a pedigree. The number of pairs recommended is intended to maintain a population size of 75 specimens.

Summary Actions: The SSP will recommend up to 11 breeding pairs and no transfers for this period. Recommendations contained in this plan supercede those made by earlier plans.
Due to space constraints, please contact the SSP Coordinator when eggs are laid. Space needs have to be considered before chicks hatch.

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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.

Description of Population Status

Introduction: Comprehensive genetic and demographic analyses of the North American red-crowned crane population were performed in October 2012, resulting in the current Breeding and Transfer Plan for this species. Recommendations contained in this plan supersede those made by earlier plans. Analyses were performed on the North American Regional Red-crowned Crane Studbook (current to 15 AUG 2012) using SPARKS 1.64 and PM2000 1.213.

Managed Population: The current population size is 76 (31.45) (TAG recommended size = 75), distributed among 30 AZA institutions. No individuals have been excluded from analysis for age, medical, or other considerations.

Demography: The North American Regional population remained small from its appearance in 1937 until 1980's. Since 1980 the annual growth rates due to captive births have varied (λ = 0.95 – 1.33) though the general trend has been one of maintenance (mean λ = 1.00) over the past decade.

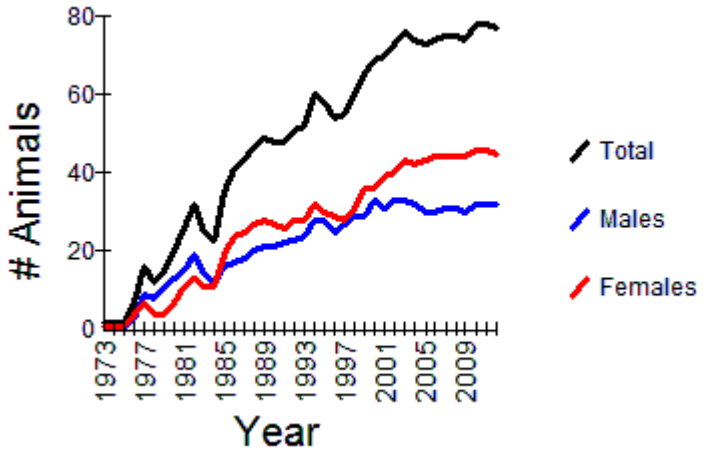


Figure 1. Census of red-crowned cranes in North America.

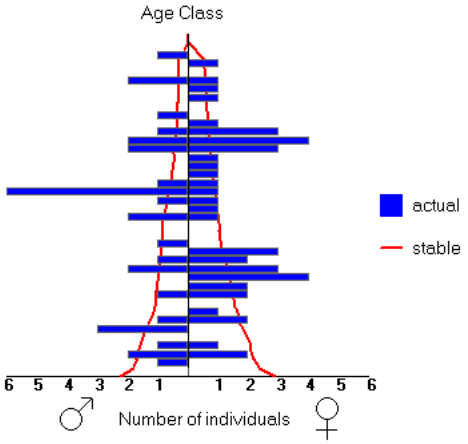


Figure 2. Age distribution of red-crowned cranes in North America.

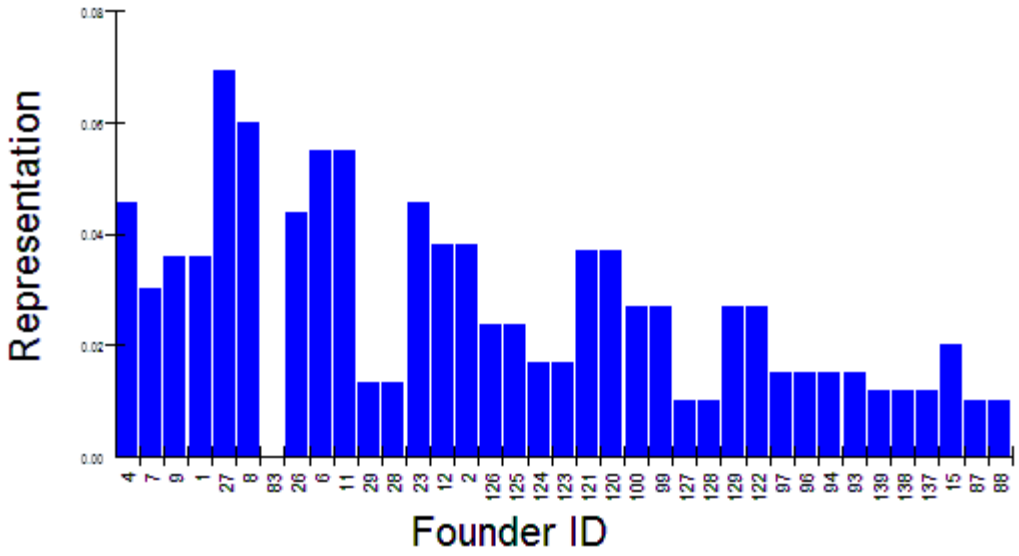
The age structure of the population is deviates from a stable one as the small numbers of animals in the juvenile age classes reflect the recent decline in population growth (since late 1990s). Some reproductive age classes are empty and few individuals are entering the reproductive age classes (Figure 2). If this trend of continues, the numbers of individuals entering reproductive age classes will limit population growth rates. The sex ratio of the population is strongly female biased.

