

# Population Analysis and Breeding Plan

## **Grey-winged Trumpeter**

*Psophia crepitans*

## **Population Management Plan**



### **POPULATION MANAGER**

**Regional Studbook Keeper**

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### **PMC/SPMAG ADVISOR**

**Colleen Lynch, AZA Population Management Center**

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**PMC**

American Zoo and Aquarium Association  
Population Management Center

Lincoln Park  
Zoo

ASSOCIATION  
OF ZOOS &  
AQUARIUMS

## Executive Summary

# Population Management Plan for Grey-winged Trumpeter

The Gruiformes Taxon Advisory Group has designated grey-winged trumpeters to be managed as a PMP with a target size of 100 specimens (2008 RCP in draft). The population is currently 45 distributed among 19 institutions.

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, smaller clutch sizes, and greater neonatal mortality. Gene diversity is currently 91%; GD is expected to be 37% at 100 years from present. Increases in population effective size and potential founder recruitment result in projections as high as 70% GD at 100 years.

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### DEMOGRAPHY

|  |                    |
|--|--------------------|
| Current Population Size (N)                    | 45                 |
| Specimens Excluded from Analyses               | 4                  |
| Target Population Size                         | 100 (RCP in draft) |
| Mean Generation Time (T, in years)             | 7.03               |
| Projected Population Growth Rate ( $\lambda$ ) | 1.05               |

### GENETICS\*

|  | <i>Current</i> | <i>Potential</i> |
|--|----------------|------------------|
| Number of Founders                           | 12             | 10               |
| Founder Genome Equivalents                   | 5.93           | 16.95            |
| Gene Diversity Retained (%)                  | 91.57          | 97.05            |
| Population Mean Kinship                      | 0.0843         |                  |
| Mean Inbreeding (F)                          | 0.00           |                  |
| % Known Pedigree                             | 64.7           | 96.6             |
| $N_e/N$                                      | 0.09           | 0.30             |
| Years To 90% Gene Diversity                  | 0              | 2                |
| Gene Diversity at 100 Years From Present (%) | 37             | 70               |

\*statistics calculated from the analytical studbook

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**Special Concerns:** The population contains several individuals with unknown pedigree specimens. Some of these specimens have been removed from the breeding pool as a result. Any information that holding institutions supply regarding unknown pedigrees will be incorporated into the analytical studbook and utilized in the next round of population management planning. Please send any pertinent information directly to the studbook keeper, [Shawn.Pedersen@Zoo.org](mailto:Shawn.Pedersen@Zoo.org).

As with SSP populations, pairings recommended for this population are prioritized to maintain or increase gene diversity through considerations of mean kinship, avoidance of inbreeding and differences in sire and dam mean kinships. In the interest of demographic stability some over-represented proven breeders continue to receive breeding recommendations. The number of breeding recommendations is intended to grow the population to the target size of 100 over the next 15 years.

**Summary Actions:** The PMP recommends 12 transfers and 16 breeding pairs. The PMP also recommends that all paired birds, including those not recommended for current breeding, be maintained under conditions conducive to breeding. Pairs should be encouraged to engage in courtship, nesting and incubating behaviors. Low rates of pairing success presents a significant challenge to the maintenance of this population; it is hoped that encouraging these behaviors will facilitate breeding if/when these animals can be placed in more genetically suitable pairings in the future.

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## Population Manager

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**This plan was prepared and distributed with the assistance of the  
AZA Population Management Center.**

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# Description of Population Status

**Introduction:** The Gruiformes Taxon Advisory Group has designated grey-winged trumpeters to be managed as a PMP with a target size of 100 specimens (2008 RCP in draft). Genetic and demographic analyses of the population were performed in April 2008 resulting in the current Population Management Plan. Analyses were performed on the analytical (XX) version of the North American Regional Grey-winged Trumpeter Studbook (current to 17 Feb 2008) using POPLINK 1.25 and PM2000 1.213. The goal of these recommendations is to insure the genetic and demographic health of the population. Recommendations proposed in a Population Management Plan are non-binding; participation is voluntary.

**Managed Population:** The current population is 45 distributed among 19 institutions. The following animals were excluded from the potential breeding population: SBs# 312, 391, 393 (pedigree <50% known).

**Special Concerns:** The population contains several individuals with unknown pedigree specimens. Many of these specimens have been removed from the breeding pool as a result. Any information that holding institutions supply regarding unknown pedigrees will be incorporated into the analytical studbook and utilized in the next round of population management planning. Please send any pertinent information directly to the studbook keeper, [Shawn.Pedersen@Zoo.org](mailto:Shawn.Pedersen@Zoo.org).

**Demography:** The grey-winged trumpeters were first exhibited in North America in 1905 but were held only sporadically until 1980; it was not until the mid 1980s that captive hatches occurred in any significant numbers. The population's failure to maintain consistent hatch rates over the past decade is of some concern. It is unknown at this time whether the failure of this population to maintain its size is due to an inability to propagate the species or simply due to the species not being the focus of propagation efforts. Institutions receiving breeding recommendations are asked to make serious attempts to achieve successful reproduction; it is hoped that such efforts will result in consistent growth rates and the population will begin to move toward the recommended target size and the large number of requests for additional specimens can be filled.

