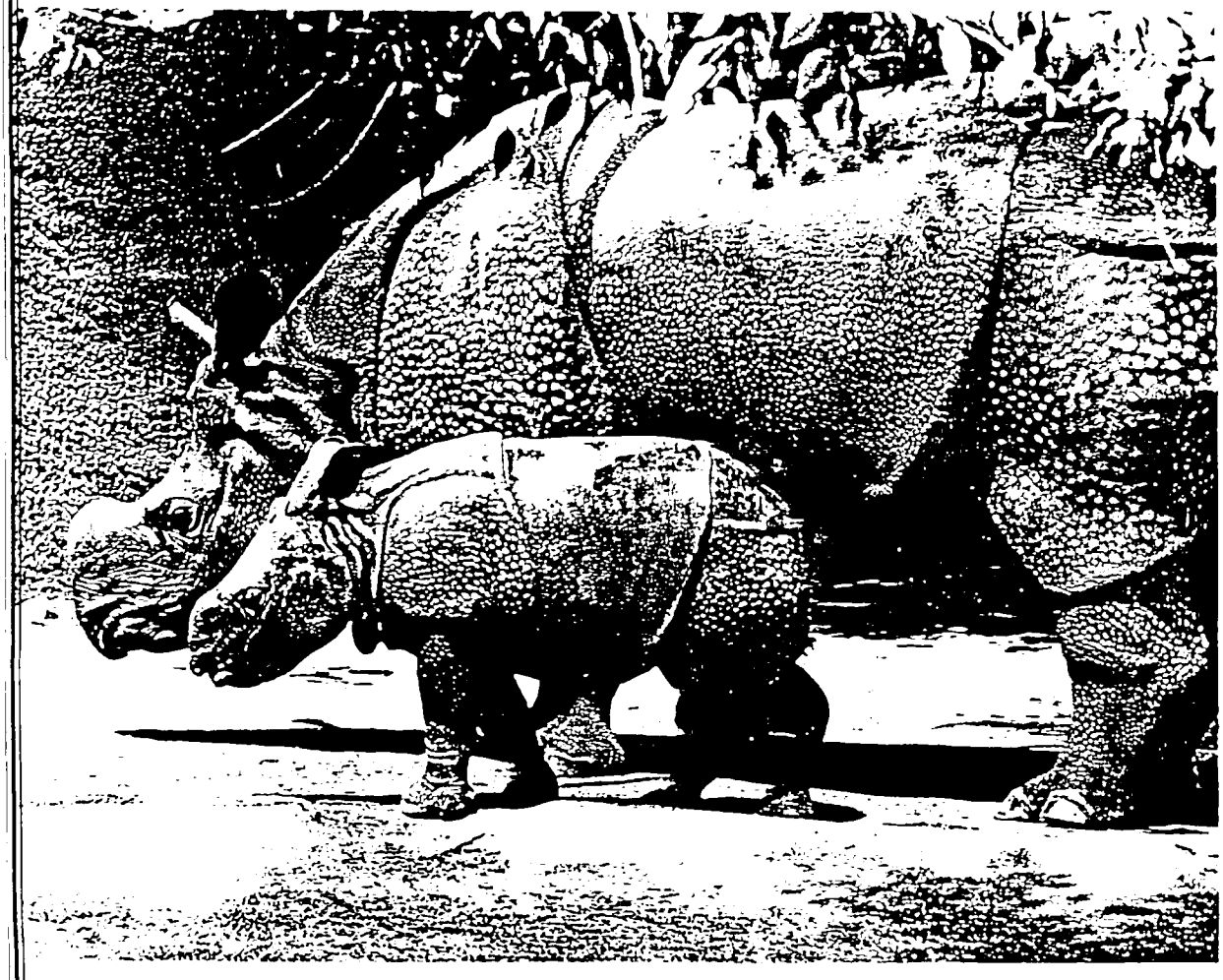
GREATER ONE-HORNED ASIAN RHINOCEROS

SSP MASTERPLAN



DECEMBER 1989

GREATER ONE-HORNED ASIAN RHINOCEROS SSP MASTERPLAN

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* * * * Cover reproduced from photo by: Neal Johnston, Los Angeles Zoo * * * *

INTRODUCTION

The Greater One-horned Asian Rhinoceros SSP was first initiated in 1981 and has slowly progressed toward its basic goal of establishing a self-sustaining population which will assure the species survival in captivity, and hopefully provide the potential for reintroduction to the wild population if and when needed.

The Propagation Group has spent its early years attempting to provide information to its members on proper introduction and breeding behavior. Of the ten institutions that are holding this species, one half have been successful in their attempts. The population has grown from breedings and one importation.

The data received from the Propagation Group provides a measure of the stability, growth, and potential long-term viability of the captive population. It has also provided the basis for the development of this Masterplan.

The genetic and demographic analyses required to properly manage any SSP population are detailed in the section entitled, "Development of an SSP Masterplan". This document also provides an outline of the process for formulating a masterplan, which ultimately produces a set of institution-by-institution, animal-by-animal recommendations.

As indicated earlier, the ultimate goal of any SSP masterplan is to propagate and manage a taxon in captivity so as to provide reinforcement for natural populations. Achievement of this goal requires the development of a genetically diverse and demographically stable population capable of long-term survival. While the Indian rhino population appears to have at least the potential for remaining genetically diverse owing to sufficient founder stock available, it could not be considered demographically stable. The founder (and potential founder) stock has experienced increasing age without producing sufficient progeny to insure broad based representation in future generations. As a result, the immediate objective of the institution recommendations is to increase the number of founders and to equalize their representation. Further specifics are provided in the "Objectives and Recommendations" section.