Males reach sexual maturity by the age of four years but many do not reproduce until after the age of seven. Females have reproduced at the age of three years. Males indicate breeding in males and females as old as 26 and 33 years of age respectively. Records indicate specimens living into their late-thirties. Infant mortality has been observed to be approximately 33% historically but in recent years has varied significantly (59% in 2005-2009 but 0% 2010-2011 years).

Genetics: The managed population is descended from 36 founders and 1 potential founder remains. Genetic diversity in the population (96.60%) is high relative the average SSP (93%). The population's gene diversity could fall below 90% in approximately 44 years. Projections of gene diversity indicate 82% at 100 years from present. 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.

GENETIC SUMMARY Genetic statistics calculated from an analytical studbook	*2009*	*2012*	*Potential*
Founders	36	36	1
Founder genome equivalents (FGE)	14.62	14.72	22.24
Gene diversity retained (GD%)	96.58	96.60	
Population mean kinship (MK)	0.0342	0.0340	
Mean inbreeding (F)	0.0026	0.0025	
Pedigree known before assumptions and exclusions (%)	100	100	
Pedigree known after assumptions and exclusions (%)	100	100	
Effective population size / census size ratio (Ne / N)	0.3373	0.33	
Years To 90% Gene Diversity	45	44	
Gene Diversity at 100 Years From Present (%) Assuming λ = 1.02, Target size = 70	71	82	

The potential gene diversity is high (96%) and the time to 90% gene diversity could be extended. Strategies to do so would include equalizing founder representation and increasing the population's target size as well as the addition of potential founders. The population's effective size is already greater than that of many managed populations.



Management Strategy: Demographic analyses indicate that an annual population growth rate of greater than 1.0, maintaining the current population size, will be attained if 2-3 offspring are produced in the coming year. With breeding recommendation success approaching 50% in some years, ten pairs will be recommended to breed to maintain the TAG recommended target population size of 75. An increase in target size may, however be beneficial to this population. The 2009 Breeding and transfer plan recommended 19 pairings, resulting in five 2010 and 2011 hatches. All 5 chicks survived their first year.

1. Recommend 11 pairings.

2. Recommend 0 transfers.

3. Due to space constraints, please contact the SSP Coordinator when eggs are laid. Space needs have to be considered before chicks hatch.