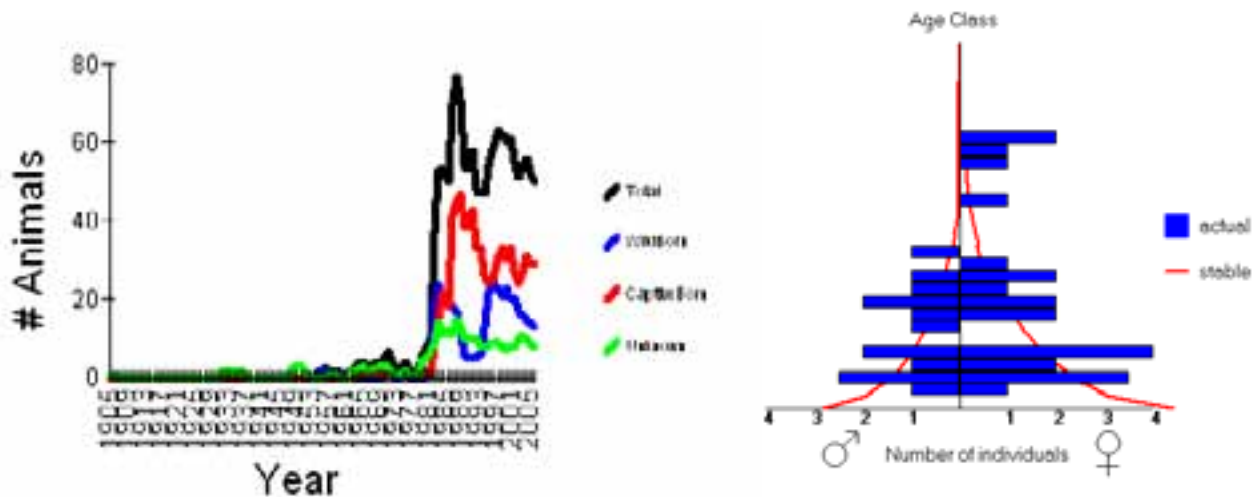


Figure 1. Population census.

Figure 2 Age structure in the PMP.

Demographic data for this population is lacking as a result of small population size combined with a short history of breeding in captivity. Captive trumpeter populations in general lack data regarding life span, reproductive span, and vital rates. Model data sets for similar species are also unavailable or limited. Lifespan may be greater than 30 years. The oldest living grey-winged trumpeter is currently 21 but historic records include animals as old as 28 years. Chick mortality is moderate with less than 36% of chicks failing to survive their first year.

The age distribution (Figure 2) deviates from a stable one with several empty age classes and a disproportionate number of individuals in the middle age classes relative to younger ones. This distribution illustrates a decrease in population growth rates as importations have slowed, attrition of the aging wild caught

specimens has increased, and captive propagation has not increased at a compensatory rate. The sex ratio is female biased (18.28.1). Reproduction has been recorded in animals from the ages of one to 15 years; some reproduction in the earliest age classes may be an artifact of data entry conventions assuming wild caught birds to be one year of age at time of capture.

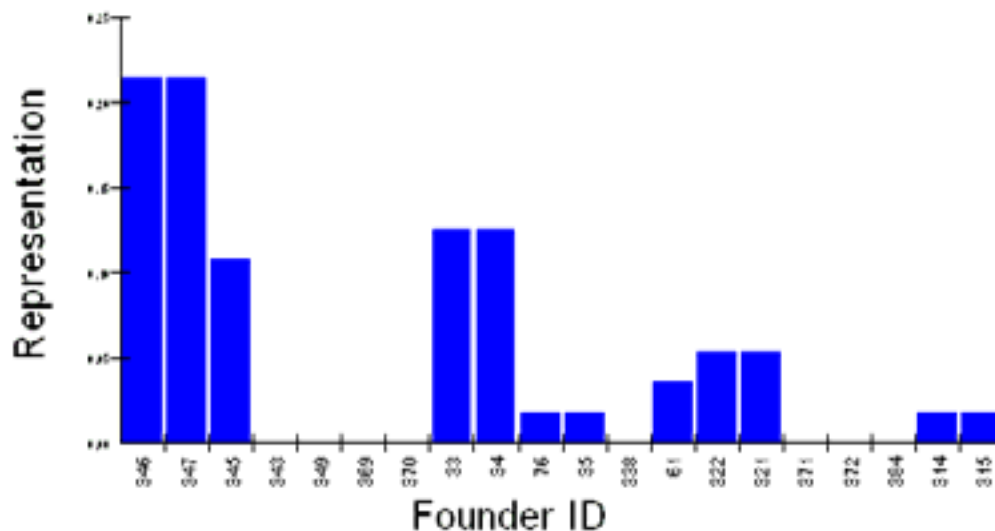
**Genetics:** The population is descended from 12 founders, with 8 potential founders remaining in the living population. However, all of these potential founders are currently over the age of eight years.

| <b>GENETICS</b>                              |                |                  |
|--|----------------|------------------|
|  | <b>Current</b> | <b>Potential</b> |
| Number of Founders                           | 12             | 10               |
| Founder Genome Equivalents                   | 5.93           | 16.95            |
| Gene Diversity Retained (%)                  | 91.57          | 97.05            |
| Population Mean Kinship                      | 0.0843         |                  |
| Mean Inbreeding (F)                          | 0.00           |                  |
| % Known Pedigree                             | 64.7           | 96.6             |
| $N_e/N$                                      | 0.09           | 0.30             |
| Years To 90% Gene Diversity                  | 0              | 2                |
| Gene Diversity at 100 Years From Present (%) | 37             | 70               |

\*projections are calculated using the analytical studbook

Gene diversity (GD) in the population (91%) is low relative to the average SSP (93%); potential gene diversity is very high at 97%. Long-term projections indicate that given current population parameters and a target population size of 100, GD is likely to be as low as 37% in 100 years. Potential founder recruitment could lessen rates of GD loss.

Several potential founders remain in the population and efforts to recruit them as breeders should be made if they can be well paired. Perhaps as critical as potential founder recruitment to gene diversity retention in grey-winged trumpeters is the population effective size. Currently  $N_e/N$  in this population is 0.09, much lower than values close to 0.3 typically seen in monogamous breeders. Increasing the proportion of breeders in the population to 0.3, even in the absence of further potential founder recruitment, increases projected GD at 100 years to 70%.



**Figure 3** Founder representation in the pmp illustrating the large number of potential founders..

**Management Strategy:** Eleven hatches are required in the coming year to maintain the current population size. An annual growth rate of 5% ( $\lambda = 1.05$ ) is projected to result in the population target size (100) in approximately 15 years and requires 14 hatches in the coming year. Unfortunately, given skewed sex ratio and unknown pedigrees, only 16 pairs could be recommended.

Parent rearing is considered to be an important factor in the future breeding success of grey-winged trumpeters. Double-clutching is encouraged in cases where multiple clutches can be obtained without excluding parent rearing.

