

Population Analysis and Breeding Plan

Chestnut-mandibled Toucan
Ramphastos ambiguus swainsonii
Species Survival Plan

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ASSOCIATION
OF ZOOS &
AQUARIUMS

Executive Summary

Species Survival Plan for Chestnut-mandibled Toucans

The Piciformes Taxon Advisory Group's 2003 Regional Collection Plan recommended chestnut-mandibled toucans to be managed with a target size of 75 individuals under the Toucan SSP. At the time of analyses, the chestnut-mandibled toucan population consists of 56 (28.24.4) individuals at 30 institutions.

The current gene diversity of the known-pedigree population is 77.78%, equivalent to that of about two founders ($FGE=2.25$). Only two birds of known wild origin have bred and contributed to the living descendant population; 14 additional potential founders remain from various importations from the wild. Two-thirds of the population consists of unknown pedigree birds, most likely descended from a few breeding pairs held by private facilities outside of the SSP.

Managed breeding resulting in equalization of founder representation and recruitment of the 14 existing potential founders, increasing the population growth rate, and improving the N_e/N ratio would all allow this population to increase and maintain gene diversity. Determining the pedigree of unknown pedigree birds would also increase gene diversity by allowing existing but unknown lineages to be included in the genetic calculations. When gene diversity decreases below 90%, it is expected that reproduction will be increasingly compromised by, among other factors, lower hatch weights, smaller clutch sizes, and greater neonatal mortality.

DEMOGRAPHICS

	<i>Current</i>
Population Size (at time of analyses)	56 (28.24.4)
Specimens Excluded from Genetic Analyses	37
Mean Generation Time (Years)	8.1*
Current Population Growth Rate	0.887

**based on very small sample size but similar to Toco Toucan*

GENETICS

	<i>Current</i>	<i>Potential</i>
Founders	4*	14 additional
Founder genome equivalents	2.25	17.00
Gene diversity retained (%)	77.78	97.06
Population mean kinship	0.2222	--
Mean inbreeding	0	--
Effective population size/census size ratio (N_e/N)	0.1053	--
Percent of pedigree known (before exclusions)	9.2	--
Percent of pedigree known (after exclusions)	100	--
Years to 90% gene diversity	n/a - GD already below 90%	
Gene diversity at 100 years from present (%)	0%	

**Only 2 founders were true founders—i.e., unrelated wild origin birds that bred in zoos. The other 2 founders are hypothetical wild parents created to connect two known clutchmates.*

There are two main concerns in this population: the lack of reproduction and the large number of unknown pedigreed birds. This population has a poor record of breeding; only three breeding pairs have successfully bred in AZA facilities. Hand-rearing for education programs has been common and is thought to interfere with breeding. Imports from the wild and birds from private breeders have sustained the population and led to problems of unknown pedigree and unknown relatedness of birds. Two-thirds of the SSP population is of unknown pedigree (35 birds) and breeding them may lead to unintentional inbreeding. Even birds from the wild may be related because clutchmates may have been collected together.

To meet demographic and genetic goals, SSP recommends 16 breeding pairs. Breeding of wild origin birds should be prioritized in order to meet genetic and demographic goals. However, due to the lack of reproduction in this population, unknown pedigree birds will be acceptable to breed to help meet demographic goals.

Summary Actions: The SSP recommends 16 breeding pairs and 4 transfers.

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Description of Population Status

Introduction: At the time of analyses, the Chestnut-mandibled Toucan SSP population consists of 56 (28.24.4) individuals at 30 AZA institutions. The Piciformes Taxon Advisory Group's 2003 Regional Collection Plan recommended chestnut-mandibled toucans be managed with a target size of 75 individuals under the Toucan SSP.

Genetic and demographic analyses of the population were performed in March 2008 at the AZA Regional Conference in Birmingham, Alabama, resulting in the current SSP Breeding and Transfer Plan. Demographic and genetic analyses were performed on the North American Regional Chestnut-mandibled Toucan Studbook (current to 1 February 2008) using PopLink 1.3, SPARKS 1.52 and PM2000 1.212. This is the first breeding and transfer plan for this species. The goal of these recommendations is to help insure the genetic and demographic health of this population.

Analytical Population: Of the 56 chestnut-mandibled birds in the population, 35 have pedigrees that are 0 – 50% known (i.e., do not trace back to known wild ancestors) and were excluded from the genetic analyses. An additional two birds have medical problems that preclude them from breeding. Exclusions are listed in Appendix A. No assumptions were made in connection with unknown pedigree birds. One bird (male 94) was reported dead during the comment period.

Demography: Records indicate chestnut-mandibled toucans first appeared in North American zoos in 1957. However, significant numbers of this species were not held until the 1980s and the first captive hatch did not occur until 1995. Captive propagation in zoos is still uncommon, and population growth still relies heavily on acquisitions from the wild and the private sector. Since 1985, population annual growth rates attributed to all sources have varied from year to year (range of annual $\lambda = 0.833 - 2.8$) but the population has exhibited an overall trend of increase with a mean annual growth rate of 1.158 (Figures 1 and 2). Over the past 5 years the population growth rate has actually declined slightly (mean lambda = 0.996).

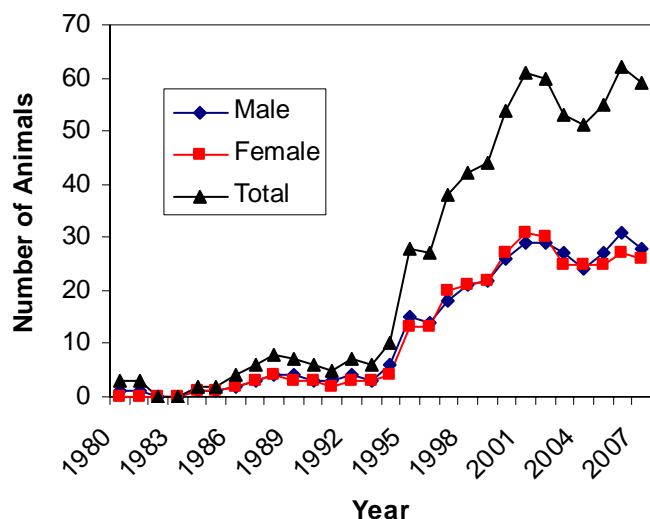


Figure 1. Population census by sex, showing the number of chestnut-mandibled toucans in North American zoos from 1980 – present (data current to 1 Feb 2008).

