

2009 Population Management Plan for the buff crested bustard

2009 Population Management Plan for the Buff-crested bustard

Eupodotis ruficrista

Population Manager and International Studbook Keeper

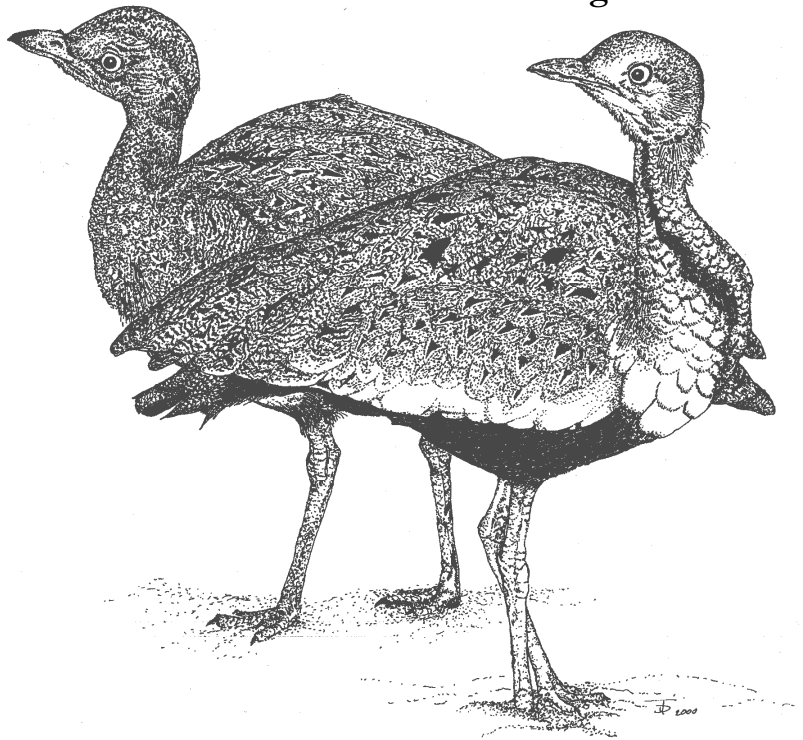
Sara Hallager

Smithsonian National Zoological Park

SPMAG Advisor

Jonathan Ballou

Smithsonian National Zoological Park



**ASSOCIATION
OF ZOOS &
AQUARIUMS**



Smithsonian
National Zoological Park

Recommendations proposed by this PMP are non-binding and participation is voluntary

Executive Summary

Breeding and Transfer Recommendations for BUFF-CRESTED BUSTARD (*Eupodotis ruficrista gindiana*) Population Management Plan for 2009

Report compiled under Population Management 2000, version 1.213

The last Breeding and Transfer Recommendations for this species were completed February 2005.

➤ Sara Hallager Species Coordinator & Studbook Keeper
Smithsonian National Zoological Park
Phone 202 633 3088
Email hallagers@si.edu

➤ Jonathan Ballou
SPMAG Advisor
Smithsonian National Zoological Park
Phone 202 633 4183
Email ballouj@si.edu

Current Population

N = 37 animals (19 males; 17 females; 1 unknown) at 14 institutions.

The 2009 Population Management Plan (PMP) for buff-crested bustards provides genetic and demographic analysis of the captive population of buff-crested bustards in the United States. The buff-crested bustard PMP includes information that can be used to determine pairings, prevent inbreeding and maintain genetic diversity.

The Gruiformes Taxon Advisory Group 2007 Space Survey indicated holding spaces for as many as 75 birds. Current capacity however is at 50 birds.

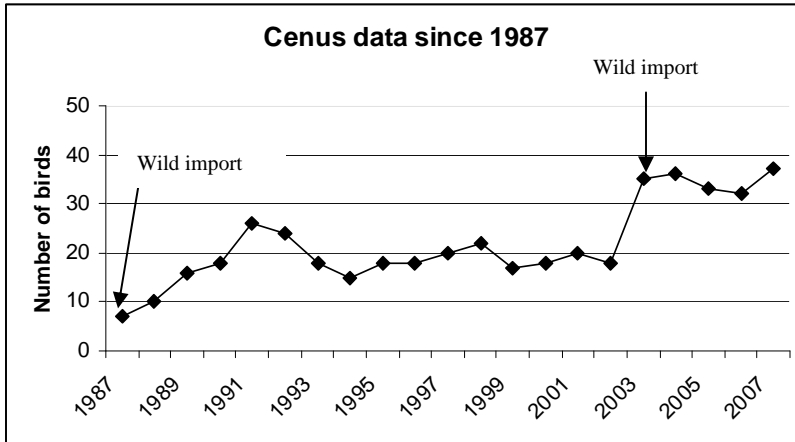
Demographic Summary Table:

Current size of managed population	37 (19.17.1)
# Specimens excluded from management	0
Mean generation time	8.8 years
Potential population growth rate	1.037
# Births in past year	5
# Deaths in past year	3

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*

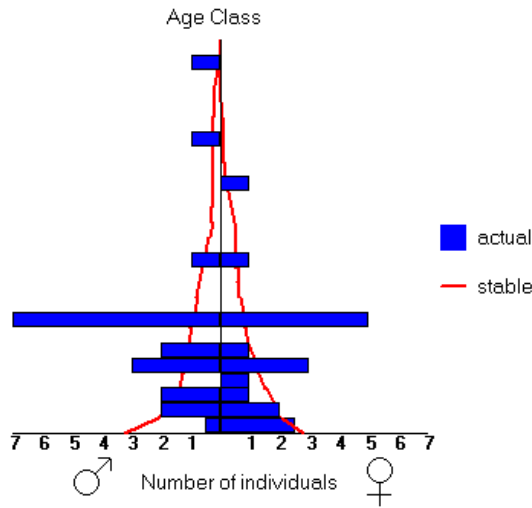
2009 Population Management Plan for the buff crested bustard

Buff crested bustards have a short captive history in North American zoos and were first exhibited in 1987. Since breeding began in 1988, 117 births have occurred in the US population. Other than an import of 17 wild birds in 2003, captive births have been the sole source of birds for zoos. The current population of 37 birds is the largest since the population was founded in 1987.



Sufficient demographic data are not available to estimate generation lengths from the studbook. Age of first reproduction in the US is 2 years in both sexes and the oldest known male and female to have bred were 20 year-old birds. Generation length is

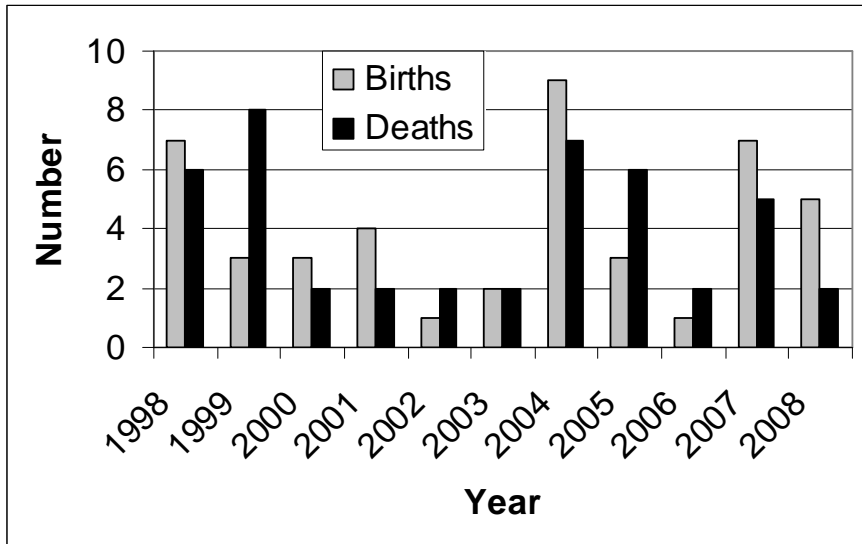
assumed to be less than the midpoint of these two years (i.e. about 8-9 years).



Recommendations proposed by Population Management Plans are non-binding— participation is voluntary.

The number of births and deaths over the past decade has fluctuated widely over the past decade (Fig. 1), making it difficult to predict the number of births needed to grow the population to 50 birds. The average mortality rate over the last five years has been about 11%. Applying this to the current population of 37 birds gives an expected number of deaths in 2009 of 3 to 4 birds. Therefore, 3 to 4 hatches are needed to maintain the population at the current number.