Recommended pairings include some over-represented specimens in the interest of demographic stability. The only animals not recommended to breed are previously excluded individuals, sibling pairs, and females for which males are unavailable due to the sex ratio bias.

1. Recommend 16 pairings to produce at least 11 offspring in the coming year. Double clutches should be attempted where possible without sacrificing parent rearing.
2. Recommend 12 transfers to create breeding pairs and to fill exhibit requests.
3. Recommend that all paired birds, including those not recommended for current breeding, be maintained under conditions conducive to breeding. Pairs should be encouraged to engage in courtship, nesting and incubating behaviors. Low rates of pairing success presents a significant challenge to the maintenance of this population; it is hoped that encouraging these behaviors will facilitate breeding if/when these animals can be placed in more genetically suitable pairings in the future.

## Summary of Breeding and Transfer Recommendations

| ID  | Location  | Local ID | Sex | Disposition | Location  | Breeding     | With | Notes   |
|-----|-----------|----------|-----|-------------|-----------|--------------|------|---|
| 423 | BIODOME   | 2519     | M   | HOLD        | BIODOME   | BREED WITH   | 196  |   |
| 371 | BIRMINGHM | B01001   | M   | HOLD        | BIRMINGHM | BREED WITH   | 372  |   |
| 372 | BIRMINGHM | B01003   | F   | HOLD        | BIRMINGHM | BREED WITH   | 371  |   |
| 345 | BROWNSVIL | 6339     | M   | HOLD        | BROWNSVIL | BREED WITH   | 351  |   |
| 351 | BROWNSVIL | 6842     | F   | HOLD        | BROWNSVIL | BREED WITH   | 345  |   |
| 357 | BROWNSVIL | 6785     | M   | HOLD        | BROWNSVIL | BREED WITH   | 408  |   |
| 408 | BROWNSVIL | 8676     | F   | HOLD        | BROWNSVIL | BREED WITH   | 357  |   |
| 149 | BROWNSVIL | 3913     | F   | HOLD        | BROWNSVIL | DO NOT BREED |      |   |
| 413 | BROWNSVIL | 8793     | F   | SEND TO     | CALDWELL  | DO NOT BREED |      | females only available at this time                   |
| 414 | BROWNSVIL | 8832     | F   | SEND TO     | CALDWELL  | DO NOT BREED |      | females only available at this time                   |
| 430 | BROWNSVIL | 9657     | M   | SEND TO     | HOUSTON   | BREED WITH   | 286  |   |
| 312 | BUSCH TAM | 57321    | M   | SEND TO     | RIOGRAND  | BREED WITH   | 391  | unknown pedigree – assumed wild caught after analysis |
| 286 | EL PASO   | 921104   | F   | SEND TO     | HOUSTON   | BREED WITH   | 430  |   |
| 343 | HONOLULU  | 970054   | F   | HOLD        | HONOLULU  | BREED WITH   | 349  |   |
| 349 | HONOLULU  | 970228   | M   | HOLD        | HONOLULU  | BREED WITH   | 343  |   |
| 405 | JACKSONVL | 604401   | M   | HOLD        | JACKSONVL | BREED WITH   | 411  |   |
| 411 | JACKSONVL | 605378   | F   | HOLD        | JACKSONVL | BREED WITH   | 405  |   |
| 382 | LOSANGELE | 991167   | M   | HOLD        | LOSANGELE | BREED WITH   | 383  |   |
| 383 | LOSANGELE | 991168   | F   | HOLD        | LOSANGELE | BREED WITH   | 382  |   |
| 428 | METROZOO  | B70327   | M   | HOLD        | METROZOO  | DO NOT BREED |      | sibling pair  |
| 429 | METROZOO  | B70328   | F   | HOLD        | METROZOO  | DO NOT BREED |      | sibling pair  |
| 206 | MILWAUKEE | B3407    | F   | HOLD        | MILWAUKEE | BREED WITH   | 412  |   |
| 412 | MILWAUKEE | B4140    | M   | HOLD        | MILWAUKEE | BREED WITH   | 206  |   |
| 369 | PITTS CA  | 5112     | M   | HOLD        | PITTS CA  | BREED WITH   | 370  | Reported as dead following analysis                   |
| 370 | PITTS CA  | 5113     | F   | HOLD        | PITTS CA  | BREED WITH   | 369  | Hold do not breed due to death of 369                 |

| ID  | Location  | Local ID | Sex | Disposition | Location  | Breeding     | With | Notes   |
|-----|-----------|----------|-----|-------------|-----------|--------------|------|---|
| 391 | RIO GRAND | B01003   | F   | HOLD        | RIO GRAND | BREED WITH   | 312  | unknown pedigree – assumed wild caught after analysis                         |
| 422 | SD-WAP    | 806034   | F   | HOLD        | SD-WAP    | DO NOT BREED |      |   |
| 346 | SEATTLE   | 970075   | M   | HOLD        | SEATTLE   | BREED WITH   | 347  |   |
| 347 | SEATTLE   | 970076   | F   | HOLD        | SEATTLE   | BREED WITH   | 346  |   |
| 395 | SEATTLE   | 200561   | F   | SEND TO     | NASHV ZOO | DO NOT BREED |      | females only available at this time   |
| 401 | SEATTLE   | 201052   | M   | HOLD        | SEATTLE   | BREED WITH   | 353  |   |
| 424 | SEATTLE   | 202055   | F   | SEND TO     | ST LOUIS  | DO NOT BREED |      | RECEIVE ONLY IF 434 IS FEMALE AS IMMEDIATE COMPANION FOR 355                  |
| 427 | SEATTLE   | 202163   | M   | SEND TO     | SEDGWICK  | BREED WITH   | 144  |   |
| 431 | SEATTLE   | 202496   | F   | SEND TO     | NASHV ZOO | DO NOT BREED |      | females only available at this time   |
| 432 | SEATTLE   | 202497   | F   | SEND TO     | SD-WAP    | DO NOT BREED |      |   |
| 434 | SEATTLE   |          | U   | SEND TO     | STLOUIS   | SEE NOTES    |      | SEND ONLY IF MALE - BREED WITH 355  |
| 144 | SEDGWICK  | 9904     | F   | HOLD        | SEDGWICK  | BREED WITH   | 427  |   |
| 353 | ST LOUIS  | 980904   | F   | SEND TO     | SEATTLE   | BREED WITH   | 401  |   |
| 355 | ST LOUIS  | 980905   | F   | HOLD        | ST LOUIS  | SEE NOTES    |      |   |
| 384 | TOLEDO    | 1690     | F   | HOLD        | TOLEDO    | DO NOT BREED |      | extreme MKdiff in this pairing  |
| 385 | TOLEDO    | 1869     | M   | HOLD        | TOLEDO    | DO NOT BREED |      | extreme MKdiff in this pairing  |
| 196 | TORONTO   | 24127    | F   | SEND TO     | BIODOME   | BREED WITH   | 423  |   |
| 338 | TORONTO   | 36778    | M   | HOLD        | TORONTO   | BREED WITH   | 393  |   |
| 393 | TORONTO   | 40995    | F   | HOLD        | TORONTO   | BREED WITH   | 338  | may breed as part of proven pair for demographic reasons - - unknown pedigree |
| 146 | WINNIPEG  | 001007   | F   | HOLD        | WINNIPEG  | BREED WITH   | 396  |   |
| 396 | WINNIPEG  | E00336   | M   | HOLD        | WINNIPEG  | BREED WITH   | 146  |   |