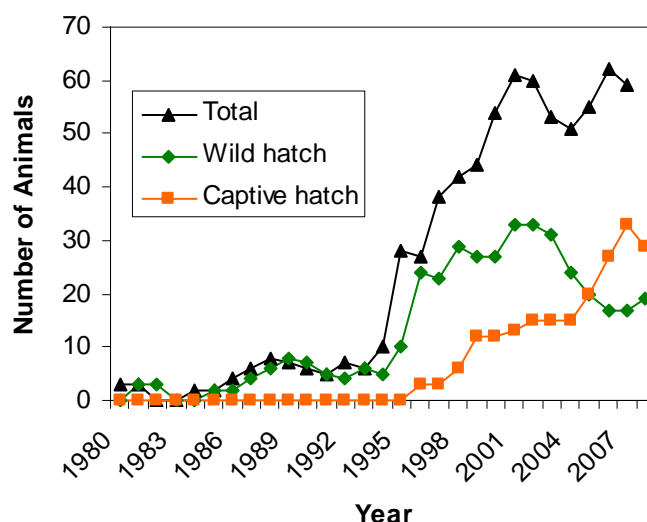


Figure 2. Population census by birth type, showing the number of chestnut-mandibled toucans in North American zoos from 1980 – present (data current to 1 Feb 2008).

The age distribution illustrates the lack of breeding in the population and the reliance on imports: there are no individuals in the juvenile age classes and there are bulges in some age classes reflecting historic imports in which large numbers of juvenile birds were collected (Figures 3 and 4). The small number of birds with known pedigrees is illustrated in Figure 4.

Demographic data for this species is lacking due to the small number of hatches and deaths recorded in the studbook. However, based on data from similar species (e.g., Toco Toucan), it may be assumed that birds in

the uppermost age classes are facing reproductive senescence and higher mortality risks. The average clutch size for this species is two chicks.

Hand-rearing is thought to interfere with breeding. The SSP recommends **not** hand-rearing chicks until either its impact on future breeding is understood or the population becomes sufficiently stable to allow a portion to be hand-raised.

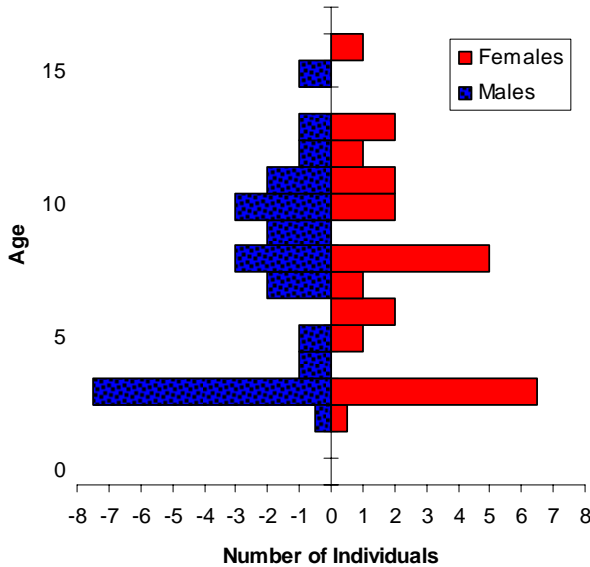


Figure 3. Age structure of the current Chestnut-mandibled SSP population, before exclusions (56, 28.24.4).

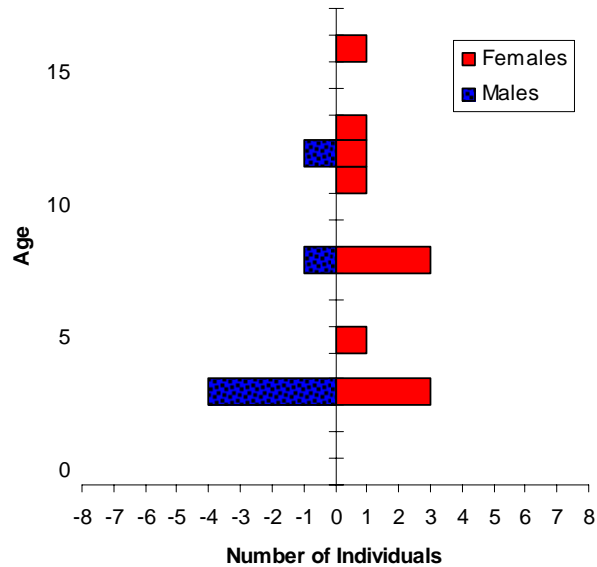


Figure 4. Age structure of the known-pedigree portion of the Chestnut-mandibled SSP population, after excluding birds with unknown pedigree or medical issues (N=19).

Genetics: The current gene diversity of the known-pedigree population is 77.78%, equivalent to that of about two founders (FGE=2.25). Only two birds of known wild origin have bred and contributed to the living descendant population; 14 additional potential founders remain from various importations from the wild. Two-thirds of the population consists of unknown pedigree birds, most likely descended from a few breeding pairs held by private facilities outside of the SSP.

GENETIC SUMMARY

	<i>Current</i>	<i>Potential</i>
Founders	4*	14 additional
Founder genome equivalents	2.25	17.00
Gene diversity retained (%)	77.78	97.06
Population mean kinship	0.2222	--
Mean inbreeding	0	--
Effective population size/census size ratio (N_e/N)	0.1053	--
Percent of pedigree known (before exclusions)	9.2	--
Percent of pedigree known (after exclusions)	100	--
Years to 90% gene diversity	n/a - GD already below 90%	
Gene diversity at 100 years from present (%)	0%	

*Only 2 founders were true founders—i.e., unrelated wild origin birds that bred in zoos.
The other 2 founders are hypothetical wild parents created to connect two known clutchmates.