Michael Dee
Indian Rhino SSP Coordinator
Los Angels Zoo

GREATER ONE-HORNED ASIAN RHINOCEROS

SSP MASTERPLAN

OBJECTIVES

GREATER ONE-HORNED ASIAN RHINOCEROS

SSP MASTERPLAN OBJECTIVES

1 Assist with conservation of the species by providing long term self sustaining captive population to reinforce survival of the species in natural habitats.

To achieve this objective the SSP Masterplan will try to preserve 90% of genetic diversity for 200 years.

2 Require that we have 20 founders and can manage for Ne/N = .5.

3 Attain 13 more founders by :

Recruiting 5-7 more through improved management.

Recruiting reproduction from non-producing founders.

Recruiting more offspring from founders with only 1 offspring.

Adjusting founder representation.

Acquire 6-8 more from the wild.

Acquire 2 more from captivity elsewhere.

4 Establish 80 as the carrying capacity for SSP.

Presumes rest of zoo world will maintain at least 50 rhinos toward total captive carrying capacity goal.

5 Try to move popultaion from existing to target founder distribution by reproducing animals according to offspring objectives.

GREATER ONE-HORNED ASIAN RHINOCEROS

LIFETIME OFFSPRING OBJECTIVES

	AT BIRTH	SURVIVE TO REPRODUCE
FOUNDERS	6	4
NON-FOUNDERS		
GREATLY OVER (FIC <.325)	1	1
OVER (.325 < FIC < .5)	3	2
OK (.5 < FIC < .8)	4	3
UNDER (FIC > .8)	7	6
AVERAGE	4	3

CAPTIVE HABITAT AVAILABLE

OUTSIDE NORTH AMERICA

	EXISTING	POTENTIAL
EUROPE	27	34
JAPAN	6	10
SINGAPORE	6	6
REST OF WORLD	39	50 (MINIMUM)

CURRENT SSP INSTITUTIONS

INSTITUTION	EXISTING	POTENTIAL
CINCINNATI	1 (1.0)	2 (1.1)
LOS ANGELES	3 (2.1)	6 (2.4)
LOWRY	1 (1.0)	2 (1.1)
MIAMI	2 (2.0)	4 (2.2)
NEW YORK	7 (2.5)	7 (3.4)
OKLAHOMA CITY	1 (0.1)	2 (1.1)
PHILADELPHIA	2 (1.1)	2 (1.1)
SAN DIEGO (WAP)	7 (3.4)	10 (4.6)
SAN FRANCISCO	2 (1.1)	2 (1.1)
TORONTO	3 (2.1)	3 (1.2)
WASHINGTON D.C.	3 (1.2)	6 (2.4)
	32 (16.16)	46 (19.27)

POSSIBLE INSTITUTIONS

FORT WORTH		2 (1.1)
FOSSIL RIM		2 (1.1)
GULF BREEZE		2 (1.1)
KINGS ISLAND		2 (1.1)
MILWAUKEE		3 (1.2)
MINNESOTA		2 (1.1)
WOODS HAVEN FARM		2 (1.1)
		15 (7.8)
	32 (16.16)	61 (26.35)
GRAND TOTAL		

GREATER ONE-HORNED ASIAN RHINOCEROS

SSP MASTERPLAN

INSTITUTIONAL RECOMMENDATIONS

GREATER ONE-HORNED ASIAN RHINOCEROS MASTERPLAN SESSION 16 March 1989

INSTITUTIONAL RECOMMENDATIONS

CINCINNATI

Male #202

Hold

LOS ANGELES

Male #35

Breed with female #89

Female #45

Transfer to Miami

Male #125

Transfer to Oklahoma City

Receive female #89 from Oklahoma City

MIAMI METRO ZOO

Male #49

Breed with female #45

Male #126

Transfer to Kings Island

Receive female #45 from Los Angeles

NEW YORK (BRONX)

Female #50

Breed with male #53

Female #66

Breed with male #53

Female #67

Breed with male #53

Male #69

Transfer to Toronto

GREATER ONE-HORNED ASIAN RHINOCEROS MASTERPLAN SESSION 16 March 1989

INSTITUTIONAL RECOMMENDATIONS

NEW YORK (BRONX) cont.

Male #83

Hold, do not breed.

Male #87

Possible surplus, will be re-evaluted after the IUCN Asian Rhino Specialist meeting that will be held in February 1990.

Female #131

Transfer to Oklahoma City

OKLAHOMA CITY

Female #89

Transfer to Los Angeles

Receive

Male #125 from Los Angeles

Female #131 from New York

PHILADELPHIA

Male #10

Breed with female #80

Female #80

Breed with male #10

SAN FRANCISCO

Male #136

Breed female #137 ASAP

Female #137

Breed with male #136 ASAP

GREATER ONE-HORNED ASIAN RHINOCEROS MASTERPLAN SESSION 16 March 1989

INSTITUTIONAL RECOMMENDATIONS

SAN DIEGO WILD ANIMAL PARK

Male #26

Hold do not breed --- Possible Surplus

Female #29

Pregnant - Breed with #106 when ready.

Female #99

Breed with #19

Male #106

Breed female #29

Female #130

Pregnant - Breed with #19 when ready.