**BIODOME**

**Biodome de Montreal**  
Montreal, Quebec

| ID  | Local ID | Sex | Disposition  | Location | Breeding   | With | Notes |
|-----|----------|-----|--------------|----------|------------|------|-------|
| 423 | 2519     | M   | HOLD         | BIODOME  | BREED WITH | 196  |       |
| 196 | 24127    | F   | RECEIVE FROM | TORONTO  | BREED WITH | 423  |       |

**BIRMINGHM**

**Birmingham Zoo**  
Birmingham, AL

| ID  | Local ID | Sex | Disposition | Location  | Breeding   | With | Notes |
|-----|----------|-----|-------------|-----------|------------|------|-------|
| 371 | B01001   | M   | HOLD        | BIRMINGHM | BREED WITH | 372  |       |
| 372 | B01003   | F   | HOLD        | BIRMINGHM | BREED WITH | 371  |       |

**BROWNSVIL**

**Gladys Porter Zoo**  
Brownsville, TX

| ID  | Local ID | Sex | Disposition | Location  | Breeding     | With | Notes                               |
|-----|----------|-----|-------------|-----------|--------------|------|-------------------------------------|
| 149 | 3913     | F   | HOLD        | BROWNSVIL | DO NOT BREED |      |                                     |
| 345 | 6339     | M   | HOLD        | BROWNSVIL | BREED WITH   | 351  |                                     |
| 351 | 6842     | F   | HOLD        | BROWNSVIL | BREED WITH   | 345  |                                     |
| 357 | 6785     | M   | HOLD        | BROWNSVIL | BREED WITH   | 408  |                                     |
| 408 | 8676     | F   | HOLD        | BROWNSVIL | BREED WITH   | 357  |                                     |
| 413 | 8793     | F   | SEND TO     | CALDWELL  | DO NOT BREED |      | females only available at this time |
| 414 | 8832     | F   | SEND TO     | CALDWELL  | DO NOT BREED |      | females only available at this time |
| 430 | 9657     | M   | SEND TO     | HOUSTON   | BREED WITH   | 286  |                                     |

**BUSCH TAM**

**Busch Gardens**  
Tampa, FL

| ID  | Local ID | Sex | Disposition | Location  | Breeding   | With | Notes   |
|-----|----------|-----|-------------|-----------|------------|------|---|
| 312 | 57321    | M   | SEND TO     | RIO GRAND | BREED WITH | 391  | unknown pedigree - assumed wild caught after analysis |

**CALDWELL**

**Caldwell Zoo**  
Tyler, TX

| ID  | Local ID | Sex | Disposition  | Location  | Breeding     | With | Notes                               |
|-----|----------|-----|--------------|-----------|--------------|------|-------------------------------------|
| 413 | 8793     | F   | RECEIVE FROM | BROWNSVIL | DO NOT BREED |      | females only available at this time |
| 414 | 8832     | F   | RECEIVE FROM | BROWNSVIL | DO NOT BREED |      | females only available at this time |

**EL PASO**

**El Paso Zoo**  
El Paso, TX

| ID  | Local ID | Sex | Disposition | Location | Breeding   | With | Notes |
|-----|----------|-----|-------------|----------|------------|------|-------|
| 286 | 921104   | F   | SEND TO     | HOUSTON  | BREED WITH | 430  |       |

**HONOLULU**

**Honolulu Zoo**  
Honolulu, HI

| ID  | Local ID | Sex | Disposition | Location | Breeding   | With | Notes |
|-----|----------|-----|-------------|----------|------------|------|-------|
| 343 | 970054   | F   | HOLD        | HONOLULU | BREED WITH | 349  |       |
| 349 | 970228   | M   | HOLD        | HONOLULU | BREED WITH | 343  |       |

**HOUSTON**

**Houston Zoo**  
Jacksonville, FL

| ID  | Local ID | Sex | Disposition  | Location  | Breeding   | With | Notes |
|-----|----------|-----|--------------|-----------|------------|------|-------|
| 286 | 921104   | F   | RECEIVE FROM | EL PASO   | BREED WITH | 430  |       |
| 430 | 9657     | M   | RECEIVE FROM | BROWNSVIL | BREED WITH | 286  |       |

**JACKSONVL**

**Jacksonville Zoo and Gardens**  
Jacksonville, FL

| ID  | Local ID | Sex | Disposition | Location  | Breeding   | With | Notes |
|-----|----------|-----|-------------|-----------|------------|------|-------|
| 405 | 604401   | M   | HOLD        | JACKSONVL | BREED WITH | 411  |       |
| 411 | 605378   | F   | HOLD        | JACKSONVL | BREED WITH | 405  |       |