Managed breeding resulting in equalization of founder representation and recruitment of the 14 existing potential founders, increasing the population growth rate, and improving the N_e/N ratio would all allow this population to increase and maintain gene diversity. Determining the pedigree of unknown pedigree birds would also increase gene diversity by allowing existing (but unknown) lineages to be included in the genetic calculations. A concern in breeding unknown pedigree birds is that they are likely to be related because only a few private breeders have been supplying the population. Institutions should attempt to track parentage in

transaction records in order to avoid pairing unknown pedigree birds with close relatives. Even birds from the wild may be related because clutchmates may have been collected together from wild nests.

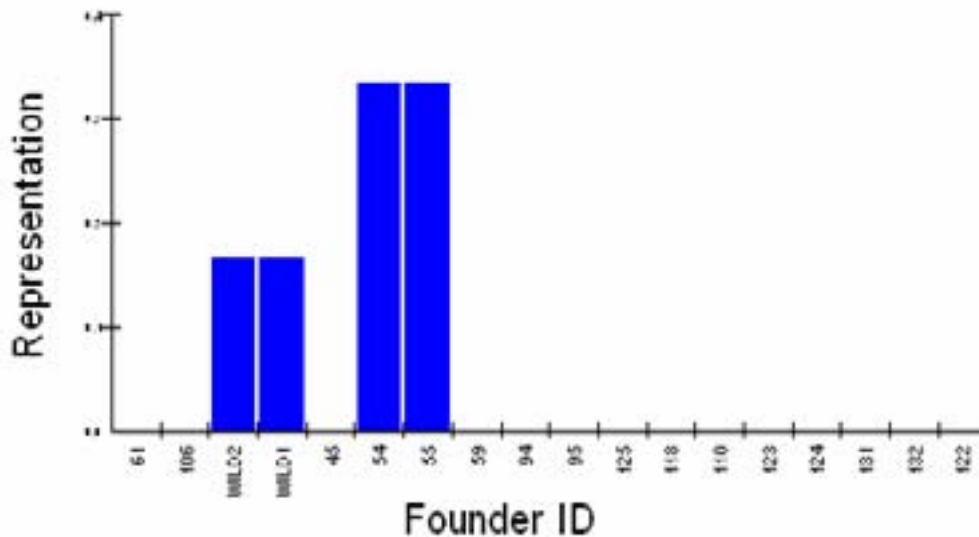


Figure 5. Founder representation in chestnut-mandibled toucans illustrating inequality of founder representation and the large number of unrepresented founders.

Management Strategy: Precise growth rates and a recommended number of hatches for this population cannot be accurately determined due to poor demographic data. However, to offset deaths and increase the probability of successful reproduction, the SSP has recommended 16 breeding pairs. The SSP should focus breeding the unrepresented birds of known wild origin, and in so doing increase gene diversity and increase the population towards its target size. Unpedigreed birds should also be encouraged to breed in the coming year to avoid demographic problems and until husbandry has improved sufficiently that genetically desirable pairs can be prioritized.

1. Recommend 16 breeding pairs.
 - a. Because hand-rearing is thought to interfere with breeding, offspring should not be hand-raised or used as program birds at this time.
 - b. Breeding institutions should be able to hold chicks for at least 1 year.
 - c. Refer to Toucan Husbandry Manual for guidance on increasing the likelihood of breeding pairs succeeding.
2. Recommend 4 transfers.
3. Determine and report sex of all unsexed birds.
4. Continue to investigate parentage of unknown pedigree birds.
 - Institutions should provide the studbook keeper with any parentage information on transaction paperwork from private breeders. It is very likely that many of the unknown pedigreed birds come from a only few breeding pairs and are related to each other.

Summary Breeding and Transfer Recommendations

ID	Location	Sex	Age	Disposition	Location	Breeding	With	Notes
54	BIRMINGHM	M	12	HOLD	BIRMINGHM	BREED WITH	55	
55	BIRMINGHM	F	12	HOLD	BIRMINGHM	BREED WITH	54	
108	BIRMINGHM	M	0	HOLD	BIRMINGHM	DO NOT BREED		Unknown pedigree
136	BIRMINGHM	M	3	SEND TO	DREHER PA	BREED WITH	105	
101	BREVARD	F	8	HOLD	BREVARD	DO NOT BREED		medical issues & unknown pedigree
120	BUFFALO	M	3	HOLD	BUFFALO	BREED WITH	121	Unknown pedigree; breed for demographic purposes.
121	BUFFALO	F	3	HOLD	BUFFALO	BREED WITH	120	Unknown pedigree; breed for demographic purposes.
137	BUSCH TAM	F	7	HOLD	BUSCH TAM	DO NOT BREED		Unknown pedigree; Not suitable for breeding
138	BUSCH TAM	M	3	HOLD	BUSCH TAM	BREED WITH	139	Unknown pedigree; breed for demographic purposes.
139	BUSCH TAM	F	3	HOLD	BUSCH TAM	BREED WITH	138	Unknown pedigree; breed for demographic purposes.
134	CINCINNAT	M	0	HOLD	CINCINNAT	BREED WITH	135	Unknown pedigree; breed for demographic purposes.
135	CINCINNAT	F	0	HOLD	CINCINNAT	BREED WITH	134	Unknown pedigree; breed for demographic purposes.
133	COLO SPRG	M	9	HOLD	COLO SPRG	DO NOT BREED		Unknown pedigree
86	COLUMBUS	F	0	HOLD	COLUMBUS	DO NOT BREED		education bird
58	DALLAS	F	0	HOLD	DALLAS	DO NOT BREED		unknown pedigree
127	DALLAS WA	M	3	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
128	DALLAS WA	F	3	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
129	DALLAS WA	U	3	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
130	DALLAS WA	U	2	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
131	DALLAS WA	U	3	HOLD	DALLAS WA	BREED WITH	132	Report sex to studbook keeper. genetically valuable potential founder.
132	DALLAS WA	U	3	HOLD	DALLAS WA	BREED WITH	131	Report sex to studbook keeper. genetically valuable potential founder.
93	DENVER	M	8	HOLD	DENVER	BREED WITH	118	Investigate parentage of this unknown pedigree bird; breed for demographic purposes.
118	DENVER	F	8	HOLD	DENVER	BREED WITH	93	
97	DICKERSON	M	8	HOLD	DICKERSON	BREED WITH	109	Unknown pedigree; breed for demographic purposes.
109	DICKERSON	F	6	HOLD	DICKERSON	BREED WITH	97	Unknown pedigree; breed for demographic purposes.
105	DREHER PA	F	8	HOLD	DREHER PA	BREED WITH	136	
59	HOUSTON	F	11	HOLD	HOUSTON	BREED WITH	76	
76	HOUSTON	M	10	HOLD	HOUSTON	BREED WITH	59	Unknown pedigree; breed for demographic purposes.
117	JACKSONVL	M	7	HOLD	JACKSONVL	DO NOT BREED		Unknown pedigree.
80	KANSASCTY	M	10	HOLD	KANSASCTY	BREED WITH	81	Unknown pedigree; breed for demographic purposes.
81	KANSASCTY	F	10	HOLD	KANSASCTY	BREED WITH	80	Unknown pedigree; breed for demographic purposes.