Female #143

Breed with #106 - when old enough

Female #200

Transfer to Mexico City ??

TAMPA (LOWRY)

Male #116

Hold

Receive female as soon as one becomes available

TORONTO

Male #53

Transfer to New York

Female #79

Breed with male #69

Receive

Male #69 from New York

GREATER ONE-HORNED ASIAN RHINOCEROS MASTERPLAN SESSION 16 March 1989

INSTITUTIONAL RECOMMENDATIONS

WASHINGTON-NZP

Male #101

Breed females #138 and #139

Female #138

Breed with male #101

Female #139

Breed with male #139

NOTE: Replace male #101, after he breeds females #138 and #139.

GREATER ONE-HORNED ASIAN RHINOCEROS

SSP MASTERPLAN

DEMOGRAPHIC & GENETIC ANALYSES

BY: RANDY ROCKWELL
AAZPA
CONSERVATION BIOLOGIST

GREATER ONE-HORNED ASIAN RHINOCEROS

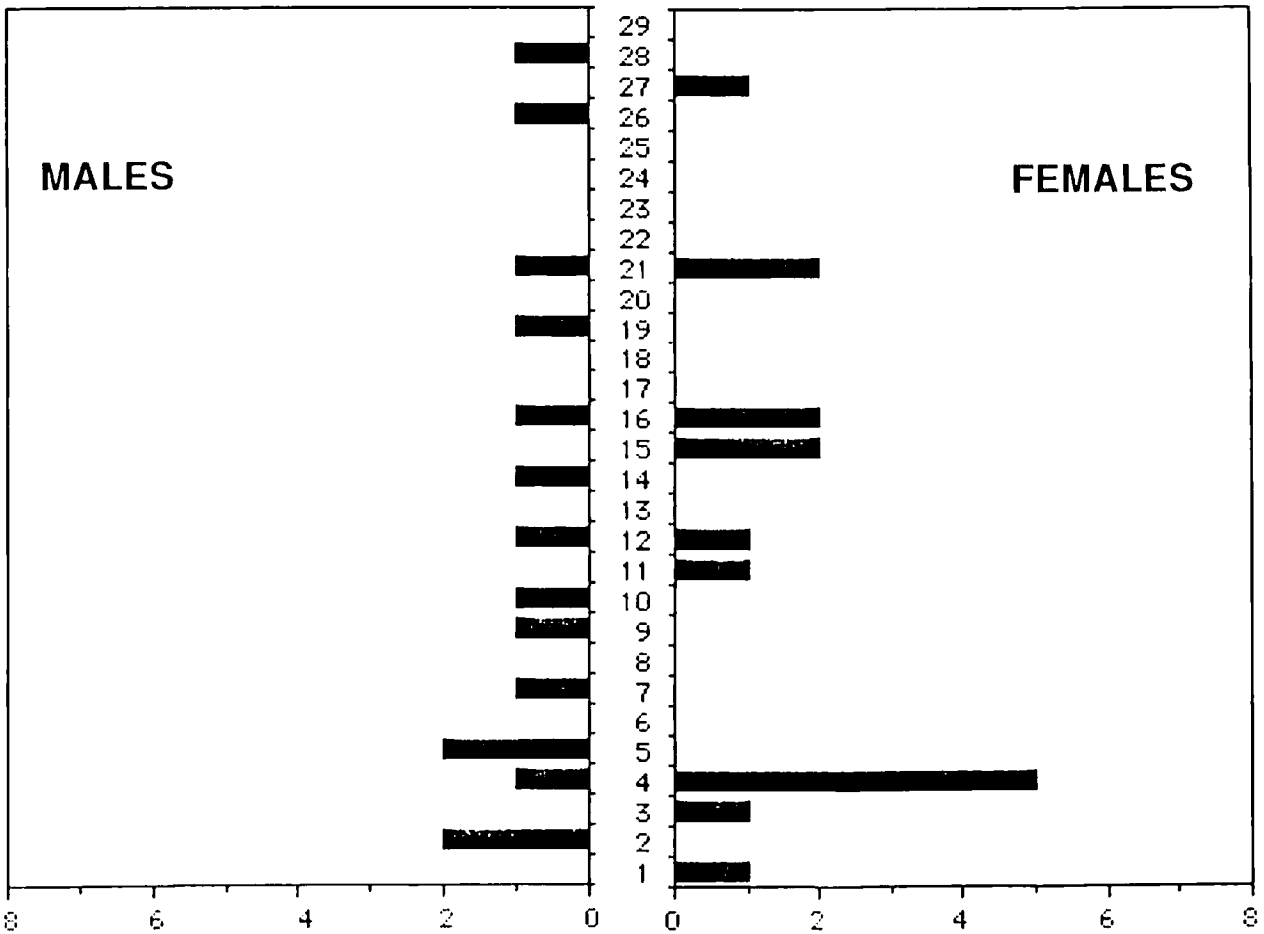
AGE STRUCTURE OF SSP POPULATION
28 DECEMBER 1989

AGE CLASS IN YEARS	MALES	FEMALES
0 - 1	0	1
1 - 2	2	0
2 - 3	0	1
3 - 4	1	5
4 - 5	2	0
5 - 6	0	0
6 - 7	1	0
7 - 8	0	0
8 - 9	1	0
9 - 10	1	0
10 - 11	0	1
11 - 12	1	1
12 - 13	0	0
13 - 14	1	0
14 - 15	0	2
15 - 16	1	2
16 - 17	0	0
17 - 18	0	0
18 - 19	1	0
19 - 20	0	0
20 - 21	1	2
21 - 22	0	0
22 - 23	0	0
23 - 24	0	0
24 - 25	0	0
25 - 26	0	0
26 - 27	0	1
27 - 28	1	0
28 - 29	0	0
KNOWN AGE	14	16
UNKNOWN AGE	2	0
TOTALS	16	16

AGE STRUCTURE

GREATER OINE-HORNED ASIAN RHINOCEROS

SSP POPULATION
(28 DECEMBER 1989)



DEMOGRAPHY GLOSSARY

Age Age class in years.