Summary of Breeding and Transfer Recommendations

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
168	ATTLEBORO	201001	M	12	HOLD	ATTLEBORO	DO NOT BREED		
157	ATTLEBORO	201002	F	13	HOLD	ATTLEBORO	DO NOT BREED		
150	BARABOO	150060	F	13	HOLD	BARABOO	DO NOT BREED		
50	BARABOO	150046	F	27	HOLD	BARABOO	DO NOT BREED		
49	BARABOO	150055	M	27	HOLD	BARABOO	DO NOT BREED		
48	BARABOO	150045	F	27	HOLD	BARABOO	DO NOT BREED		
41	BARABOO	150040	F	28	HOLD	BARABOO	DO NOT BREED		
33	BARABOO	150028	F	32	HOLD	BARABOO	DO NOT BREED		
25	BARABOO	150019	M	34	HOLD	BARABOO	DO NOT BREED		
18	BARABOO	150001	M	37	HOLD	BARABOO	DO NOT BREED		
256	BIRMINGHM	208008	M	5	HOLD	BIRMINGHM	DO NOT BREED		
56	BIRMINGHM	203088	F	26	HOLD	BIRMINGHM	DO NOT BREED		
252	CINCINNAT	206142	F	6	HOLD	CINCINNAT	DO NOT BREED		
132	CINCINNAT	295247	M	18	HOLD	CINCINNAT	DO NOT BREED		
70	CINCINNAT	296263	F	24	HOLD	CINCINNAT	DO NOT BREED		
79	CLEVELAND	960308	M	21	HOLD	CLEVELAND	DO NOT BREED		
180	COLUMBUS	106018	F	11	HOLD	COLUMBUS	DO NOT BREED		
65	COLUMBUS	109043	F	25	HOLD	COLUMBUS	DO NOT BREED		
312	DALLAS	10K715	M	2	HOLD	DALLAS	DO NOT BREED		
241	DALLAS	04E935	F	9	HOLD	DALLAS	DO NOT BREED		
113	DENVER	940417	M	21	HOLD	DENVER	BREED WITH	44	
44	DENVER	980372	F	28	HOLD	DENVER	BREED WITH	113	
59	DETROIT	3315	F	26	HOLD	DETROIT	DO NOT BREED		
45	DETROIT	4911	M	27	HOLD	DETROIT	DO NOT BREED		
268	DREHER PA	209237	M	3	HOLD	DREHER PA	DO NOT BREED		
188	DREHER PA	203015	F	10	HOLD	DREHER PA	DO NOT BREED		
115	FORTWORTH	940708	F	22	HOLD	FORTWORTH	BREED WITH	114	
114	FORTWORTH	940707	M	22	HOLD	FORTWORTH	BREED WITH	115	
143	FOSSILRIM	19000	M	15	HOLD	FOSSILRIM	DO NOT BREED		
37	FOSSILRIM	19002	F	29	HOLD	FOSSILRIM	DO NOT BREED		
186	FRANKLINP	F01462	F	11	HOLD	FRANKLINP	DO NOT BREED		
36	FRANKLINP	93A849	M	30	HOLD	FRANKLINP	DO NOT BREED		
19	FRANKLINP	93A848	F	36	HOLD	FRANKLINP	DO NOT BREED		
243	GRANBY	B03015	F	9	HOLD	GRANBY	DO NOT BREED		
311	HOUSTON	25311	M	2	HOLD	HOUSTON	DO NOT BREED		
310	HOUSTON	25311	F	2	HOLD	HOUSTON	DO NOT BREED		
109	HOUSTON	15540	F	18	HOLD	HOUSTON	DO NOT BREED		
90	HOUSTON	15539	M	20	HOLD	HOUSTON	DO NOT BREED		
110	KANSASCTY	203472	F	23	HOLD	KANSASCTY	BREED WITH	39	
39	KANSASCTY	A09021	M	28	HOLD	KANSASCTY	BREED WITH	110	
274	KANSASCTY	A10006	F	3	HOLD	KANSASCTY	DO NOT BREED		
148	KANSASCTY	A12047	F	14	HOLD	KANSASCTY	DO NOT BREED		
254	LOUISVILL	202293	F	6	HOLD	LOUISVILL	BREED WITH	240	
240	LOUISVILL	202072	M	9	HOLD	LOUISVILL	BREED WITH	254	
112	MANHATTAN	990039	M	21	HOLD	MANHATTAN	BREED WITH	40	
40	MANHATTAN	201005	F	28	HOLD	MANHATTAN	BREED WITH	112	
162	NASHV ZOO	1997	F	12	HOLD	NASHV ZOO	DO NOT BREED		
161	NASHV ZOO	1996	F	12	HOLD	NASHV ZOO	DO NOT BREED		
249	NZP-CRC	215944	F	7	HOLD	NZP-CRC	BREED WITH	27	
182	NZP-CRC	214858	F	11	HOLD	NZP-CRC	DO NOT BREED		
60	NZP-CRC	209574	M	26	HOLD	NZP-CRC	DO NOT BREED		

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ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
46	NZP-CRC	209343	F	27	HOLD	NZP-CRC	DO NOT BREED		
27	NZP-CRC	207147	M	34	HOLD	NZP-CRC	BREED WITH	249	
119	OKLAHOMA	653402	F	21	HOLD	OKLAHOMA	BREED WITH	118	
118	OKLAHOMA	653301	M	21	HOLD	OKLAHOMA	BREED WITH	119	
250	PROVIDNCE	200176	M	6	HOLD	PROVIDNCE	DO NOT BREED		
179	PROVIDNCE	200159	F	12	HOLD	PROVIDNCE	DO NOT BREED		
313	SAN ANTON	_____	F	2	HOLD	SAN ANTON	DO NOT BREED		
164	SAN ANTON	A01042	M	12	HOLD	SAN ANTON	DO NOT BREED		
104	SAN ANTON	UOOO88	F	19	HOLD	SAN ANTON	DO NOT BREED		
26	SANDIEGOZ	204495	F	33	HOLD	SANDIEGOZ	DO NOT BREED		
131	SD-WAP	895343	M	18	HOLD	SD-WAP	BREED WITH	83	
83	SD-WAP	891383	F	34	HOLD	SD-WAP	BREED WITH	131	
102	SEATTLE	920701	M	21	HOLD	SEATTLE	BREED WITH	101	
101	SEATTLE	920702	F	20	HOLD	SEATTLE	BREED WITH	102	
255	TAUTPHAUS	K8A001	M	5	HOLD	TAUTPHAUS	BREED WITH	147	
147	TAUTPHAUS	K4A035	F	14	HOLD	TAUTPHAUS	BREED WITH	255	
145	WATERTNSD	2322	F	14	HOLD	WATERTNSD	BREED WITH	63	
63	WATERTNSD	2327	M	26	HOLD	WATERTNSD	BREED WITH	145	
184	WHEELING	3437	F	11	HOLD	WHEELING	DO NOT BREED		
314	WILDS	A11142	M	1	HOLD	WILDS	DO NOT BREED		
190	WILDS	203001	F	10	HOLD	WILDS	DO NOT BREED		
151	WILDS	990404	M	13	HOLD	WILDS	DO NOT BREED		
80	WILDS	961006	M	21	HOLD	WILDS	DO NOT BREED		
58	WILDS	940902	F	26	HOLD	WILDS	DO NOT BREED		
54	WILDS	960702	F	27	HOLD	WILDS	DO NOT BREED		