ID	Location	Sex	Age	Disposition	Location	Breeding	With	Notes
27	LOSANGELE	M	15	HOLD	LOSANGELE	BREED WITH	95	Unknown pedigree; breed for demographic purposes.
45	LOSANGELE	F	13	HOLD	LOSANGELE	DO NOT BREED		education bird
126	MINOT	F	3	HOLD	MINOT	DO NOT BREED		Descended from known wild parents; Recommended to be in a breeding situation.
82	ATLANTA	F	10	HOLD	ATLANTA	BREED WITH	83	previously NASHV ZOO 1221. Unknown pedigree; breed for demographic purposes.
83	ATLANTA	M	10	HOLD	ATLANTA	BREED WITH	82	previously NASHV ZOO 1220; Unknown pedigree; breed for demographic purposes.
107	OAKLAND	M	7	HOLD	OAKLAND	BREED WITH	110	Unknown pedigree; breed for demographic purposes.
110	OAKLAND	F	5	HOLD	OAKLAND	BREED WITH	107	Unknown pedigree; breed for demographic purposes.
112	OMAHA	M	5	HOLD	OMAHA	DO NOT BREED		
119	ORLANDO	F	6	HOLD	ORLANDO	DO NOT BREED		education bird
106	PARAMUS	M	0	HOLD	PARAMUS	SEE NOTES		genetically valuable potential founder; SSP will seek appropriate mate.
51	PITTS CA	F	13	HOLD	PITTS CA	DO NOT BREED		excluded for medical reasons
94	PORTLAND	M	8	HOLD	PORTLAND	BREED WITH	126	genetically valuable potential founder; reported dead during comment period.
95	PORTLAND	F	8	SEND TO	LOSANGELE	BREED WITH	27	Pair together since 2001 and has not bred; Please sex this genetically valuable potential founder & send to LA to pair with new male for breeding.
73	RIO GRAND	M	11	HOLD	RIO GRAND	BREED WITH	74	Unknown pedigree; ok to breed for demographic purposes.
74	RIO GRAND	F	11	HOLD	RIO GRAND	BREED WITH	73	Unknown pedigree; ok to breed for demographic purposes.
84	RIO GRAND	M	9	SEND TO	SANFORD	DO NOT BREED		unknown pedigree; move pre-arranged
116	RIO GRAND	M	4	SEND TO	SANFORD	DO NOT BREED		unknown pedigree; move pre-arranged
40	SANDIEGOZ	M	13	HOLD	SANDIEGOZ	DO NOT BREED		education bird
122	SEA WORLD	M	3	HOLD	SEA WORLD	BREED WITH	123	genetically valuable potential founder
123	SEA WORLD	F	3	HOLD	SEA WORLD	BREED WITH	122	genetically valuable potential founder
124	SOUTHBEND	M	3	HOLD	SOUTHBEND	BREED WITH	125	genetically valuable potential founder
125	SOUTHBEND	F	8	HOLD	SOUTHBEND	BREED WITH	124	genetically valuable potential founder
72	SYRACUSE	M	11	HOLD	SYRACUSE	DO NOT BREED		excluded for medical reasons
26	W ORANGE	F	16	HOLD	W ORANGE	BREED WITH	61	genetically valuable potential founder
61	W ORANGE	M	0	HOLD	W ORANGE	BREED WITH	26	genetically valuable potential founder

ATLANTA
Zoo Atlanta
 Atlanta, GA

Note: Please provide studbook keeper with parental information from transaction paperwork from Nashville or R. Miller if possible. Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
82	NASHV ZOO 1221	F	10	HOLD	ATLANTA	BREED WITH	83	Unknown pedigree; breed for demographic purposes.
83	NASHV ZOO 1220	M	10	HOLD	ATLANTA	BREED WITH	82	Unknown pedigree; breed for demographic purposes.

BIRMINGHAM
Birmingham Zoo
 Birmingham, AL

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
54	B00013	M	12	HOLD	BIRMINGHM	BREED WITH	55	
55	B00016	F	12	HOLD	BIRMINGHM	BREED WITH	54	
108	B03001	M	0	HOLD	BIRMINGHM	DO NOT BREED		Unknown pedigree
136	205063	M	3	SEND TO	DREHER PA	BREED WITH	105	

BREVARD
Brevard Zoo
 Melbourne, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
101	940673	F	8	HOLD	BREVARD	DO NOT BREED		medical issues & unknown pedigree

BUFFALO

Buffalo Zoological Gardens

Buffalo, NY

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
120	B07009	M	3	HOLD	BUFFALO	BREED WITH	121	Unknown pedigree; breed for demographic purposes.
121	B07010	F	3	HOLD	BUFFALO	BREED WITH	120	Unknown pedigree; breed for demographic purposes.