Px Age-specific survival.

Probability that an animal of a given age will survive to the next age class.

Lx Age-specific survivorship.

Probability of a newborn surviving to a given age class.

Mx Age-specific fertility.

Average number of offspring (of the same sex as the parent) produced by an animal in the given age class. Can also be interpreted as average percentage of animals that will reproduce.

r Instantaneous rate of change.

If $r < 0$ ..... Population is declining

$r = 0$ ..... Population is stationary (Does not change in number)

$r > 0$ ..... Population is increasing

lambda Percent of population change per year.

If lambda < 1 ..... Population is declining

lambda $= 1$ ..... Population is stationary (Does not change in number)

lambda > 1 ..... Population is increasing

R_o Net reproductive rate, the rate of change per generation.

If $R_o < 1$ ..... Population is declining

$R_o = 1$ ..... Population is stationary (Does not change in number)

$R_o > 1$ ..... Population is increasing

G Generation Time

Average length of time between the birth of a parent and the birth of its offspring. Equivalently, the average age at which an animal produces its offspring)

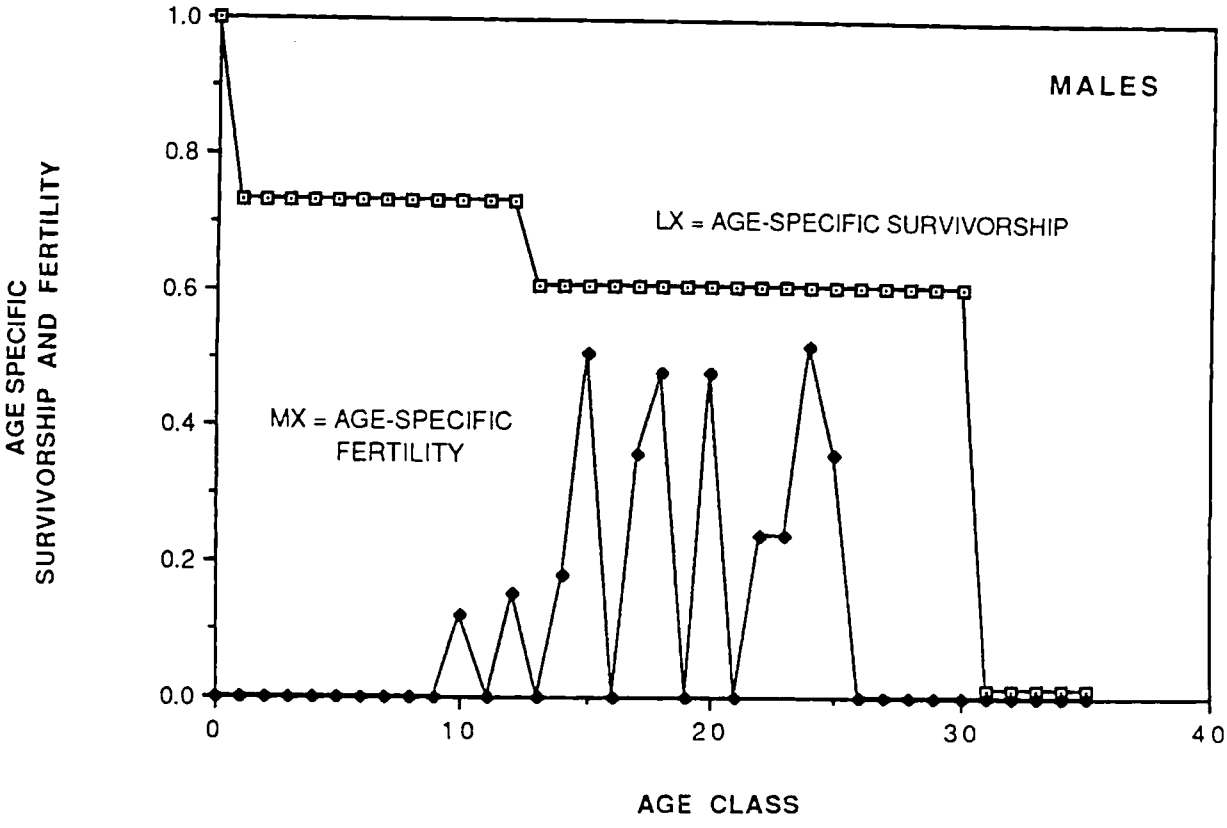
GREATER ONE-HORNED ASIAN RHINOCEROS

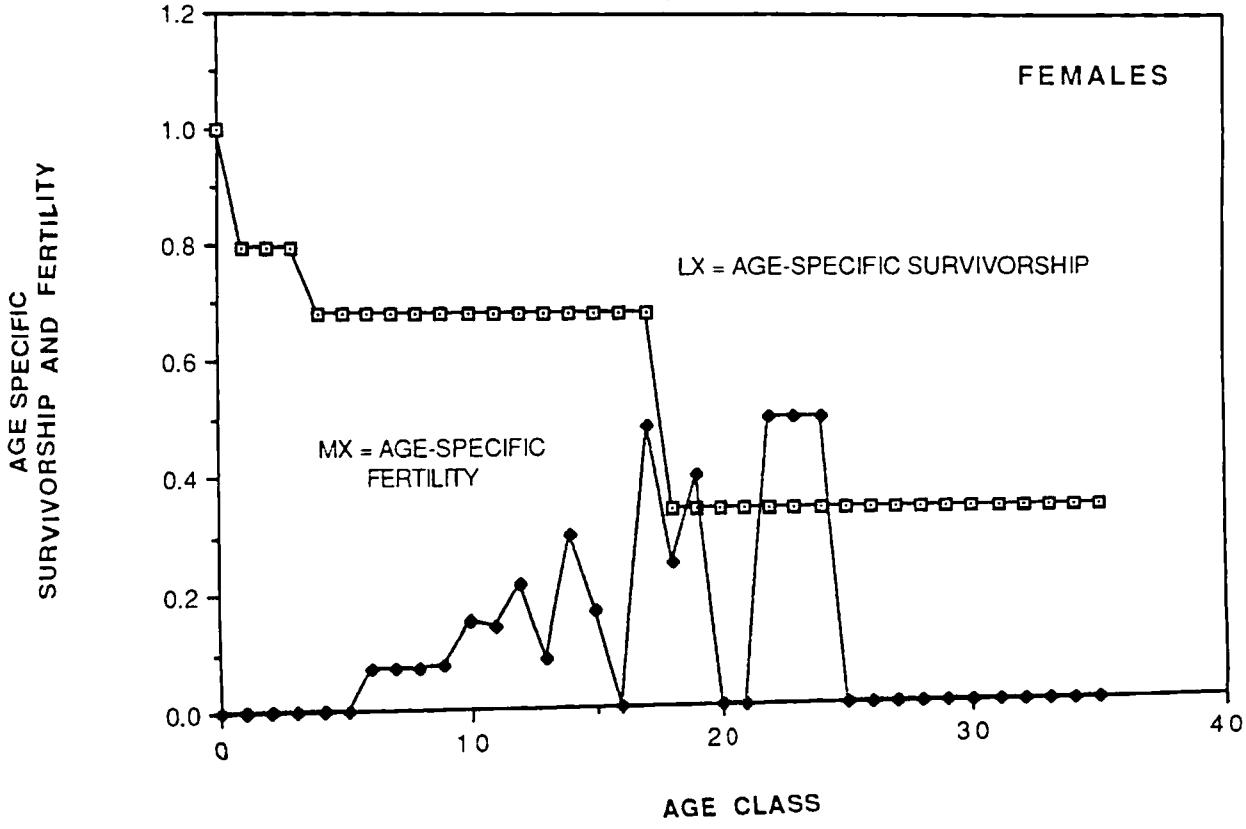
NORTH AMERICAN POPULATION

(01 JAN 1974 - 31 DEC 1988)

MALES					FEMALES				
Age	Px	Lx	Mx		Age	Px	Lx	Mx	
0	0.733	1.000	0.000	r =	0	0.797	1.000	0.000	r =
1	1.000	0.733	0.000	0.0426	1	1.000	0.797	0.000	0.0425
2	1.000	0.733	0.000		2	1.000	0.797	0.000	
3	1.000	0.733	0.000	lambda =	3	0.857	0.797	0.000	lambda =