**LOSANGELE**

**Los Angeles Zoo & Botanical Gardens**  
Los Angeles, CA

| ID  | Local ID | Sex | Disposition | Location  | Breeding   | With | Notes |
|-----|----------|-----|-------------|-----------|------------|------|-------|
| 382 | 991167   | M   | HOLD        | LOSANGELE | BREED WITH | 383  |       |
| 383 | 991168   | F   | HOLD        | LOSANGELE | BREED WITH | 382  |       |

**METROZOO**

**Miami Metrozoo**  
Miami, FL

| ID  | Local ID | Sex | Disposition | Location | Breeding     | With | Notes        |
|-----|----------|-----|-------------|----------|--------------|------|--------------|
| 428 | B70327   | M   | HOLD        | METROZOO | DO NOT BREED |      | sibling pair |
| 429 | B70328   | F   | HOLD        | METROZOO | DO NOT BREED |      | sibling pair |

**MILWAUKEE**

**Milwaukee County Zoological Gardens**  
Milwaukee, WI

| ID  | Local ID | Sex | Disposition | Location  | Breeding   | With | Notes |
|-----|----------|-----|-------------|-----------|------------|------|-------|
| 206 | B3407    | F   | HOLD        | MILWAUKEE | BREED WITH | 412  |       |
| 412 | B4140    | M   | HOLD        | MILWAUKEE | BREED WITH | 206  |       |

**NASHV ZOO**

**Nashville Zoo**  
Nashville, TN

| ID  | Local ID | Sex | Disposition  | Location | Breeding     | With | Notes                               |
|-----|----------|-----|--------------|----------|--------------|------|-------------------------------------|
| 395 | 200561   | F   | RECEIVE FROM | SEATTLE  | DO NOT BREED |      | females only available at this time |
| 431 | 202496   | F   | RECEIVE FROM | SEATTLE  | DO NOT BREED |      | females only available at this time |

**PITTS CA**

**National Aviary in Pittsburgh**  
Pittsburgh, PA

| ID  | Local ID | Sex | Disposition | Location | Breeding   | With | Notes                                 |
|-----|----------|-----|-------------|----------|------------|------|---------------------------------------|
| 369 | 5112     | M   | HOLD        | PITTS CA | BREED WITH | 370  | Reported as dead following analysis   |
| 370 | 5113     | F   | HOLD        | PITTS CA | BREED WITH | 369  | Hold do not breed due to death of 369 |

**RIO GRAND**

**Albuquerque Biological Park**  
Albuquerque, NM

| ID  | Local ID | Sex | Disposition  | Location  | Breeding   | With | Notes   |
|-----|----------|-----|--------------|-----------|------------|------|---|
| 391 | B01003   | F   | HOLD         | RIO GRAND | BREED WITH | 312  | unknown pedigree – assumed wild caught after analysis |
| 312 | 57321    | M   | RECEIVE FROM | BUSCH TAM | BREED WITH | 391  | unknown pedigree – assumed wild caught after analysis |

**SD-WAP**

**San Diego Wild Animal Park**  
Escondido, CA

| ID  | Local ID | Sex | Disposition  | Location | Breeding     | With | Notes |
|-----|----------|-----|--------------|----------|--------------|------|-------|
| 422 | 806034   | F   | HOLD         | SD-WAP   | DO NOT BREED |      |       |
| 432 | 202497   | F   | RECEIVE FROM | SEATTLE  | DO NOT BREED |      |       |

**SEATTLE****Woodland Park Zoological Gardens**  
Seattle, WA

| ID  | Local ID | Sex | Disposition  | Location  | Breeding     | With | Notes  |
|-----|----------|-----|--------------|-----------|--------------|------|--|
| 346 | 970075   | M   | HOLD         | SEATTLE   | BREED WITH   | 347  |  |
| 347 | 970076   | F   | HOLD         | SEATTLE   | BREED WITH   | 346  |  |
| 395 | 200561   | F   | SEND TO      | NASHV ZOO | DO NOT BREED |      | females only available at this time                  |
| 401 | 201052   | M   | HOLD         | SEATTLE   | BREED WITH   | 353  |  |
| 424 | 202055   | F   | SEND TO      | ST LOUIS  | DO NOT BREED |      | RECEIVE ONLY IF 434 IS FEMALE AS IMMEDIATE COMPANION |
| 427 | 202163   | M   | SEND TO      | SEDGWICK  | BREED WITH   | 144  |  |
| 431 | 202496   | F   | SEND TO      | NASHV ZOO | DO NOT BREED |      | females only available at this time                  |
| 432 | 202497   | F   | SEND TO      | SD-WAP    | DO NOT BREED |      |  |
| 434 | 202497   | U   | SEND TO      | ST LOUIS  | SEE NOTES    |      | SEND ONLY IF MALE - BREED WITH 355                   |
| 353 | 980904   | F   | RECEIVE FROM | ST LOUIS  | BREED WITH   | 401  |  |

**SEDGWICK****Sedgwick County Zoo**  
Wichita, KS

| ID  | Local ID | Sex | Disposition  | Location | Breeding   | With | Notes |
|-----|----------|-----|--------------|----------|------------|------|-------|
| 427 | 202163   | M   | RECEIVE FROM | SEATTLE  | BREED WITH | 144  |       |
| 144 | 9904     | F   | HOLD         | SEDGWICK | BREED WITH | 427  |       |

**ST LOUIS****Saint Louis Zoological Park**  
St. Louis, MO

| ID  | Local ID | Sex | Disposition  | Location | Breeding     | With | Notes   |
|-----|----------|-----|--------------|----------|--------------|------|---|
| 353 | 980904   | F   | SEND TO      | SEATTLE  | BREED WITH   | 401  |   |
| 355 | 980905   | F   | HOLD         | ST LOUIS | SEE NOTES    | 432  | RECEIVE NEXT MALE OFFSPRING FROM SEATTLE 346/347 FOR BREEDING– THIS MAY BE 434 (WAITING ON SEX RESULTS) |
| 424 | 202055   | F   | RECEIVE FROM | SEATTLE  | DO NOT BREED |      | RECEIVE ONLY IF 434 IS FEMALE AS IMMEDIATE COMPANION FOR 355  |
| 434 |          | U   | RECEIVE FROM | SEATTLE  | SEE NOTES    |      | SEND ONLY IF MALE - BREED WITH 355  |