BUSCH TAM

Busch Gardens

Tampa, FL

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
137	63660	F	7	HOLD	BUSCH TAM	DO NOT BREED		Unknown pedigree. Not suitable for breeding.
138	63142	M	3	HOLD	BUSCH TAM	BREED WITH	139	Unknown pedigree; breed for demographic purposes.
139	63143	F	3	HOLD	BUSCH TAM	BREED WITH	138	Unknown pedigree; breed for demographic purposes.

CINCINNAT

Cincinnati Zoo & Botanical Garden

Cincinnati, OH

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
134	206267	M	0	HOLD	CINCINNAT	BREED WITH	135	Unknown pedigree; breed for demographic purposes.
135	206266	F	0	HOLD	CINCINNAT	BREED WITH	134	Unknown pedigree; breed for demographic purposes.

COLO SPRG

Cheyenne Mtn Zoological Park
Colorado Springs, CO

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
133	26A017	M	9	HOLD	COLO SPRG	DO NOT BREED		Unknown pedigree

COLUMBUS

Columbus Zoo and Aquarium
Powell, OH

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
86	991056	F	0	HOLD	COLUMBUS	DO NOT BREED		education bird

DALLAS

Dallas Zoo
Dallas, TX

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
58	97B845	F	0	HOLD	DALLAS	DO NOT BREED		unknown pedigree

DALLAS WA

Dallas World Aquarium
Dallas, TX

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
127	6A010	M	3	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
128	6A009	F	3	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
129	6A011	U	3	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
130	6A012	U	2	HOLD	DALLAS WA	DO NOT BREED		unknown pedigree
131	7A099	U	3	HOLD	DALLAS WA	BREED WITH	132	Report sex to studbook keeper. Genetically valuable potential founder.
132	7A100	U	3	HOLD	DALLAS WA	BREED WITH	131	Report sex to studbook keeper. Genetically valuable potential founder.

DENVER

Denver Zoological Gardens

Denver, CO

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
93	A00262	M	8	HOLD	DENVER	BREED WITH	118	Investigate parentage of this unknown pedigree bird; breed for demographic purposes.
118	A02184	F	8	HOLD	DENVER	BREED WITH	93	

DICKERSON

Dickerson Park Zoo

Springfield, MO

Note: Please provide studbook keeper with parental information if possible. For #109, check R. Miller transaction paperwork. Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
97	5249	M	8	HOLD	DICKERSON	BREED WITH	109	Unknown pedigree; breed for demographic purposes.
109	5563	F	6	HOLD	DICKERSON	BREED WITH	97	Unknown pedigree; breed for demographic purposes.

DREHER PA

Palm Beach Zoo at Dreher Park

West Palm Beach, FL

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
136	205063	M	3	RECEIVE FROM	BIRMINGHM	BREED WITH	105	
105	200043	F	8	HOLD	DREHER PA	BREED WITH	136	

HOUSTON

Houston Zoo, Inc.

Houston, TX

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
59	18803	F	11	HOLD	HOUSTON	BREED WITH	76	
76	18561	M	10	HOLD	HOUSTON	BREED WITH	59	Unknown pedigree; breed for demographic purposes.

JACKSONVL

Jacksonville Zoo and Gardens

Jacksonville, FL

Note: SSP will continue to seek appropriate mate for this male to breed for demographic purposes (female recommended in draft was reported not suitable for breeding).

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
117	606334	M	7	HOLD	JACKSONVL	DO NOT BREED (SEE NOTES)		Unknown pedigree.

KANSASCTY

Kansas City Zoo

Kansas City, MO

Note: Please provide studbook keeper with parental information from R. Miller transaction paperwork. Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
80	98A117	M	10	HOLD	KANSASCTY	BREED WITH	81	Unknown pedigree; breed for demographic purposes.
81	98A118	F	10	HOLD	KANSASCTY	BREED WITH	80	Unknown pedigree; breed for demographic purposes.

LOSANGELE

Los Angeles Zoo & Botanical Gardens

Los Angeles, CA

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
27	990180	M	15	HOLD	LOSANGELE	BREED WITH	95	Unknown pedigree; breed for demographic purposes.
45	990246	F	13	HOLD	LOSANGELE	DO NOT BREED		education bird
95	A10085	F	8	RECEIVE FROM	PORTLAND	BREED WITH	27	Genetically valuable potential founder

MINOT

Roosevelt Park Zoo

Minot, ND

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
126	A255	F	3	HOLD	MINOT	SEE NOTES		Descended from known wild parents; Recommended to be in a breeding situation.

OAKLAND

Oakland Zoo

Oakland, CA

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
107	1523	M	7	HOLD	OAKLAND	BREED WITH	110	Unknown pedigree; breed for demographic purposes.
110	1831	F	5	HOLD	OAKLAND	BREED WITH	107	Unknown pedigree; breed for demographic purposes.

OMAHA

Omaha's Henry Doorly Zoo

Omaha, NE

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
112	14756	M	5	HOLD	OMAHA	DO NOT BREED		

ORLANDO

Sea World Orlando

Orlando, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
119	SW2502	F	6	HOLD	ORLANDO	DO NOT BREED		education bird

PARAMUS

Bergen County Zoological Park
Paramus, NJ

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
106	2562	M	0	HOLD	PARAMUS	SEE NOTES		genetically valuable potential founder; SSP will seek appropriate mate.