Fig. 1. Births and deaths of buff crested bustards since 1998



Genetic Summary Table:

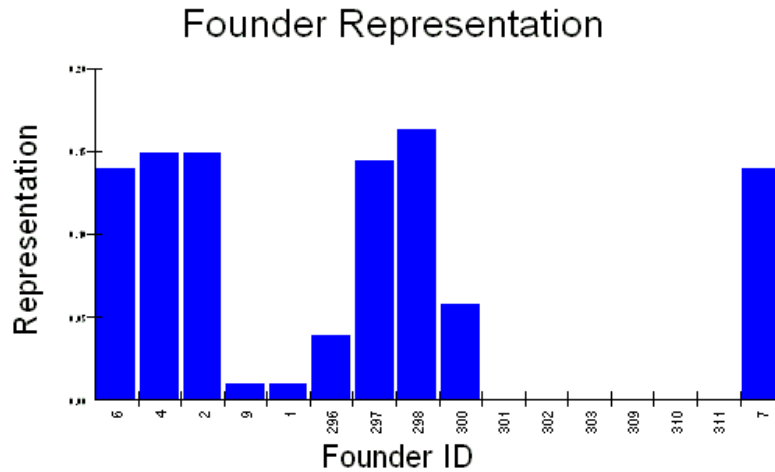
	Current	Potential
Founders	10	6 additional
Founder genome equivalents	5.52	14.32
Founder genome surviving	7.85	14.32
Gene diversity retained	0.91	0.965
Population mean kinship	0.091	0.035
Mean inbreeding	0.024	0.035
Ne / N	0.26	-----
% of pedigree known	100	-----

1. The current PMP population is descended from 10 founders with 6 additional founders available.
2. Population mean kinship is a measure of the average relatedness among animals in the population. Wild caught birds are not included. On average, individuals are related to each other between cousins and half-sibs so the genetic situation is not

Recommendations proposed by Population Management Plans are non-binding— participation is voluntary.

particularly good. Fortunately, some of the recently imported birds have begun to breed, so the mean kinship should improve in the next few years.

3. 91% of the gene diversity of the wild population is retained in the captive population. Captive breeding goals often set objectives of 90% or higher, so the population is currently just above this level. If genetic management was “ideal”, 97% of the wild gene diversity could be retained. Gene diversity increased since the publication of the last PMP due to the breeding of several recently imported birds.
4. The founder genome equivalent of 5.52 represents the genetic equivalent of 5.52 wild caught and unrelated birds. Under ideal genetic management, the potential founder genome equivalent could be as high as 14.32.



Recommendations proposed by Population Management Plans are non-binding— participation is voluntary.

Table 1
Summary of Breeding and Transfer Recommendations

ID	Location	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
310	BIRMINGHM	B03002	M	7	HOLD	BIRMINGHM	BREED WITH	311	
311	BIRMINGHM	B03003	F	7	HOLD	BIRMINGHM	BREED WITH	310	
70	CINCINNAT	204022	F	11	HOLD	CINCINNAT	DO NOT BREED		RESULTING OFFSPRING F=0.1875
313	CINCINNAT	204021	M	5	HOLD	CINCINNAT	DO NOT BREED		RESULTING OFFSPRING F=0.1875
336	COLUMBIA	9935	F	1	HOLD	COLUMBIA			336 & 209 ARE A GOOD GENETIC MATCH
209	COLUMBUS	106011	M	11	HOLD	COLUMBUS			336 & 209 ARE A GOOD GENETIC MATCH
6	DALLAS	874884	M	24	HOLD	DALLAS	BREED WITH	325, 342	
296	DALLAS	03E639	M	7	HOLD	DALLAS	BREED WITH	325, 342	
325	DALLAS	05F906	F	3	HOLD	DALLAS	BREED WITH	6, 296	
342	DALLAS	08J116	F	0	HOLD	DALLAS	NO REC.		
343	DALLAS	08J327	U	0					SEX BIRD > PLACEMENT DEPENDENT ON SEX OF BIRD
321	DENVER	A08139	M	4	HOLD	DENVER			
47	FRESNO	6787	F	16	HOLD	FRESNO	BREED WITH	303	
303	FRESNO	280161	M	7	HOLD	FRESNO	BREED WITH	47	
300	HOUSTON	20386	F	7	HOLD	HOUSTON	BREED WITH	324	
324	HOUSTON	22130	M	4	HOLD	HOUSTON	BREED WITH	300	
345	HOUSTON	24167	M	1	SEND TO	PHILIDELPHIA			
320	METROZOO	B80265	F	4	HOLD	METROZOO	DO NOT BREED		RESULTING OFFSPRING F=0.1875
334	METROZOO	B80045	M	2	HOLD	METROZOO	DO NOT BREED		RESULTING OFFSPRING F=0.1875
332	RIO GRAND	B08023	M	2	HOLD	RIO GRAND	BREED WITH	339	BREED ONLY FOR