**TOLEDO**

**Toledo Zoological Gardens**  
Toledo, OH

| ID  | Local ID | Sex | Disposition | Location | Breeding     | With | Notes                          |
|-----|----------|-----|-------------|----------|--------------|------|--------------------------------|
| 384 | 1690     | F   | HOLD        | TOLEDO   | DO NOT BREED |      | extreme MKdiff in this pairing |
| 385 | 1869     | M   | HOLD        | TOLEDO   | DO NOT BREED |      | extreme MKdiff in this pairing |

**TORONTO**

**Toronto Zoo**  
Scarborough, Ontario

| ID  | Local ID | Sex | Disposition | Location | Breeding   | With | Notes   |
|-----|----------|-----|-------------|----------|------------|------|---|
| 196 | 24127    | F   | SEND TO     | BIODOME  | BREED WITH | 423  |   |
| 338 | 36778    | M   | HOLD        | TORONTO  | BREED WITH | 393  |   |
| 393 | 40995    | F   | HOLD        | TORONTO  | BREED WITH | 338  | may breed as part of proven pair for demographic reasons - - unknown pedigree |

**WINNIPEG**

**Assiniboine Park Zoo**  
Winnipeg, Manitoba

| ID  | Local ID | Sex | Disposition | Location | Breeding   | With | Notes |
|-----|----------|-----|-------------|----------|------------|------|-------|
| 146 | 001007   | F   | HOLD        | WINNIPEG | BREED WITH | 396  |       |
| 396 | E00336   | M   | HOLD        | WINNIPEG | BREED WITH | 146  |       |

## Appendix A Assumptions

### SPECIMENS WITH UNKNOWN PARENTAGE

| Studbook ID | Current Status | Sire | Dam | XX SIRE | XX DAM | Birth Date | First Location | Second Location | Current Location | # AZA Living Descendants | % AZA Living Population | # Total Living Descendants | Living Descendants' Studbook ID   |
|-------------|----------------|------|-----|---------|--------|------------|----------------|-----------------|------------------|--------------------------|-------------------------|----------------------------|-----------------------------------|
| 61          | Dead           | UNK  | UNK | WILD    | WILD   | 1/1/1983   | GUYANAZOO      | CHASE B         | FORTWORTH        | 7                        | 16.28%                  | 7                          | 351, 413, 430, 411, 412, 408, 414 |
| 192         | Dead           | UNK  | 33  | 34      | 33     | 11/16/1988 | SANDIEGOZ      | SEATTLE         | SEATTLE          | 7                        | 16.28%                  | 7                          | 351, 413, 430, 411, 412, 408, 414 |
| 144         | Living         | UNK  | UNK | 34      | 33     | 11/1/1987  | UNKNOWN        | CHISHOLM        | SEDGWICK         | 1                        | 2.33%                   | 1                          | 144                               |
| 149         | Living         | UNK  | UNK | 34      | 33     | 1/12/1988  | UNKNOWN        | CHISHOLM        | BROWNSVIL        | 1                        | 2.33%                   | 1                          | 149                               |
| 196         | Living         | UNK  | UNK | 34      | 33     | 11/25/1988 | UNKNOWN        | CHISHOLM        | TORONTO          | 1                        | 2.33%                   | 1                          | 196                               |
| 206         | Living         | UNK  | 33  | 34      | 33     | 3/31/1989  | SANDIEGOZ      | PROVIDNCE       | MILWAUKEE        | 1                        | 2.33%                   | 1                          | 206                               |
| 312         | Living         | UNK  | UNK | WILD    | WILD   | 10/13/1993 | UNKNOWN        | CYPRESS         | BUSCH TAM        | 1                        | 2.33%                   | 1                          | 312                               |
| 382         | Living         | UNK  | UNK | WILD    | WILD   | 1/1/2000   | UNKNOWN        | MOHILEF D       | LOSANGELE        | 1                        | 2.33%                   | 1                          | 382                               |
| 383         | Living         | UNK  | UNK | WILD    | WILD   | 1/1/2000   | UNKNOWN        | MOHILEF D       | LOSANGELE        | 1                        | 2.33%                   | 1                          | 383                               |
| 391         | Living         | UNK  | UNK | WILD    | WILD   | 3/8/2001   | UNKNOWN        | FALLBROOK       | RIO GRAND        | 1                        | 2.33%                   | 1                          | 391                               |
| 393         | Living         | UNK  | UNK | --      | --     | 6/1/2001   | UNKNOWN        | QUEBEC          | TORONTO          | 1                        | 2.33%                   | 1                          | 393                               |
| 146         | Living         | UNK  | 33  | 34      | 33     | 11/2/1987  | SANDIEGOZ      | CHISHOLM        | WINNIPEG         | 0                        | 0%                      | 1                          | 146                               |

## Appendix B Animals Excluded from Genetic Analysis

| Studbook ID | Reason Excluded      |
|-------------|----------------------|
| 312         | < 50% known pedigree |
| 391         | < 50% known pedigree |
| 393         | < 50% known pedigree |