PITTS CA

National Aviary in Pittsburgh
Pittsburgh, PA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
51	4518	F	13	HOLD	PITTS CA	DO NOT BREED		excluded for medical reasons

PORTLAND

Oregon Zoo
Portland, OR

Note: Please send to LA to set up genetically valuable breeding pair.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
94	A10084	M	8	HOLD	PORTLAND	BREED WITH	126	Reported dead during the comment period.
95	A10085	F	8	SEND TO	LOSANGELE	BREED WITH	27	

RIO GRAND

Albuquerque Biological Park

Albuquerque, NM

Note: Please provide studbook keeper with parental information for 73, 74, & 84 from R. Miller transaction paperwork. Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
73	B22600	M	11	HOLD	RIO GRAND	BREED WITH	74	Unknown pedigree; ok to breed for demographic purposes.
74	B22601	F	11	HOLD	RIO GRAND	BREED WITH	73	Unknown pedigree; ok to breed for demographic purposes.
84	B22602	M	9	SEND TO	SANFORD	DO NOT BREED		unknown pedigree; move pre-arranged
116	B05029	M	4	SEND TO	SANFORD	DO NOT BREED		unknown pedigree; move pre-arranged

SANDIEGOZ

Zoological Society of San Diego

San Diego, CA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
40	396180	M	13	HOLD	SANDIEGOZ	DO NOT BREED		education bird

SANFORD

Central Florida Zoo

Sanford, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
84	B22602	M	9	RECEIVE FROM	RIO GRAND	DO NOT BREED		unknown pedigree; move pre-arranged
116	B05029	M	4	RECEIVE FROM	RIO GRAND	DO NOT BREED		unknown pedigree; move pre-arranged

SEA WORLD

Sea World San Diego

San Diego, CA

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
122	CMT001	M	3	HOLD	SEA WORLD	BREED WITH	123	genetically valuable potential founder
123	CMT002	F	3	HOLD	SEA WORLD	BREED WITH	122	genetically valuable potential founder

SOUTHBEND

Potawatomi Zoo

South Bend, IN

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
124	25084	M	3	HOLD	SOUTHBEND	BREED WITH	125	genetically valuable potential founder
125	25083	F	8	HOLD	SOUTHBEND	BREED WITH	124	genetically valuable potential founder

SYRACUSE

Rosamond Gifford Zoo at Burnet Park

Syracuse, NY

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
72	B00076	M	11	HOLD	SYRACUSE	DO NOT BREED		excluded for medical reasons

W ORANGE

Turtle Back Zoo

West Orange, NJ

Note: Offspring should not be hand-reared or used as program birds until either the effect of hand-rearing is better understood or breeding in this population significantly improves.

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
26	5857	F	16	HOLD	W ORANGE	BREED WITH	61	genetically valuable potential founder
61	5743	M	0	HOLD	W ORANGE	BREED WITH	26	genetically valuable potential founder

Appendix A

Animals Excluded from Genetic Analyses

Studbook	Sex	Sire	Dam	Location	% Known	Local ID	Reason for exclusion
51	F	WILD	WILD	PITTS CA	100%	4518	medical
72	M	WILD	WILD	SYRACUSE	100%	B00076	medical
105	F	29	39	DREHER PA	50%	200043	Unknown pedigree
58	F	UNK	UNK	DALLAS	0%	97B845	Unknown pedigree
86	F	UNK	UNK	COLUMBUS	0%	991056	Unknown pedigree
108	M	UNK	UNK	BIRMINGHM	0%	B03001	Unknown pedigree
134	M	UNK	UNK	CINCINNAT	0%	206267	Unknown pedigree
135	F	UNK	UNK	CINCINNAT	0%	206266	Unknown pedigree
27	M	UNK	UNK	LOSANGELE	0%	990180	Unknown pedigree
40	M	UNK	UNK	SANDIEGOZ	0%	396180	Unknown pedigree
73	M	UNK	UNK	RIO GRAND	0%	B22600	Unknown pedigree
74	F	UNK	UNK	RIO GRAND	0%	B22601	Unknown pedigree
76	M	UNK	UNK	HOUSTON	0%	18561	Unknown pedigree
80	M	UNK	UNK	KANSASCTY	0%	98A117	Unknown pedigree
81	F	UNK	UNK	KANSASCTY	0%	98A118	Unknown pedigree
82	F	UNK	UNK	ATLANTA	0%	1221	Unknown pedigree
83	M	UNK	UNK	ATLANTA	0%	1220	Unknown pedigree
84	M	UNK	UNK	RIO GRAND	0%	B22602	Unknown pedigree
133	M	UNK	UNK	COLO SPRG	0%	26A017	Unknown pedigree
93	M	UNK	UNK	DENVER	0%	A00262	Unknown pedigree
97	M	UNK	UNK	DICKERSON	0%	5249	Unknown pedigree
101	F	UNK	UNK	BREVARD	0%	940673	Unknown pedigree
107	M	UNK	UNK	OAKLAND	0%	1523	Unknown pedigree
117	M	UNK	UNK	JACKSONVL	0%	606334	Unknown pedigree
137	F	UNK	UNK	BUSCH TAM	0%	63660	Unknown pedigree
109	F	UNK	UNK	DICKERSON	0%	5563	Unknown pedigree
119	F	UNK	UNK	ORLANDO	0%	SW2502	Unknown pedigree
112	M	UNK	UNK	OMAHA	0%	14756	Unknown pedigree
116	M	UNK	UNK	RIO GRAND	0%	B05029	Unknown pedigree
127	M	UNK	UNK	DALLAS WA	0%	6A010	Unknown pedigree
128	F	UNK	UNK	DALLAS WA	0%	6A009	Unknown pedigree
129	U	UNK	UNK	DALLAS WA	0%	6A011	Unknown pedigree
138	M	UNK	UNK	BUSCH TAM	0%	63142	Unknown pedigree
139	F	UNK	UNK	BUSCH TAM	0%	63143	Unknown pedigree
121	F	UNK	UNK	BUFFALO	0%	B07010	Unknown pedigree
120	M	UNK	UNK	BUFFALO	0%	B07009	Unknown pedigree
130	U	UNK	UNK	DALLAS WA	0%	6A012	Unknown pedigree

Appendix B

Assumptions

No assumptions were made for this year's analyses.

Appendix C

Summary of Data Exports

Project with no exclusions (for reports)

Project: TOUCCM

Report compiled under Population Management 2000, version 1.212

10:13:44 AM, 3/5/2008

Comments: chestnut-mandibled toucans created at Birmingham.