Recommendations proposed by Population Management Plans are non-binding— participation is voluntary.

2009 Population Management Plan for the buff crested bustard

										DEMOGRAPHIC NEEDS (OFFSPRING F=0.0625) BREED ONLY FOR DEMOGRAPHIC NEEDS (OFFSPRING F=0.0625)
339	RIO GRAND	B08032	F	1	HOLD	RIO GRAND	BREED WITH	332		
23	SAN ANTON	L01067	M	19	HOLD	SAN ANTON	BREED WITH	298		
297	SAN ANTON	M03017	M	7	HOLD	SAN ANTON	BREED WITH	298, 314, 333, 344		
298	SAN ANTON	M03018	F	7	HOLD	SAN ANTON	BREED WITH	297, 323		
314	SAN ANTON	M04041	F	5	HOLD	SAN ANTON	BREED WITH	297, 323		
323	SAN ANTON	A06041	M	4	HOLD	SAN ANTON	BREED WITH	298, 314, 333, 344		
333	SAN ANTON	U07001	F	2	HOLD	SAN ANTON	BREED WITH	297, 323		
341	SAN ANTON	A08069	M	1	SEND TO					TBD
344	SAN ANTON	L08063	F	0	HOLD	SAN ANTON	BREED WITH	297, 323		
277	SD-WAP	801265	M	7	HOLD	SD-WAP	DO NOT BREED			NEGATIVE CHANGE IN GD IF BRED TO 315 OR 319
309	SD-WAP	805018	M	7	HOLD	SD-WAP	BREED WITH	319,315		
315	SD-WAP	805065	F	4	HOLD	SD-WAP	BREED WITH	309		
319	SD-WAP	804176	F	4	HOLD	SD-WAP	BREED WITH	309		
294	ST LOUIS	101992	F	7	HOLD	ST LOUIS	DO NOT BREED			RESULTING OFFSPRING F=0.125
312	ST LOUIS	103526	M	5	HOLD	ST LOUIS	DO NOT BREED			RESULTING OFFSPRING F=0.125
301	WILD WRLD	7012	M	7	HOLD	WILD WRLD	BREED WITH	302		
302	WILD WRLD	7013	F	7	HOLD	WILD WRLD	BREED WITH	301		

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*

2009 Population Management Plan for the buff crested bustard

BIRMINGHAM

Birmingham Zoo
Birmingham, AL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
310	B03002	M	7	HOLD	BIRMINGHAM	BREED WITH	311	
311	B03003	F	7	HOLD	BIRMINGHAM	BREED WITH	310	

CINCINNAT

Cincinnati Zoo & Botanical Garden
Cincinnati, OH

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
70	204022	F	11	HOLD	CINCINNAT	DO NOT BREED		SEE TABLE 1
313	204021	M	5	HOLD	CINCINNAT	DO NOT BREED		SEE TABLE 1

COLUMBIA

Riverbanks Zoo and Garden
Columbia, SC

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
336	9935	F	1	HOLD	COLUMBIA			

COLUMBUS

Columbus Zoo and Aquarium
Powell, OH

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
209	106011	M	11	HOLD	COLUMBUS			

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*

2009 Population Management Plan for the buff crested bustard

DALLAS

Dallas Zoo
Dallas, TX

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
6	874884	M	24	HOLD	DALLAS	BREED WITH	342, 325	
296	03E639	M	7	HOLD	DALLAS	BREED WITH	342, 325	
325	05F906	F	3	HOLD	DALLAS	BREED WITH	6, 296	
342	08J116	F	0	HOLD	DALLAS			
343	08J327	U	0	SEND TO		SEX BIRD > PLACEMENT TBD		