ATTLEBORO

Capron Park Zoo
Attleboro, MA

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
157	ATTLEBORO	201002	F	13	HOLD	ATTLEBORO	DO NOT BREED		
168	ATTLEBORO	201001	M	12	HOLD	ATTLEBORO	DO NOT BREED		

BARABOO

International Crane Foundation
Baraboo, WI

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
18	BARABOO	150001	M	37	HOLD	BARABOO	DO NOT BREED		
25	BARABOO	150019	M	34	HOLD	BARABOO	DO NOT BREED		
33	BARABOO	150028	F	32	HOLD	BARABOO	DO NOT BREED		
41	BARABOO	150040	F	28	HOLD	BARABOO	DO NOT BREED		
48	BARABOO	150045	F	27	HOLD	BARABOO	DO NOT BREED		
49	BARABOO	150055	M	27	HOLD	BARABOO	DO NOT BREED		
50	BARABOO	150046	F	27	HOLD	BARABOO	DO NOT BREED		
150	BARABOO	150060	F	13	HOLD	BARABOO	DO NOT BREED		

BIRMINGHM

Birmingham Zoo
Birmingham, AL

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
56	BIRMINGHM	203088	F	26	HOLD	BIRMINGHM	DO NOT BREED		
256	BIRMINGHM	208008	M	5	HOLD	BIRMINGHM	DO NOT BREED		

CINCINNAT

Cincinnati Zoo & Botanical Garden
Cincinnati, OH

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
70	CINCINNAT	296263	F	24	HOLD	CINCINNAT	DO NOT BREED		
132	CINCINNAT	295247	M	18	HOLD	CINCINNAT	DO NOT BREED		
252	CINCINNAT	206142	F	6	HOLD	CINCINNAT	DO NOT BREED		

CLEVELAND

Cleveland Metroparks Zoo
Cleveland, OH

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
79	CLEVELAND	960308	M	21	HOLD	CLEVELAND	DO NOT BREED		

COLUMBUS

Columbus Zoo and Aquarium
Powell, OH

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
65	COLUMBUS	109043	F	25	HOLD	COLUMBUS	DO NOT BREED		
180	COLUMBUS	106018	F	11	HOLD	COLUMBUS	DO NOT BREED		

DALLAS

Dallas Zoo
Dallas, TX

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
241	DALLAS	04E935	F	9	HOLD	DALLAS	DO NOT BREED		
312	DALLAS	10K715	M	2	HOLD	DALLAS	DO NOT BREED		

DENVER

Denver Zoological Gardens
Denver, CO

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
44	DENVER	980372	F	28	HOLD	DENVER	BREED WITH	113	If possible, sex eggs and hatch males
113	DENVER	940417	M	21	HOLD	DENVER	BREED WITH	44	

DETROIT

Detroit Zoological Institute
Royal Oak, MI

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
45	DETROIT	4911	M	27	HOLD	DETROIT	DO NOT BREED		
59	DETROIT	3315	F	26	HOLD	DETROIT	DO NOT BREED		

DREHER PA

Palm Beach Zoo at Dreher Park
West Palm Beach, FL

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
188	DREHER PA	203015	F	10	HOLD	DREHER PA	DO NOT BREED		
268	DREHER PA	209237	M	3	HOLD	DREHER PA	DO NOT BREED		

FORTWORTH

Fort Worth Zoological Park
Ft Worth, TX

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
114	FORTWORTH	940707	M	22	HOLD	FORTWORTH	BREED WITH	115	
115	FORTWORTH	940708	F	22	HOLD	FORTWORTH	BREED WITH	114	

FOSSILRIM

Fossil Rim Wildlife Center
Glen Rose, TX

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
37	FOSSILRIM	19002	F	29	HOLD	FOSSILRIM	DO NOT BREED		
143	FOSSILRIM	19000	M	15	HOLD	FOSSILRIM	DO NOT BREED		