4	1.000	0.733	0.000	1.044	4	1.000	0.683	0.000	1.043
5	1.000	0.733	0.000		5	1.000	0.683	0.000	
6	1.000	0.733	0.000	Ro =	6	1.000	0.683	0.077	Ro =
7	1.000	0.733	0.000	2.253	7	1.000	0.683	0.077	1.991
8	1.000	0.733	0.000		8	1.000	0.683	0.077	
9	1.000	0.733	0.000	G =	9	1.000	0.683	0.085	G =
10	1.000	0.733	0.120	19.061	10	1.000	0.683	0.165	16.206
11	1.000	0.733	0.000		11	1.000	0.683	0.155	
12	0.830	0.733	0.152		12	1.000	0.683	0.232	
13	1.000	0.608	0.000		13	1.000	0.683	0.095	
14	1.000	0.608	0.181		14	1.000	0.683	0.217	
15	1.000	0.608	0.507		15	1.000	0.683	0.180	
16	1.000	0.608	0.000		16	1.000	0.683	0.000	
17	1.000	0.608	0.361		17	0.500	0.683	0.525	
18	1.000	0.608	0.480		18	1.000	0.342	0.000	
19	1.000	0.608	0.000		19	1.000	0.342	0.433	
20	1.000	0.608	0.481		20	1.000	0.342	0.000	
21	1.000	0.608	0.000		21	1.000	0.342	0.000	
22	1.000	0.608	0.241		22	1.000	0.342	0.542	
23	1.000	0.608	0.241		23	1.000	0.342	0.542	
24	1.000	0.608	0.522		24	1.000	0.342	0.542	
25	1.000	0.608	0.361		25	1.000	0.342	0.000	
26	1.000	0.608	0.000		26	1.000	0.342	0.000	
27	1.000	0.608	0.000		27	1.000	0.342	0.000	
28	1.000	0.608	0.000		28	1.000	0.342	0.000	
29	1.000	0.608	0.000		29	1.000	0.342	0.000	
30	0.019	0.608	0.000		30	1.000	0.342	0.000	
31	1.000	0.012	0.000		31	1.000	0.342	0.000	
32	1.000	0.012	0.000		32	1.000	0.342	0.000	
33	1.000	0.012	0.000		33	1.000	0.342	0.000	
34	1.000	0.012	0.000		34	1.000	0.342	0.000	
35	0.000	0.012	0.000		35	0.000	0.342	0.000	
36	0.000	0.000	0.000		36	0.000	0.000	0.000	
37	0.000	0.000	0.000		37	0.000	0.000	0.000	
38	0.000	0.000	0.000		38	0.000	0.000	0.000	
39	0.000	0.000	0.000		39	0.000	0.000	0.000	
40	0.000	0.000	0.000		40	0.000	0.000	0.000	