DENVER

Denver Zoological Gardens
Denver, CO

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
321	A08139	M	4	HOLD	DENVER			

FRESNO

Chaffee Zoological Gardens of Fresno
Fresno, CA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
47	6787	F	16	HOLD	FRESNO	BREED WITH	303	
303	280161	M	7	HOLD	FRESNO	BREED WITH	47	

HOUSTON

Houston Zoo, Inc.
Houston, TX

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
300	20386	F	7	HOLD	HOUSTON	BREED WITH	324	
324	22130	M	4	HOLD	HOUSTON	BREED WITH	300	
345	24167	M	1	SEND TO	PHILIDELPHIA			

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*

2009 Population Management Plan for the buff crested bustard

METROZOO

Miami Metrozoo
Miami, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
320	B80265	F	4	HOLD	METROZOO	DO NOT BREED		SEE TABLE 1
334	B80045	M	2	HOLD	METROZOO	DO NOT BREED		SEE TABLE 1

RIO GRAND

Albuquerque Biological Park
Albuquerque, NM

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
332	B08023	M	2	HOLD	RIO GRAND	BREED WITH	339	SEE TABLE 1
339	B08032	F	1	HOLD	RIO GRAND	BREED WITH	332	SEE TABLE 1

SAN ANTON

San Antonio Zoological Gardens & Aqua
San Antonio, TX

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
23	L01067	M	19	HOLD	SAN ANTON	BREED WITH	298	
297	M03017	M	7	HOLD	SAN ANTON	BREED WITH	298, 314, 333, 344	
298	M03018	F	7	HOLD	SAN ANTON	BREED WITH	297, 323	
314	M04041	F	5	HOLD	SAN ANTON	BREED WITH	297, 323	
323	A06041	M	4	HOLD	SAN ANTON	BREED WITH	298, 314, 333, 344	
333	U07001	F	2	HOLD	SAN ANTON	BREED WITH	297, 323	
341	A08069	M	1	SEND TO	TBD			
344	L08063	F	0	HOLD	SAN ANTON	BREED WITH	297, 323	

Recommendations proposed by Population Management Plans are non-binding— participation is voluntary.

2009 Population Management Plan for the buff crested bustard

SD-WAP

San Diego Wild Animal Park

Escondido, CA

Institutional contact/representative: Mike Mace

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
277	801265	M	7	HOLD	SD-WAP	DO NOT BREED		SEE TABLE 1
309	805018	M	7	HOLD	SD-WAP	BREED WITH	319,315	
315	805065	F	4	HOLD	SD-WAP	BREED WITH	309	
319	804176	F	4	HOLD	SD-WAP	BREED WITH	309	

ST LOUIS

Saint Louis Zoological Park

St. Louis, MO

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
294	101992	F	7	HOLD	ST LOUIS	DO NOT BREED		SEE TABLE 1
312	103526	M	5	HOLD	ST LOUIS	DO NOT BREED		SEE TABLE 1

WILD WRLD

Wildlife World Zoo

Litchfield Park, AZ

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
301	7012	M	7	HOLD	WILD WRLD	BREED WITH	302	
302	7013	F	7	HOLD	WILD WRLD	BREED WITH	301	

PHILIDELPHIA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
345	24167	M	1	RECEIVE FROM	HOUSTON			

Recommendations proposed by Population Management Plans are non-binding— participation is voluntary.

Appendix 1: Life Table data for males and females

Q_x = mortality; P_x = survival; L_x = cumulative survivorship; M_x = fecundity; V_x = expected future reproduction