FRANKLINP

Zoo New England / Franklin Park Zoo
Boston, MA

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
19	FRANKLINP	93A848	F	36	HOLD	FRANKLINP	DO NOT BREED		
36	FRANKLINP	93A849	M	30	HOLD	FRANKLINP	DO NOT BREED		
186	FRANKLINP	F01462	F	11	HOLD	FRANKLINP	DO NOT BREED		

GRANBY

Granby Zoo
Granby, Quebec

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
243	GRANBY	B03015	F	9	HOLD	GRANBY	DO NOT BREED		

HOUSTON

The Houston Zoo
Houston, TX

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
90	HOUSTON	15539	M	20	HOLD	HOUSTON	DO NOT BREED		
109	HOUSTON	15540	F	18	HOLD	HOUSTON	DO NOT BREED		
310	HOUSTON	25311	F	2	HOLD	HOUSTON	DO NOT BREED		
311	HOUSTON	25311	M	2	HOLD	HOUSTON	DO NOT BREED		

KANSASCTY

Kansas City Zoo
Kansas City, MO

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
39	KANSASCTY	A09021	M	28	HOLD	KANSASCTY	BREED WITH	110	
110	KANSASCTY	203472	F	23	HOLD	KANSASCTY	BREED WITH	39	
148	KANSASCTY	A12047	F	14	HOLD	KANSASCTY	DO NOT BREED		
274	KANSASCTY	A10006	F	3	HOLD	KANSASCTY	DO NOT BREED		

LOUISVILL

Louisville Zoological Garden
Louisville, KY

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
240	LOUISVILL	202072	M	9	HOLD	LOUISVILL	BREED WITH	254	
254	LOUISVILL	202293	F	6	HOLD	LOUISVILL	BREED WITH	240	

MANHATTAN

Sunset Zoo
Manhattan, KS

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
40	MANHATTAN	201005	F	28	HOLD	MANHATTAN	BREED WITH	112	
112	MANHATTAN	990039	M	21	HOLD	MANHATTAN	BREED WITH	40	

NASHV ZOO

Nashville Zoo at Grassmere
Nashville, TN

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
161	NASHV ZOO	1996	F	12	HOLD	NASHV ZOO	DO NOT BREED		
162	NASHV ZOO	1997	F	12	HOLD	NASHV ZOO	DO NOT BREED		

NZP-CRC

NZP-Conservation & Research Center
Front Royal, VA

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
27	NZP-CRC	207147	M	34	HOLD	NZP-CRC	BREED WITH	249	
46	NZP-CRC	209343	F	27	HOLD	NZP-CRC	DO NOT BREED		
60	NZP-CRC	209574	M	26	HOLD	NZP-CRC	DO NOT BREED		
182	NZP-CRC	214858	F	11	HOLD	NZP-CRC	DO NOT BREED		
249	NZP-CRC	215944	F	7	HOLD	NZP-CRC	BREED WITH	27	

OKLAHOMA

Oklahoma City Zoological Park
Oklahoma City, OK

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
118	OKLAHOMA	653301	M	21	HOLD	OKLAHOMA	BREED WITH	119	
119	OKLAHOMA	653402	F	21	HOLD	OKLAHOMA	BREED WITH	118	

PROVIDNCE

Roger Williams Park Zoo
Providence, RI

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
179	PROVIDNCE	200159	F	12	HOLD	PROVIDNCE	DO NOT BREED		
250	PROVIDNCE	200176	M	6	HOLD	PROVIDNCE	DO NOT BREED		

SAN ANTON

San Antonio Zoological Gardens & Aqua
San Antonio, TX

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
104	SAN ANTON	UOOO88	F	19	HOLD	SAN ANTON	DO NOT BREED		
164	SAN ANTON	A01042	M	12	HOLD	SAN ANTON	DO NOT BREED		
313	SAN ANTON	_____	F	2	HOLD	SAN ANTON	DO NOT BREED		

SANDIEGOZ

Zoological Society of San Diego
San Diego, CA

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
26	SANDIEGOZ	204495	F	33	HOLD	SANDIEGOZ	DO NOT BREED		

SD-WAP

San Diego Wild Animal Park
Escondido, CA

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
83	SD-WAP	891383	F	34	HOLD	SD-WAP	BREED WITH	131	
131	SD-WAP	895343	M	18	HOLD	SD-WAP	BREED WITH	83	

SEATTLE

Woodland Park Zoological Gardens
Seattle, WA

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
101	SEATTLE	920702	F	20	HOLD	SEATTLE	BREED WITH	102	If possible, sex eggs and hatch males
102	SEATTLE	920701	M	21	HOLD	SEATTLE	BREED WITH	101	