Studbook information:

Data exported on: 3/5/2008

Data compiled by: Matt Schmit

Contact info: Houston Zoo Inc mschmit@houstonzoo.org

Data current thru: 2/1/2008

Scope of data: Regional

Demographic data from: C:\Program Files\PopLink 1.3\PopLink Databases\CMTouc2\mCMTouc2.prn and C:\Program Files\PopLink 1.3\PopLink Databases\CMTouc2\fcMTouc2.prn

Demographic filter conditions:

Locations = N.AMERICA During 1/1/1985 - 3/5/2008 Status = Living

Genetic data from: C:\Program Files\PopLink 1.3\PopLink Databases\CMTouc2\CMTouc2.ped

Genetic filter conditions:

Locations = N.AMERICA

As of 3/5/2008

Status = Living

Project with unknowns excluded

Project: cmtouc2

Report compiled under Population Management 2000, version 1.212

Comments: created after Birmingham to investigate genetic calculations and stats

Studbook information:

Data exported on: 10 Apr 2008 from Sparks v1.52

Data compiled by: Matt Schmit

Contact info: Houston Zoo Inc mschmit@houstonzoo.org

Data current thru: 1 Feb 2008

Scope of data: Regional

Demographic data from: C:\sparks\cmtouc2\mcmouc2.prn and C:\sparks\cmtouc2\fcmtouc2.prn

Filter Conditions In Effect: Locations: N.AMERICA/ Dates: Between 01/01/1985 and 09/04/2008

Genetic data from: C:\sparks\cmtouc2\cmtouc2.ped

Genetic filter conditions:

Dates: As of 09/04/2008

Association: \Sparks\AZA.fed

Status: Living on 9 Apr 2008

Appendix D Life Tables

Males

Age (x)	Qx	Px	lx	Mx	Vx	Ex	Risk (Qx)	Risk (Mx)
0	0.120	0.880	1.000	0.000	1.064	9.078	20.200	17.800
1	0.000	1.000	0.880	0.000	1.006	8.628	29.100	29.100
2	0.050	0.950	0.880	0.000	0.913	7.824	36.600	35.800
3	0.030	0.970	0.836	0.000	0.841	7.110	33.800	33.400
4	0.090	0.910	0.811	0.000	0.792	6.497	31.800	29.900
5	0.100	0.900	0.738	0.000	0.774	6.072	31.200	29.400
6	0.040	0.960	0.664	0.380	0.738	5.464	28.500	27.500
7	0.170	0.830	0.638	0.080	0.353	4.980	26.800	24.800
8	0.100	0.900	0.529	0.000	0.280	4.618	20.400	19.100
9	0.130	0.870	0.476	0.280	0.280	4.085	15.400	15.000
10	0.200	0.800	0.414	0.000	0.000	3.684	9.900	8.700
11	0.330	0.670	0.331	0.000	0.000	3.616	6.000	5.600
12	0.310	0.690	0.222	0.000	0.000	3.858	3.300	2.800
13	0.000	1.000	0.153	0.000	0.000	3.500	1.300	1.300
14	0.000	1.000	0.153	0.000	0.000	2.500	1.000	1.000
15	0.000	1.000	0.153	0.000	0.000	1.500	0.300	0.300
16	1.000	0.000	0.153	0.000	0.000	1.000	0.000	0.000
17	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

r = -0.1223

lambda = 0.8849

T = 8.22

N = 8.00

N(at 20 yrs) = 0.69

Females

Age (x)	Qx	Px	lx	Mx	Vx	Ex	Risk (Qx)	Risk (Mx)
0	0.160	0.840	1.000	0.000	1.087	9.696	15.700	13.300
1	0.000	1.000	0.840	0.000	1.060	9.524	25.000	25.000
2	0.000	1.000	0.840	0.000	0.943	8.524	32.500	32.500
3	0.090	0.910	0.840	0.000	0.879	7.879	33.000	31.000
4	0.030	0.970	0.764	0.000	0.833	7.329	29.700	29.500
5	0.000	1.000	0.741	0.280	0.753	6.427	30.000	30.000
6	0.140	0.860	0.741	0.080	0.453	5.835	29.300	26.600
7	0.140	0.860	0.638	0.090	0.386	5.622	24.300	22.100
8	0.170	0.830	0.548	0.000	0.311	5.463	17.600	16.700
9	0.150	0.850	0.455	0.330	0.330	5.319	13.600	12.300
10	0.300	0.700	0.387	0.000	0.000	5.529	10.100	7.900
11	0.000	1.000	0.271	0.000	0.000	5.500	5.400	5.400
12	0.000	1.000	0.271	0.000	0.000	4.500	4.300	4.300
13	0.000	1.000	0.271	0.000	0.000	3.500	2.400	2.400
14	0.000	1.000	0.271	0.000	0.000	2.500	2.000	2.000
15	0.500	0.500	0.271	0.000	0.000	2.000	2.000	1.800
16	0.000	1.000	0.135	0.000	0.000	1.500	0.300	0.300
17	1.000	0.000	0.135	0.000	0.000	1.000	0.000	0.000
18	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000

r = -0.1165

lambda = 0.8900

T = 7.88

N = 11.00

N(at 20 yrs) = 1.07

Appendix E

Ordered Mean Kinship List

*Note: This list is current to March 2008 and values are subject to change with any birth, death, import, export, inclusion, or exclusion.
Unknown sex individuals appear on both the male and female side of the mean kinship list.
Unknown pedigree animals have been excluded as their genetic value cannot be calculated.*

Population MK = 0.2222

MALES

SB#	MK	%Known	Age	Location
131	0.000	100.0	U3	DALLAS WA
132	0.000	100.0	U3	DALLAS WA
106	0.000	100.0	0	PARAMUS
94	0.000	100.0	8	PORTLAND
122	0.000	100.0	3	SEA WORLD
124	0.000	100.0	3	SOUTHBEND
61	0.000	100.0	0	W ORANGE
54	0.167	100.0	12	BIRMINGHM
136	0.250	100.0	3	BIRMINGHM