Age	Males					Females				
	Q _x	P _x	L _x	M _x	V _x	Q _x	P _x	L _x	M _x	V _x
0	0.410	0.590	1.000	0.000	1.258	0.290	0.710	1.000	0.000	1.170
1	0.190	0.810	0.590	0.010	1.938	0.150	0.850	0.710	0.000	1.581
2	0.190	0.810	0.478	0.110	2.463	0.050	0.950	0.604	0.160	1.832
3	0.070	0.930	0.387	0.210	2.820	0.160	0.840	0.573	0.300	1.937
4	0.040	0.960	0.360	0.230	2.860	0.070	0.930	0.482	0.170	1.929
5	0.050	0.950	0.346	0.270	2.849	0.120	0.880	0.448	0.320	2.015
6	0.000	1.000	0.328	0.500	2.740	0.150	0.850	0.394	0.330	2.033
7	0.070	0.930	0.328	0.360	2.402	0.000	1.000	0.335	0.230	1.924
8	0.130	0.870	0.305	0.280	2.345	0.120	0.880	0.335	0.150	1.871
9	0.000	1.000	0.266	0.300	2.297	0.090	0.910	0.295	0.360	1.999
10	0.140	0.860	0.266	0.320	2.222	0.050	0.950	0.268	0.200	1.831
11	0.120	0.880	0.228	0.130	2.264	0.000	1.000	0.255	0.370	1.738
12	0.140	0.860	0.201	0.490	2.537	0.000	1.000	0.255	0.150	1.421
13	0.330	0.670	0.173	1.170	2.743	0.000	1.000	0.255	0.520	1.319
14	0.000	1.000	0.116	0.000	2.029	0.140	0.860	0.255	0.100	0.892
15	0.000	1.000	0.116	0.260	2.099	0.200	0.800	0.219	0.130	0.988
16	0.000	1.000	0.116	0.260	1.904	0.290	0.710	0.175	0.250	1.173
17	0.000	1.000	0.116	0.260	1.701	0.500	0.500	0.124	0.420	1.538
18	0.000	1.000	0.116	0.520	1.491	0.000	1.000	0.062	0.610	1.742
19	0.000	1.000	0.116	0.000	1.005	0.000	1.000	0.062	0.000	1.175
20	0.000	1.000	0.116	1.040	1.040	0.000	1.000	0.062	1.220	1.220
21	0.000	1.000	0.116	0.000	0.000	1.000	0.000	0.062	0.000	0.000
22	0.000	1.000	0.116	0.000	0.000	1.000	0.000	0.000	0.000	0.000
23	0.000	1.000	0.116	0.000	0.000	1.000	0.000	0.000	0.000	0.000
24	1.000	0.000	0.116	0.000	0.000	1.000	0.000	0.000	0.000	0.000
25	1.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000

Projected population growth rates

Males: $r = 0.0343$; $\lambda = 1.0349$; $R_0 = 1.375$; $T = 9.29$

Females: $r = 0.0375$; $\lambda = 1.0383$; $R_0 = 1.364$; $T = 8.25$

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*

Appendix 2: Ordered mean kinships

Males						Females					
Rank	Stbk#	MK	Known	Age	Location	Rank	Stbk#	MK	Known	Age	Location
1	301	0.0000	100.0	7	WILD WRLD	1	302	0.0000	100.0	7	WILD WRLD
2	303	0.0000	100.0	7	FRESNO	2	311	0.0000	100.0	7	BIRMINGHM
3	309	0.0000	100.0	7	SD-WAP	3	300	0.0289	100.0	7	HOUSTON
4	310	0.0000	100.0	7	BIRMINGHM	4	342	0.0637	100.0	0	DALLAS
5	296	0.0192	100.0	7	DALLAS	5	336	0.0745	100.0	1	COLUMBIA
6	209	0.0541	100.0	11	COLUMBUS	6	298	0.0817	100.0	7	SAN ANTON
7	6	0.0697	100.0	24	DALLAS	7	47	0.0841	100.0	16	FRESNO
8	297	0.0721	100.0	7	SAN ANTON	8	294	0.0841	100.0	7	ST LOUIS
9	332	0.0745	100.0	2	RIO GRAND	9	314	0.0865	100.0	5	SAN ANTON
10	345	0.0745	100.0	1	HOUSTON	10	315	0.0865	100.0	4	SD-WAP
11	323	0.0793	100.0	4	SAN ANTON	11	333	0.0865	100.0	2	SAN ANTON
12	341	0.0865	100.0	1	SAN ANTON	12	344	0.0865	100.0	0	SAN ANTON
13	23	0.0889	100.0	19	SAN ANTON	13	325	0.0889	100.0	3	DALLAS
14	324	0.1010	100.0	4	HOUSTON	14	339	0.0950	100.0	1	RIO GRAND
15	277	0.1070	100.0	7	SD-WAP	15	70	0.1070	100.0	11	CINCINNAT
16	334	0.1106	100.0	2	METROZOO	16	319	0.1130	100.0	4	SD-WAP
17	313	0.1130	100.0	5	CINCINNAT	17	320	0.1130	100.0	4	METROZOO
18	321	0.1130	100.0	4	DENVER						
19	312	0.1178	100.0	5	ST LOUIS						