TAUTPHAUS

Tautphaus Park Zoo
Idaho Falls, ID

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
147	TAUTPHAUS	K4A035	F	14	HOLD	TAUTPHAUS	BREED WITH	255	
255	TAUTPHAUS	K8A001	M	5	HOLD	TAUTPHAUS	BREED WITH	147	

WATERTNSD

Bramble Park Zoo
Watertown, SD

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
63	WATERTNSD	2327	M	26	HOLD	WATERTNSD	BREED WITH	145	
145	WATERTNSD	2322	F	14	HOLD	WATERTNSD	BREED WITH	63	

WHEELING

Oglebay's Good Children's Zoo
Wheeling, WV

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
184	WHEELING	3437	F	11	HOLD	WHEELING	DO NOT BREED		

WILDS

The Wilds
Cumberland, OH

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
54	WILDS	960702	F	27	HOLD	WILDS	DO NOT BREED		
58	WILDS	940902	F	26	HOLD	WILDS	DO NOT BREED		
80	WILDS	961006	M	21	HOLD	WILDS	DO NOT BREED		
151	WILDS	990404	M	13	HOLD	WILDS	DO NOT BREED		
190	WILDS	203001	F	10	HOLD	WILDS	DO NOT BREED		
314	WILDS	A11142	M	1	HOLD	WILDS	DO NOT BREED		

Appendix A
Life Tables

Males

Age	Qx	Px	lx	Mx	Risk (Qx)	Risk (Mx)
0	0.19	0.81	1	0	90.1	75.1
1	0.04	0.96	0.81	0	74.5	72.7
2	0.01	0.99	0.778	0	71.5	70.5
3	0.03	0.97	0.77	0	70.8	69.2
4	0.01	0.99	0.747	0.04	69.3	68.8
5	0.03	0.97	0.739	0.1	67.1	65.9
6	0.05	0.95	0.717	0.08	62.3	60.4
7	0.07	0.93	0.681	0.17	60	58.1
8	0.02	0.98	0.634	0.16	55.6	54.7
9	0	1	0.621	0.19	53.8	53.8
10	0	1	0.621	0.14	54	54
11	0.04	0.96	0.621	0.16	53.1	51.5
12	0.04	0.96	0.596	0.13	47.2	46.1
13	0	1	0.572	0.05	40.4	40.4
14	0	1	0.572	0.1	39.5	39.5
15	0.05	0.95	0.572	0.17	39.4	38.4
16	0.03	0.97	0.544	0.17	37	36
17	0	1	0.527	0.1	36	36
18	0	1	0.527	0.07	33.5	33.5
19	0.03	0.97	0.527	0.02	32	31.8
20	0.07	0.93	0.511	0.04	29.4	28.4
21	0.09	0.91	0.476	0.02	22	21.1
22	0.06	0.94	0.433	0	16.8	16.5
23	0	1	0.407	0	14.6	14.6
24	0	1	0.407	0.04	14	14
25	0.07	0.93	0.407	0.04	14	13.2
26	0	1	0.378	0.04	11.6	11.6
27	0	1	0.378	0	9.7	9.7
28	0.12	0.88	0.378	0	8.3	7.8
29	0	1	0.333	0	7	7
30	0	1	0.333	0	6.1	6.1
31	0.17	0.83	0.333	0	5.8	5.6
32	0	1	0.276	0.1	5	5
33	0	1	0.276	0.1	5	5
34	0.28	0.72	0.276	0	3.6	3.5
35	0	1	0.199	0	2	2
36	0	1	0.199	0	2	2
37	0	1	0.199	0	0.6	0.6
38	1	0	0.199	0	0	0
39	1	0	0	0	0	0

30-day	mortality	(both	sexes):	13.10%	(26	of	198	neonates)
r	=	0.0184						
lambda	=	1.0186						
T	=	12.21						
N	=	32						
N(at	20	yrs)	=	46.28				