GREATER ONE-HORNED ASIAN RHINOCEROS





GREATER ONE-HORNED ASIAN RHINOCEROS

ACTUAL AGE AT FIRST REPRODUCTION

(HISTORICAL NORTH AMERICAN POPULATION)

MALES		FEMALES	
STUDBOOK	AGE(MONTHS)	STUDBOOK	AGE(MONTHS)
5	85	56	55
83	103	99	87
14	106	8	94
18	117	80	101
26	132	99	110
13	159	15	111
32	161	7	116
19	162	28	130
76	201	17	140
1	345	29	140
		31	140
		66	147
		45	154
		30	183
		77	208
		11	280

GREATER ONE-HORNED ASIAN RHINOCEROS

BIRTH LIMITS

27 March 1989

Number of births required to maintain a stationary population at a given carrying capacity.

CARRYING CAPACITY			BIRTHS REQUIRED		
MALES	FEMALES	TOTAL	MALES	FEMALES	TOTAL
25	25	50	1	1	2
50	50	100	2	3	5
75	75	150	3	4	7
100	100	200	4	5	9
125	125	250	5	6	11
150	150	300	6	8	14
175	175	350	6	9	15
200	200	400	7	10	17

GENETICS GLOSSARY

GENOME
The complete set of genes (alleles) carried by an individual.

RETENTION
Fraction of founder's original set of genes (genome) still present in the population.

EXISTING REPRESENTATION
The existing percentage representation of founders in the population.

TARGET REPRESENTATION
The desired or target percentage representation of founders. These target figures are proportional to the fraction of each founder genome that survived. Achieving these target representation values will maximize preservation of genetic diversity.

DIFFERENCE
(Target Representation) - (Existing Representation)

A minus sign (-) designates a founder that is over-represented.

POTENTIAL FOUNDER
An animal from a source population (e.g., the wild) that establish a derived population (e.g., a captive or new wild population).

FOUNDER
An animal from a source (e.g., wild) population that actually produce offspring and have descendants in the living derived (e.g., captive) population.

The minus sign (-) designates the unknown mate of the founder with that number.

MEAN RETENTION
Average fraction of each founder genome surviving in the population.

MEAN HETEROZYGOSITY
Average fraction of original heterozygosity remaining in the population.

BOTTLENECK
A generation in the lineage from a founder when only one or a few offspring are produced so that not all of the founder's alleles are transmitted onto the next generation.

FOUNDER GENOME SURVIVING
The sum of the allelic retention; i.e., the number of founder genomes still in the population. This metric measures loss of original diversity due to bottlenecks in the pedigree of the population.

FOUNDER GENOME EQUIVALENTS
The number of newly wild caught animals required to obtain the genetic diversity in the present captive population. This metric reflects loss due to both bottlenecks and disparities in founder representation.