Ordered Mean Kinships for Unknown sex animals

Rank	Stbk#	MK	Known	Age	Location
1	343	0.0637	100.0	0	DALLAS

Mean Kinship (MK) is a measurement of the average relatedness of an individual to all individuals in the living descendant population. The more common the genes of the bird, the more related it is to everyone in the population and the higher its MK. The lower the MK, the less related. By breeding birds with low MK, we can increase the frequency of their genes within the population, thus increasing gene diversity.

Recommendations proposed by Population Management Plans are non-binding— participation is voluntary.

Institutional representatives

BIRMINGHAM

Birmingham Zoo
2630 Cahaba Rd.
Birmingham, AL 35223
Phone: (205)879-0409 x251
Email: Cpinger@birminghamzoo.com
Contact person: Cindy Pinger

CINCINNAT

Cincinnati Zoo & Botanical Garden
3400 Vine St.
Cincinnati, OH 45220-1399
Phone: (513)475-6153
Email: David.Oehler@fuse.net
Contact person: David Oehler

COLUMBUS

Columbus Zoo and Aquarium
PO Box 400
Powell, OH 43065
Phone: 614 645 3400
Email: Kelly.Vineyard@columbuszoo.org
Contact person: Kelly Vineyard

COLUMBIA

Riverbanks Zoo and Garden
500 Wildlife Parkway
Columbia SC 28202
Phone: 803 779 8717x 1159
Email: mvince@riverbanks.org
Contact person: Martin Vince

DALLAS

Dallas Zoo
650 South R.L. Thornton Freeway
Dallas, TX 75203-3013
Phone: (214)670-6839
Email: Chris.Brown@dallascityhall.com
Contact person: Chris Brown

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*

DENVER

Denver Zoological Gardens
2300 Steele St
Denver CO 80205
Phone: (303)376-4914
Email: jazua@denverzoo.org
Contact person: John Azua

FRESNO

Chaffee Zoological Gardens of Fresno
894 W Belmont Ave.
Fresno, CA 93728-2891
Phone: (559)621-5700
Email: asnider@fresnochaffeezoo.com
Contact person: Andy Snider

HOUSTON

The Houston Zoo
1513 N MacGregor
Houston, TX 77030-1603
Phone: (713)533-6525
Email: Hbailey@houstonzoo.org
Contact person: Hannah Bailey

METROZOO

Miami Metrozoo
12400 SW 152nd St
Miami FL 33177
Phone: (315) 251 0400x251
Email: JDUN@miamidade.gov
Contact person: Jim Dunster

PHILADELPHIA

Philadelphia Zoo
3400 West Girard Ave
Philadelphia PA 19104
Phone 215 243 5368
Email: Baltz.Aliza@phillyzoo.org
Contact person: Aliza Baltz

RIO GRAND

Albuquerque Biological Park
902 10th St SW
Albuquerque NM 87102
Phone: 505 764 6258

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*

2009 Population Management Plan for the buff-crested bustard

Email: phoenicops@aol.com
Contact person: Peter Shannon

SAN ANTON

San Antonio Zoological Gardens & Aquarium
3903 N. St. Mary's Street
San Antonio, TX 78212-3199
Phone: (210)734-7184
Email: curbirds@sazoo-aq.org
Contact person: Josef San Miquel

SD-WAP

San Diego Wild Animal Park
15500 San Pasqual Valley Rd
Escondido, CA 92027
Phone: (619)738-5077
Email: mmace@sandiegozoo.org
Contact person: Mike Mace

ST LOUIS

Saint Louis Zoological Park
1 Government Dr.
St. Louis, MO 63110-1395
Phone: (314)781-0900 x362
Email: Macek@stlzoo.org
Contact person: Mike Macek

WILD WRLD

Wildlife World Zoo
Northern Ave. at State Route 303
Litchfield Park, AZ 85340-9466
Phone: (623)935-9453
Email: jackewert@wildlifeworld.com
Contact person: Jack Ewert

*Recommendations proposed by Population Management Plans are non-binding—
participation is voluntary.*