Females

Age	Qx	Px	lx	Mx	Risk (Qx)	Risk (Mx)
0	0.2	0.8	1	0	103.5	83.8
1	0.05	0.95	0.8	0	84.3	82.7
2	0.05	0.95	0.76	0	78	75.9
3	0	1	0.722	0.01	74.2	74.2
4	0	1	0.722	0.09	75.8	75.8
5	0.05	0.95	0.722	0.12	76.6	75.3
6	0.04	0.96	0.686	0.07	72.2	70.2
7	0.03	0.97	0.658	0.14	66.4	65.3
8	0	1	0.639	0.13	64	64
9	0.03	0.97	0.639	0.13	63.1	62
10	0.02	0.98	0.62	0.03	58.4	58.1
11	0.02	0.98	0.607	0.11	53.3	52.6
12	0	1	0.595	0.07	48.2	48.2
13	0.04	0.96	0.595	0.08	44.8	43.9
14	0.03	0.97	0.571	0.11	37.1	36.5
15	0	1	0.554	0.12	34.6	34.6
16	0.06	0.94	0.554	0.03	34	33.5
17	0.03	0.97	0.521	0.05	32	32
18	0	1	0.505	0.02	30.3	30.3
19	0	1	0.505	0.05	29.4	29.4
20	0.04	0.96	0.505	0.02	28.4	28.3
21	0	1	0.485	0	26.2	26.2
22	0	1	0.485	0.11	26.6	26.6
23	0.04	0.96	0.485	0.11	26.4	26.3
24	0	1	0.466	0.27	23.7	23.7
25	0.04	0.96	0.466	0.09	22.4	22
26	0	1	0.447	0.03	19	19
27	0.07	0.93	0.447	0	15.2	14.8
28	0	1	0.416	0.05	10.8	10.8
29	0	1	0.416	0.05	9.4	9.4
30	0	1	0.416	0.11	9	9
31	0	1	0.416	0	8.4	8.4
32	0	1	0.416	0	7.3	7.3
33	0	1	0.416	0.17	5.9	5.9
34	0	1	0.416	0	5	5
35	0	1	0.416	0	5	5
36	0	1	0.416	0	4.3	4.3
37	0	1	0.416	0	3.3	3.3
38	0.33	0.67	0.416	0	3	2.6
39	0	1	0.279	0	1.3	1.3
40	0	1	0.279	0	1	1
41	1	0	0.279	0	1	0.9
42	1	0	0	0	0	0
43	1	0	0	0	0	0

30-day	mortality	(both	sexes):	13.10%	(26	of	198	neonates)
r	=	0.0184						
lambda	=	1.0173						
T	=	14.68						
N	=	45						
N(at	20	yrs)	=	63.38				

Appendix B
Ordered Mean Kinship

Males

SB#	MK	%Known	Age	Location
39	0.010	100.0	28	KANSASCTY
112	0.010	100.0	21	MANHATTAN
114	0.017	100.0	22	FORTWORTH
240	0.019	100.0	9	LOUISVILL
312	0.019	100.0	2	DALLAS
131	0.023	100.0	18	SD-WAP
113	0.024	100.0	21	DENVER
102	0.027	100.0	21	SEATTLE
118	0.027	100.0	21	OKLAHOMA
132	0.028	100.0	18	CINCINNAT
304	0.028	100.0	5	GRANBY
49	0.030	100.0	27	BARABOO
63	0.030	100.0	26	WATERTNSD
250	0.032	100.0	6	PROVIDNCE
255	0.032	100.0	5	TAUTPHAUS
256	0.032	100.0	5	BIRMINGHM
268	0.032	100.0	3	DREHER PA
79	0.033	100.0	21	CLEVELAND
143	0.033	100.0	15	FOSSILRIM
164	0.033	100.0	12	SAN ANTON
18	0.034	100.0	37	BARABOO
36	0.034	100.0	30	FRANKLINP
27	0.035	100.0	34	NZP-CRC
90	0.035	100.0	20	HOUSTON
25	0.036	100.0	34	BARABOO
314	0.038	100.0	1	DENVER
168	0.039	100.0	12	ATTLEBORO
311	0.041	100.0	2	HOUSTON
60	0.045	100.0	26	NZP-CRC
45	0.046	100.0	27	DETROIT
151	0.046	100.0	13	WILDS
80	0.049	100.0	21	WILDS

Females

SB#	MK	%Known	Age	Location
83	0.000	100.0	34	SD-WAP
40	0.010	100.0	28	MANHATTAN
110	0.015	100.0	23	KANSASCTY
274	0.019	100.0	3	KANSASCTY
115	0.020	100.0	22	FORTWORTH
26	0.022	100.0	33	SANDIEGOZ
241	0.022	100.0	9	DALLAS
249	0.022	100.0	7	NZP-CRC
254	0.022	100.0	6	LOUISVILL
101	0.030	100.0	20	SEATTLE
46	0.032	100.0	27	NZP-CRC
119	0.032	100.0	21	OKLAHOMA
182	0.032	100.0	11	NZP-CRC
190	0.032	100.0	10	WILDS
243	0.032	100.0	9	GRANBY
145	0.033	100.0	14	WATERTNSD
147	0.033	100.0	14	TAUTPHAUS
157	0.033	100.0	13	ATTLEBORO
184	0.033	100.0	11	WHEELING
37	0.036	100.0	29	FOSSILRIM
58	0.036	100.0	26	WILDS
313	0.036	100.0	2	SAN ANTON
19	0.037	100.0	36	FRANKLINP
50	0.039	100.0	27	BARABOO
109	0.039	100.0	18	HOUSTON
186	0.039	100.0	11	FRANKLINP
104	0.041	100.0	19	SAN ANTON
161	0.041	100.0	12	NASHV ZOO
162	0.041	100.0	12	NASHV ZOO
180	0.041	100.0	11	COLUMBUS
188	0.041	100.0	10	DREHER PA
252	0.041	100.0	6	CINCINNAT
310	0.041	100.0	2	HOUSTON
179	0.042	100.0	12	PROVIDNCE
56	0.043	100.0	26	BIRMINGHM
41	0.045	100.0	28	BARABOO
48	0.045	100.0	27	BARABOO
54	0.045	100.0	27	WILDS
59	0.045	100.0	26	DETROIT
44	0.046	100.0	28	DENVER
150	0.046	100.0	13	BARABOO
33	0.048	100.0	32	BARABOO
65	0.048	100.0	25	COLUMBUS
70	0.048	100.0	24	CINCINNAT
148	0.048	100.0	14	KANSASCTY