## Appendix C Life Tables

| Age | Males |       |       |       |       | Females |       |       |       |       |
|-----|-------|-------|-------|-------|-------|---------|-------|-------|-------|-------|
|     | Qx    | Px    | Lx    | Mx    | Vx    | Qx      | Px    | Lx    | Mx    | Vx    |
| 0   | 0.360 | 0.640 | 1.000 | 0.030 | 1.220 | 0.360   | 0.640 | 1.000 | 0.000 | 1.220 |
| 1   | 0.140 | 0.860 | 0.640 | 0.030 | 1.732 | 0.150   | 0.850 | 0.640 | 0.000 | 1.772 |
| 2   | 0.140 | 0.860 | 0.550 | 0.070 | 2.092 | 0.100   | 0.900 | 0.544 | 0.010 | 2.130 |
| 3   | 0.120 | 0.880 | 0.473 | 0.310 | 2.459 | 0.130   | 0.870 | 0.490 | 0.250 | 2.512 |
| 4   | 0.090 | 0.910 | 0.417 | 0.220 | 2.541 | 0.110   | 0.890 | 0.426 | 0.250 | 2.699 |
| 5   | 0.130 | 0.870 | 0.379 | 0.570 | 2.754 | 0.080   | 0.920 | 0.379 | 0.320 | 2.842 |
| 6   | 0.110 | 0.890 | 0.330 | 0.290 | 2.626 | 0.100   | 0.900 | 0.349 | 0.960 | 2.907 |
| 7   | 0.160 | 0.840 | 0.294 | 0.380 | 2.850 | 0.090   | 0.910 | 0.314 | 1.440 | 2.258 |
| 8   | 0.060 | 0.940 | 0.247 | 0.300 | 2.948 | 0.120   | 0.880 | 0.286 | 0.770 | 0.958 |
| 9   | 0.140 | 0.860 | 0.232 | 0.120 | 3.106 | 0.160   | 0.840 | 0.251 | 0.180 | 0.229 |
| 10  | 0.170 | 0.830 | 0.199 | 0.730 | 3.730 | 0.110   | 0.890 | 0.211 | 0.060 | 0.060 |
| 11  | 0.140 | 0.860 | 0.165 | 1.680 | 3.759 | 0.270   | 0.730 | 0.188 | 0.000 | 0.000 |
| 12  | 0.270 | 0.730 | 0.142 | 2.020 | 2.748 | 0.180   | 0.820 | 0.137 | 0.000 | 0.000 |
| 13  | 0.120 | 0.880 | 0.104 | 0.620 | 0.970 | 0.000   | 1.000 | 0.112 | 0.000 | 0.000 |
| 14  | 0.430 | 0.570 | 0.091 | 0.240 | 0.503 | 0.220   | 0.780 | 0.112 | 0.000 | 0.000 |
| 15  | 0.500 | 0.500 | 0.052 | 0.510 | 0.510 | 0.150   | 0.850 | 0.088 | 0.000 | 0.000 |
| 16  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 0.170   | 0.830 | 0.075 | 0.000 | 0.000 |
| 17  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 0.000   | 1.000 | 0.062 | 0.000 | 0.000 |
| 18  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 0.000   | 1.000 | 0.062 | 0.000 | 0.000 |
| 19  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 0.000   | 1.000 | 0.062 | 0.000 | 0.000 |
| 20  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 0.420   | 0.580 | 0.062 | 0.000 | 0.000 |
| 21  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 1.000   | 0.000 | 0.036 | 0.000 | 0.000 |
| 22  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 1.000   | 0.000 | 0.000 | 0.000 | 0.000 |
| 23  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 1.000   | 0.000 | 0.000 | 0.000 | 0.000 |
| 24  | 0.000 | 1.000 | 0.026 | 0.000 | 0.000 | 1.000   | 0.000 | 0.000 | 0.000 | 0.000 |
| 25  | 0.500 | 0.500 | 0.026 | 0.000 | 0.000 | 1.000   | 0.000 | 0.000 | 0.000 | 0.000 |
| 26  | 0.000 | 1.000 | 0.013 | 0.000 | 0.000 | 1.000   | 0.000 | 0.000 | 0.000 | 0.000 |
| 27  | 1.000 | 0.000 | 0.013 | 0.000 | 0.000 | 1.000   | 0.000 | 0.000 | 0.000 | 0.000 |
| 28  | 1.000 | 0.000 | 0.000 | 0.000 | 0.000 | 1.000   | 0.000 | 0.000 | 0.000 | 0.000 |

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

### Projected population growth rates

Males:  $r = 0.0555$ ;  $\lambda = 1.0571$ ;  $R_0 = 1.526$ ;  $T = 7.61$

Females:  $r = 0.0481$ ;  $\lambda = 1.0493$ ;  $R_0 = 1.365$ ;  $T = 6.47$

## Appendix D Ordered Mean Kinships

### Males

| SB# | MK    | %Known | Age | Location  |
|-----|-------|--------|-----|-----------|
| 338 | 0.000 | 100.0  | 12  | TORONTO   |
| 349 | 0.000 | 100.0  | 0   | HONOLULU  |
| 369 | 0.000 | 100.0  | 0   | PITTS CA  |
| 371 | 0.000 | 100.0  | 9   | BIRMINGHM |
| 401 | 0.018 | 100.0  | 6   | SEATTLE   |
| 357 | 0.036 | 100.0  | 10  | BROWNSVIL |
| 345 | 0.054 | 100.0  | 0   | BROWNSVIL |
| 412 | 0.077 | 87.5   | 4   | MILWAUKEE |
| 430 | 0.077 | 87.5   | U2  | BROWNSVIL |
| 346 | 0.107 | 100.0  | 0   | SEATTLE   |
| 385 | 0.116 | 100.0  | 8   | TOLEDO    |
| 396 | 0.116 | 100.0  | 7   | WINNIPEG  |
| 405 | 0.116 | 100.0  | 4   | JACKSONVL |
| 423 | 0.116 | 100.0  | 3   | BIODOME   |
| 427 | 0.116 | 100.0  | 2   | SEATTLE   |
| 428 | 0.116 | 100.0  | 2   | METROZOO  |
| 432 | 0.116 | 100.0  | 1   | SEATTLE   |