GREATER ONE-HORNED ASIAN RHINOCEROS
SSP POPULATION

FOUNDER ALLELE REPRESENTATION

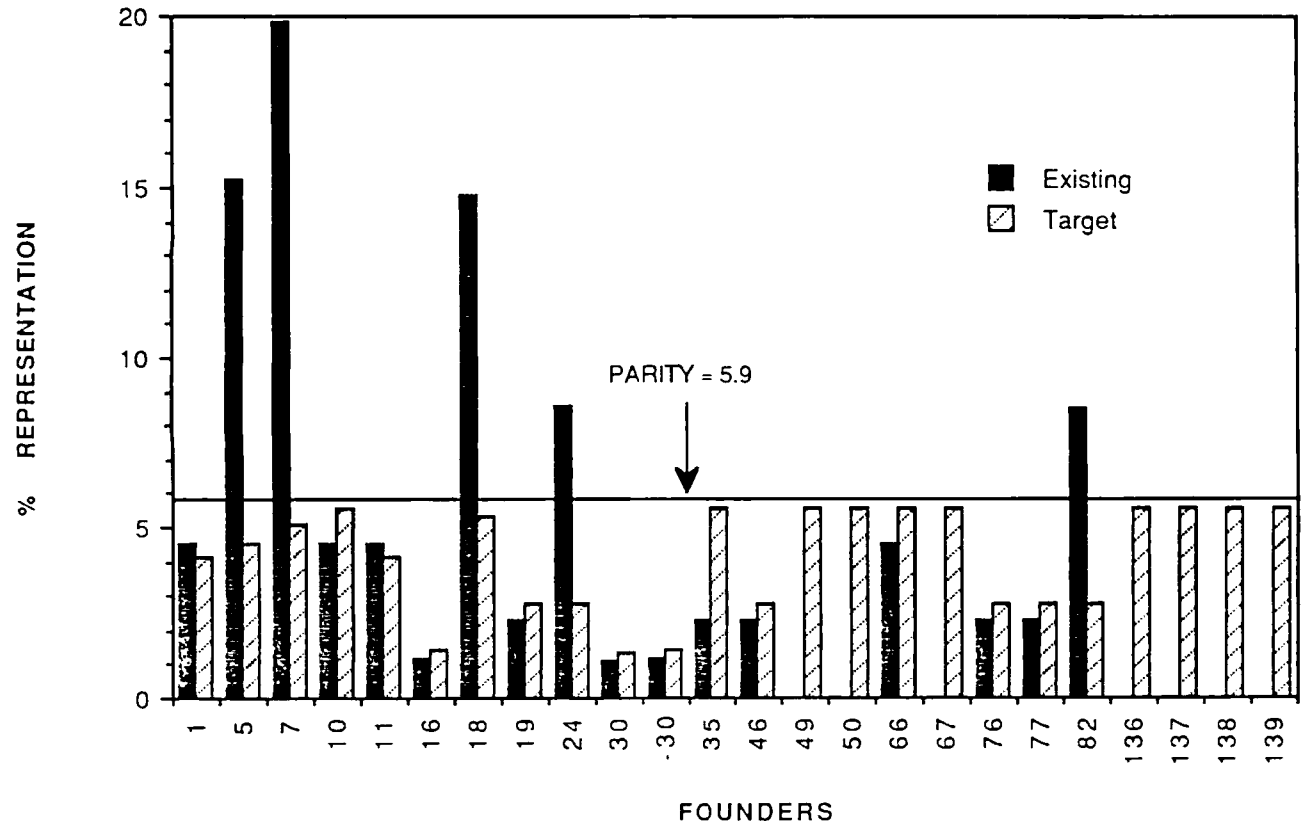
28 December 1989

Founder	Retention	% Representation	Target	Difference
1M	0.738	4.545	4.121	-0.425
5M	0.815	15.252	4.548	-10.704
7F	0.907	19.873	5.064	-14.808
10ML	0.754	4.545	5.584	1.038
11F	0.741	4.545	4.135	-0.411
16F	0.257	1.168	1.435	0.267
18M	0.953	14.800	5.318	-9.482
19M	0.500	2.273	2.792	0.519
24M	0.500	8.564	2.792	-5.772
30F	0.244	1.109	1.362	0.253
-30F	0.256	1.164	1.429	0.266
35ML	0.500	2.273	5.584	3.311
46F	0.500	2.273	2.792	0.519
49ML	0	0	5.584	5.584
50FL	0	0	5.584	5.584
66FL	0.746	4.545	5.584	1.038
67FL	0	0	5.584	5.584
76M	0.500	2.273	2.792	0.519
77F	0.500	2.273	2.792	0.519
82F	0.500	8.525	2.792	-5.733
136ML	0	0	5.584	5.584
137FL	0	0	5.584	5.584
138FL	0	0	5.584	5.584
139FL	0	0	5.584	5.584

GENETIC SUMMARY

	LIVING DESCENDANT POPULATION	POTENTIAL
Number of founders:	17	24
Parity (%):	5.882	4.167
Mean retention:	0.583	0.746
Founder Genomes Surviving:	9.910	17.909
Founder Equivalents:	9.050	21.133
Founder Genome Equivalents:	7.036	17.910
Fraction of wild heterozygosity retained:	0.912	0.972
Fraction of wild heterozygosity lost:	0.088	0.028
Mean inbreeding coefficient realized:	0.029	

GREATER ONE-HORNED ASIAN RHINOCEROS
FOUNDER REPRESENTATION



GREATER ONE-HORNED ASIAN RHINOCEROS

CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

==========

Effective Size and Carrying Capacity Necessary for Maintaining the Specified Amount of Genetic Diveristy for the Specified Amount of Time

---

Number of Years per Generation:	17.5	# Generations during 200 Years:	11
Yearly Growth Rate (lambda):	1.043	Exponential Growth Rate (r):	0.042
Effective Number of Founders:	10	Growth rate per Generation:	2.089
Estimated Ne/N Ratio:	0.50	Exponential Growth/Gener:	0.737
Desired % Hetero. Retain:	90.0		
Length of Time Period (Years):	200		

Effective Size Required to Maintain 90.0% of the Original Founder's Heterozygosity for 200 Years: 294

Actual Carrying Capacity Required (Based on Ne/N Ratio): 588

=12/28/89========== j.ballou Mar'89 ===

GREATER ONE-HORNED ASIAN RHINOCEROS

CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

ACTUAL CARRYING CAPACITIES Required to Maintain 90.0% of the Original Heterozygosity for Various Time Periods Given Various Founder Numbers

LENGTH OF PROGRAM (YEARS)

No. Effective Founders	50	100	150	175	200
7	****	****	****	****	****
10	20	110	312	492	588
15	20	56	108	148	168
20	20	50	88	118	132
25	20	48	82	106	120

Table Parameters

Lambda: 1.043
Gen. Length: 17.5
Ne/N Ratio: 0.50

**** = Not Possible with these parameters

== 12/28/89 ========== j.ballou-NZP Mar 89 =

Capacity 2.11

ACTUAL CARRYING CAPACITIES Required to Maintain Various Levels of Heterozygosity for 200 Years with Various Numbers of Founders