FEMALES

SB#	MK	%Known	Age	Location
131	0.000	100.0	U3	DALLAS WA
132	0.000	100.0	U3	DALLAS WA
118	0.000	100.0	8	DENVER
59	0.000	100.0	11	HOUSTON
45	0.000	100.0	13	LOSANGELE
110	0.000	100.0	5	OAKLAND
95	0.000	100.0	8	PORTLAND
123	0.000	100.0	3	SEA WORLD
125	0.000	100.0	8	SOUTHBEND
55	0.167	100.0	12	BIRMINGHM
26	0.167	100.0	16	W ORANGE
126	0.250	100.0	3	MINOT

Appendix F

Definitions

Management Terms

SSP Master Plan – A document that provides complete breeding and transfer recommendations for a Species Survival Plan (SSP®) population. The document is based on genetic and demographic analyses with consideration of behavioral, social, and institutional wants and needs. A draft of the Master Plan must be published in the Members Only section of the AZA Web site for a 30-day comment period. After the Coordinator incorporates/responds to institutional comments, a final version of the Master Plan must be published in the Members Only section of the AZA Web site. SSP Participation by AZA institutions is required.

Full Participation – AZA policy stating that all AZA accredited institutions and certified related facilities having an SSP animal in their collection are required to participate in the SSP partnership process and abide by the recommendations of the SSP.

Population Management Plan (PMP)– A document that provides complete breeding and transfer recommendations for a PMP population. The document is based on genetic and demographic analyses with consideration of behavioral, social, and institutional wants and needs. A draft of the PMP must be published in the Members Only section of the AZA Web site for a 30-day comment period. After the PMP Manager incorporates/responds to institutional comments, a final version of the PMP must be published in the Members Only section of the AZA Web site. PMP Participation by AZA institutions is voluntary.

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.

Ix, 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, V_x .

Appendix G

Directory of Institutional Representatives

Contact Name (IR)	Institution	E-mail
Lori Perkins (IL)	ATLANTA - Zoo Atlanta, Atlanta, GA	lperkins@zooatlanta.org
Tim Snyder	BIRMINGHAM - Birmingham Zoo, Birmingham, AL	tsnyder@birminghamzoo.com
Michelle Smurl (IL)	BREVARD - Brevard Zoo, Melbourne, FL	msmurl@brevardzoo.org
Gerald Aquilina	BUFFALO - Buffalo Zoological Gardens, Buffalo, NY	gdaquilina@aol.com
Michael Wells	BUSCH TAM - Busch Gardens, Tampa, FL	Mike.Wells@BuschGardens.com
David Oehler	CINCINNAT - Cincinnati Zoo & Botanical Garden, Cincinnati, OH	david.oehler@cincinnati-zoo.org
Tracy Leeds (IL)	COLO SPRG - Cheyenne Mtn Zoological Park, Colorado Springs, CO	tleeds@cmzoo.org
Mitch Berg	COLUMBUS - Columbus Zoo and Aquarium, Powell, OH	mitch.berg@columbuszoo.org
Sherry Mossbarger	DALLAS - Dallas Zoo, Dallas, TX	sherry.mossbarger@dallascityhall.com
Cindy DiGesualdo	DALLAS WA - Dallas World Aquarium, Dallas, TX	vetcindy@dwazoo.com
John Azua	DENVER - Denver Zoological Gardens, Denver, CO	jazua@denverzoo.org
John Collette	DICKERSON - Dickerson Park Zoo, Springfield, MO	jcollette@dickersonparkzoo.org
Keith Lovett	DREHER PA - Palm Beach Zoo at Dreher Park, West Palm Beach, FL	klovett@palmbeachzoo.org
Chris Holmes	HOUSTON - Houston Zoo, Inc., Houston, TX	cholmes@houstonzoo.org
Robin Lentz	JACKSONVL - Jacksonville Zoo and Gardens, Jacksonville, FL	lentzr@jacksonvillezoo.org
Liz Harmon	KANSASCTY - Kansas City Zoo, Kansas City, MO	lizharmon@fotzkc.org
Susie Kasielke	LOSANGELE - Los Angeles Zoo & Botanical Gardens, Los Angeles, CA	Susie.Kasielke@lacity.org
Sarah Schoenberg	MINOT - Roosevelt Park Zoo, Minot, ND	sarahrpz@srt.com
Victor Alm	OAKLAND - Oakland Zoo, Oakland, CA	victor@oaklandzoo.org
Bob Lastovica	OMAHA - Omaha's Henry Doorly Zoo, Omaha, NE	birds@omahazoo.com
Julie Ensor	ORLANDO - Sea World Orlando, Orlando, FL	Julie.ENSOR@Seaworld.com
Cindy Norton (IL)	PARAMUS - Bergen County Zoological Park, Paramus, NJ	CNorton@co.bergen.nj.us
Steve Sarro	PITTS CA - National Aviary in Pittsburgh, Pittsburgh, PA	steve.sarro@aviary.org
Shawn St. Michael	PORTLAND - Oregon Zoo, Portland, OR	Stmichaels@metro.dst.or.us
Peter Shannon	RIO GRAND - Albuquerque Biological Park, Albuquerque, NM	pshannon@cabq.gov
Dave Rimlinger	SANDIEGOZ - Zoological Society of San Diego, San Diego, CA	drimlinger@sandiegozoo.org
Wendy Turner	SEA WORLD - Sea World San Diego, San Diego, CA	wendy.turner@SeaWorld.com
Laura Arriaga	SOUTHBEND - Potawatomi Zoo, South Bend, IN	larriaga@southbendin.gov
Ted Fox (IL)	SYRACUSE - Rosamond Gifford Zoo at Burnet Park, Syracuse, NY	henryfox@ongov.net
Maggie Liguori (IL)	W ORANGE - Turtle Back Zoo, West Orange, NJ	coffeyfrogs@yahoo.com