### Females

| SB# | MK    | %Known | Age | Location  |
|-----|-------|--------|-----|-----------|
| 343 | 0.000 | 100.0  | 0   | HONOLULU  |
| 370 | 0.000 | 100.0  | 0   | PITTS CA  |
| 372 | 0.000 | 100.0  | 9   | BIRMINGHM |
| 384 | 0.000 | 100.0  | 8   | TOLEDO    |
| 286 | 0.018 | 100.0  | 16  | EL PASO   |
| 353 | 0.036 | 100.0  | 10  | ST LOUIS  |
| 355 | 0.036 | 100.0  | 10  | ST LOUIS  |
| 144 | 0.071 | 100.0  | 21  | SEDGWICK  |
| 146 | 0.071 | 100.0  | 21  | WINNIPEG  |
| 149 | 0.071 | 100.0  | 20  | BROWNSVIL |
| 196 | 0.071 | 100.0  | 0   | TORONTO   |
| 206 | 0.071 | 100.0  | 19  | MILWAUKEE |
| 408 | 0.077 | 87.5   | 4   | BROWNSVIL |
| 411 | 0.077 | 87.5   | 4   | JACKSONVL |
| 413 | 0.077 | 87.5   | 4   | BROWNSVIL |
| 414 | 0.077 | 87.5   | 4   | BROWNSVIL |
| 430 | 0.077 | 87.5   | U2  | BROWNSVIL |
| 351 | 0.089 | 75.0   | 11  | BROWNSVIL |
| 347 | 0.107 | 100.0  | 0   | SEATTLE   |
| 395 | 0.116 | 100.0  | 7   | SEATTLE   |
| 422 | 0.116 | 100.0  | 3   | SD-WAP    |
| 424 | 0.116 | 100.0  | 3   | SEATTLE   |
| 429 | 0.116 | 100.0  | 2   | METROZOO  |
| 431 | 0.116 | 100.0  | 1   | SEATTLE   |

## Appendix E Summary of Data Exports

**Report compiled under POPLINK V. 1.25 & Population Management 2000, V. 1.213**

Data exported on: 12 MAY 2008  
Data compiled by: Shawn Pedersen  
Data current thru: 17 FEB 2008  
Plan: email

### Filter Conditions in Effect:

**Genetics:** N.A.M., Dates: As of End of date 12 MAY 2008 / Status: Living  
**Demography :** N.A.M, Dates: During 01/01/1980 <= date .and. date <= 12/05/2008

# 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 ( $\lambda$ ) 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 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  | Email                          | Phone               |
|-------------------|--|--------------------------------|---------------------|
| Joe Barkowski     | SEDGWICK - Sedgwick County Zoo, Wichita, KS                      | jbarkowski@scz.org             | 316-266-8235        |
| Mike Mace         | SD-WAP - San Diego Wild Animal Park, Escondido, CA               | MMace@sandiegozoo.org          | 760-738-5077        |
| Chantal Routhier  | BIODOME - Biodome de Montreal, Montreal, Quebec                  | crouthier@ville.montreal.qc.ca | 514-868-3001        |
| Cindy Pinger      | BIRMINGHAM - Birmingham Zoo, Birmingham, AL                      | cpinger@birminghamzoo.com      | 205-879-0409        |
| Colette Adams     | BROWNSVIL - Gladys Porter Zoo, Brownsville, TX                   | cadams@gpz.org                 | 956-546-9431        |
| Mike Wells        | BUSCH TAM - Busch Gardens, Tampa, FL                             | Michael.Wells@BuschGardens.com | (813) 987-5588      |
| Tim Snyder        | CHICAGOBR - Chicago Zoological Park, Brookfield, IL              | tim.snyder@czs.org             | 708-688-8401        |
| Josef Lindholm    | DALLAS WA - Dallas World Aquarium, Dallas, TX                    | josef@dwazoo.com               | 214-720-2224 x401   |
| John Kiseda       | EL PASO - El Paso Zoo, El Paso, TX                               | KisedaJJ@elpasotexas.gov       | 915-521-1850 x1860  |
| Linda Santos      | HONOLULU - Honolulu Zoo, Honolulu, HI                            | lsantos1@honolulu.gov          | 808-971-7169        |
| Hannah Bailey     | HOUSTON - Houston Zoo, Inc., Houston, TX                         | hbailey@houstonzoo.org         | 713-533-6565        |
| Robin B. Lentz    | JACKSONVL - Jacksonville Zoo and Gardens, Jacksonville, FL       | lentzr@JaxZoo.org              | (904) 757-4462 x166 |
| Susie Kasielke    | LOSANGELE - Los Angeles Zoo & Botanical Gardens, Los Angeles, CA | susie.kasielke@lacity.org      | 323-644-4745        |
| James Dunster     | METROZOO - Miami Metrozoo, Miami, FL                             | JDUN@miamidade.gov             | 305-251-0400 x251   |
| Alex Waier        | MILWAUKEE - Milwaukee County Zoological Gardens, Milwaukee, WI   | Alex.Waier@Milwcnty.com        |                     |
| Joe deGraauw      | NASHV ZOO - Nashville Zoo at Grassmere, Nashville, TN            | jdegraauw@nashvillezoo.org     | 615-833-1534 x155   |
| Steven Sarro      | PITTS CA - National Aviary in Pittsburgh, Pittsburgh, PA         | steve.sarro@aviary.org         | (412) 323-7235 x211 |
| Peter Shannon     | RIO GRAND - Albuquerque Biological Park, Albuquerque, NM         | pshannon@cabq.gov              | 505-764-6258        |
| Shawn Pedersen    | SEATTLE - Woodland Park Zoological Gardens, Seattle, WA          | shawn.pedersen@zoo.org         | 206-548-2516        |
| Michael Macek     | ST LOUIS - Saint Louis Zoological Park, St. Louis, MO            | Macek@stlzoo.org               | 314-781-0900 x362   |
| Robert Webster    | TOLEDO - Toledo Zoological Gardens, Toledo, OH                   | robert.webster@ToledoZoo.org   | 419-385-5721 x2008  |
| Phil King         | WINNIPEG - Assiniboine Park Zoo, Winnipeg, Manitoba              | pking@winnipeg.ca              |                     |
| Roger Sweeney     | TRACY AV - Tracy Aviary, Salt Lake City, UT                      | RogerS@tracyaviary.org         | 801-596-8500 x15    |
| Tom Mason         | TORONTO - Toronto Zoo, Scarborough, Ontario                      | tmason@torontozoo.ca           | 416-392-5972        |
| Diane Fell        | TULSA - Tulsa Zoo & Living Museum, Tulsa, OK                     | DIANEFELL@ci.tulsa.ok.us       | 918-669-6208        |