PERCENT HETEROZYGOSITY RETAINED

No. Effective Founders	70.0	75.0	80.0	85.0	90.0
7	36	50	82	240	****
10	34	42	62	106	588
15	32	40	54	80	168
20	32	38	52	74	132
25	32	38	50	70	120

Table Parameters

Lambda: 1.043
Gen. Length: 17.5
Ne/N Ratio: 0.50

**** = Not Possible with these parameters

== 12/28/89 ========== j.ballou-NZP Mar 89 =

GREATER ONE-HORNED ASIAN RHINOCEROS

CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

Actual Carrying Capacity Required to Maintain 90.0% of the Original Heterozygosity for Different Founder #s Under Various Ne/N Ratios

		No. EFFECTIVE FOUNDERS				
		7	10	15	20	25
Ne/N Ratio	0.30	****	980	280	220	200
	0.04	****	7350	2100	1650	1500
	0.50	****	588	168	132	120
	0.60	****	490	140	110	100
	0.70	****	420	120	94	86

Table Parameters	
Lambda:	1.043
Gen. Length:	17.5
Time Period:	200

**** = Not Possible with these parameters

== 12/28/89 ========== j.ballou-NZP Mar 89 =

Capacity 2.11

Actual Carrying Capacity Required to Maintain 90.0% of the Original Heterozygosity for Various Time Periods Under Various Ne/N Ratios

		LENGTH OF PROGRAM (YEARS)				
		50	100	150	175	200
Ne/N Ratio	0.30	33	183	520	820	980
	0.40	25	138	390	615	735
	0.50	20	110	312	492	588
	0.60	17	92	260	410	490
	0.70	14	79	223	351	420

Table Parameters	
Lambda:	1.043
Gen. Length:	17.5
No. Fndrs:	10

== 12/28/89 ========== j.ballou-NZP Feb 89 =

GREATER ONE-HORNED ASIAN RHINOCEROS

CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

Actual Carrying Capacities Required to Maintain Various Levels of Heterozygosity for Various Ne/N Ratios for 200 Years

		PERCENT HETEROZYGOSITY TO RETAIN				
		70.0	75.0	80.0	85.0	90.0
Ne/N Ratio	0.30	57	70	103	177	980
	0.40	43	53	78	133	735
	0.50	34	42	62	106	588
	0.60	28	35	52	88	490
	0.70	24	30	44	76	420

Table Parameters

Lambda:	1.043
Gen. Length:	17.5
No. Fndrs:	10

== 12/28/89 ========== j.ballou-NZP Mar 89 =

Capacity 2.11

ACTUAL CARRYING CAPACITIES Required to Maintain Various Levels of Heterozygosity for Various Time Periods Given 10 Effective Founders

		LENGTH OF PROGRAM (YEARS)				
		50	100	150	175	200
Percent Heter. Retained	70.0	6	14	24	30	34
	75.0	8	18	30	38	42
	80.0	10	24	42	54	62
	85.0	12	36	70	94	106
	90.0	20	110	312	492	588

Table Parameters

Lambda:	1.043
Gen. Length:	17.5
Ne/N Ratio:	0.50

== 12/28/89 ========== j.ballou-NZP Mar 89 =

GREATER ONE-HORNED ASIAN RHINOCEROS

CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

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Effective Size and Carrying Capacity Necessary for Maintaining the Specified Amount of Genetic Diveristy for the Specified Amount of Time

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Number of Years per Generation:	17.5	# Generations during 200 Years:	11
Yearly Growth Rate (lambda):	1.043	Exponential Growth Rate (r):	0.042
Effective Number of Founders:	15	Growth rate per Generation:	2.089
Estimated Ne/N Ratio:	0.50	Exponential Growth/Gener:	0.737
Desired % Hetero. Retain:	90.0		
Length of Time Period (Years):	200		

Effective Size Required to Maintain 90.0% of the Original Founder's Heterozygosity for 200 Years: 84

Actual Carrying Capacity Required (Based on Ne/N Ratio): 168

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GREATER ONE-HORNED ASIAN RHINOCEROS

CALCULATIONS FOR CARRYING CAPACITY

Capacity 2.11

Actual Carrying Capacity Required to Maintain 90.0% of the Original Heterozygosity for Various Time Periods Under Various Ne/N Ratios

		LENGTH OF PROGRAM (YEARS)				
		50	100	150	175	200
Ne/N Ratio	0.30	33	93	180	247	280
	0.40	25	70	135	185	210
	0.50	20	56	108	148	168
	0.60	17	47	90	123	140
	0.70	14	40	77	106	120

Table Parameters

Lambda:	1.043
Gen. Length:	17.5
No. Fndrs:	15

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Capacity 2.11

Actual Carrying Capacities Required to Maintain Various Levels of Heterozygosity for Various Ne/N Ratios for 200 Years

		PERCENT HETEROZYGOSITY TO RETAIN				
		70.0	75.0	80.0	85.0	90.0
Ne/N Ratio	0.30	53	67	90	133	280
	0.40	40	50	68	100	210
	0.50	32	40	54	80	168
	0.60	27	33	45	67	140
	0.70	23	29	39	57	120

Table Parameters

Lambda:	1.043
Gen. Length:	17.5
No. Fndrs:	15

== 12/28/89 ========== j.ballou-NZP Mar 89 =