Appendix C
Summary of Data Exports

Project: rccr12
Report compiled under Population Management 2000, version 1.213
5:27:29 AM, 9/30/2012

Comments:

Date to be used for calculations: 9/30/2012

Demographic data from: C:\ISISDOSBOX\SPARKS\GJAPON_N\MGJAPON_.PRN and
C:\ISISDOSBOX\SPARKS\GJAPON_N\FGJAPON_.PRN
1980 to present

Genetic data from: C:\ISISDOSBOX\SPARKS\GJAPON_N\rccr12.ped

Studbook information:
Data exported on: 30 Sep 2012
Version: Sparks v1.64
Data compiled by: Tori Spinoso
Contact info: Tori Spinoso tjspin@gmail.com
Data current thru: 15 AUG 2012
Scope of data: North American

Genetic filter conditions:
Locations: N.AMERICA/
Dates: On 29 Sep 2012
Status: Living on 29 Sep 2012

Appendix D
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 F

Directory of Institutional Representatives

Institutional Representative	Institution	Email
Cindy Pinger	Birmingham Zoo	cpinger@birminghamzoo.com
Jim Lloyd	Bramble Park Zoo	jlloyd@watertownsd.us
Sue Rifai	Capron Park Zoo	sue@capronparkzoo.com
David Oehler	Cincinnati Zoo and Botanical Garden	david.oehler@cincinnatizoo.org
Stan Searles	Cleveland Metroparks Zoo	als@clevelandmetroparks.com
Kelly Vineyard	Columbus Zoo and Aquarium	kelly.vineyard@columbuszoo.org
Sherry Mossbarger	Dallas Zoo	birdkeeper44@yahoo.com
John Azua	Denver Zoological Gardens	jazua@denverzoo.org
Bonnie Van Dam	Detroit Zoological Park	bvandam@detroitzoo.org
Katy Cussen	Fort Worth Zoo	Kcussen@fortworthzoo.org
Janet Johnson	Fossil Rim Wildlife Center	janetj@fossilrim.org
Fred Beall	Franklin Park Zoo	fbeall@zoonewengland.com
Pauline Leggett	Granby Zoo	pleggett@zoodegranby.com
Hannah Bailey	Houston Zoo	hbailey@houstonzoo.org
Bryant Tarr	International Crane Foundation	btarr@savingcranes.org
Joni Hartman	Kansas City Zoo	Joni_Hartman@fotzkc.org
Gary Michael	Louisville Zoological Garden	gary.michael@louisvilleky.gov
Joe DeGraauw	Nashville Zoo	jdegraauw@nashvillezoo.org
Joe Greathouse	Oglebay's Good Zoo	jgreathouse@oglebay-resort.com
Darcy Henthorn	Oklahoma City Zoological Park	DHenthorn@okczoo.com
Keith Lovett	Palm Beach Zoo	klovett@palmbeachzoo.org
Tim French	Roger Williams Park Zoo	tfrench@rwpzoo.org
Josef San Miguel	San Antonio Zoo	curbirds@sazoo-aq.org
Dave Rimlinger	San Diego Zoo	drimlinger@sandiegozoo.org
Michael Mace	San Diego Wild Animal park	mmace@sandiegozoo.org
Warren Lynch	Smithsonian Conservation Biology Inst.	lynchw@si.edu
Brian Devoren	Sunset Zoo	davoren@ci.manhattan.ks.us
Beth Rich	Tautphaus Park Zoo	bcrich@idahofallsidaho.gov
Patty Glaze	The Wilds	pglaze@thewilds.org
Mark Myers	Woodland Park Zoo	mark.myers@zoo.org