Population Analysis & Breeding and Transfer Plan

North Island Brown Kiwi (*Apteryx mantelli*)
AZA Yellow Program

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25 May 2022

PMC Population Management Center

LINCOLN PARK ZOO.

ASSOCIATION OF ZOOS & AQUARIUMS

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Acknowledgments

The North Island Brown Kiwi SSP planning meeting was held via online conferencing on 10 March 2022, attended by the following:

Kathy Brader, Smithsonian's National Zoo and Conservation Biology Institute
Cara Groome Bryan, AZA Population Management Center

Cover photo courtesy of Smithsonian Conservation Biology Institute

This plan was prepared and distributed with the assistance of the Planning Coordinator and Program Assistant at the AZA Population Management Center (pmc@lpzoo.org).

Description of Population Status

Species Survival Plan® for the North Island Brown Kiwi (*Apteryx mantelli*)

Introduction: This current SSP population consists of 60 animals (36 males, 23 females, and 1 unknown sex) distributed among 16 facilities (9 AZA facilities (30 total; 20 males, 9 females, and 1 unknown sex) and 7 approved Sustainability Partner facilities (30 total; 16 males 14 females, and 0 unknown sex). The Struthioniformes (formerly Ratite/Tinamiformes) Taxon Advisory Group has set the target population size for this population to be 25 animals in AZA (2010 Regional Collection Plan). Under AZA's current sustainability designations, this Program qualifies as a Yellow SSP (≥50 animals; <90% gene diversity for 100 years). This is the fifth Breeding and Transfer Plan for this program.

Analytical Assumptions and Exclusions: The pedigree of this population is 100% known and 100% certain (Appendix A). 5 (3.1.1) animals have been excluded from the potentially breeding population (Appendix C).

Demography: This SSP species is recorded to have existed in European zoos back in the early 1900s, but zoo breeding did not prove successful and this population soon died out. Kiwi were again imported from New Zealand to London in 1953, San Diego Zoo in 1954, and then subsequent others. The first recorded hatch in AZA/EAZA zoos occurred in 1975 at the Smithsonian National Zoological Park. Zoo breeding grew more successful from that point on (Figure 1). The population has increased on average over the past five years by 1.7% (λ=1.017).

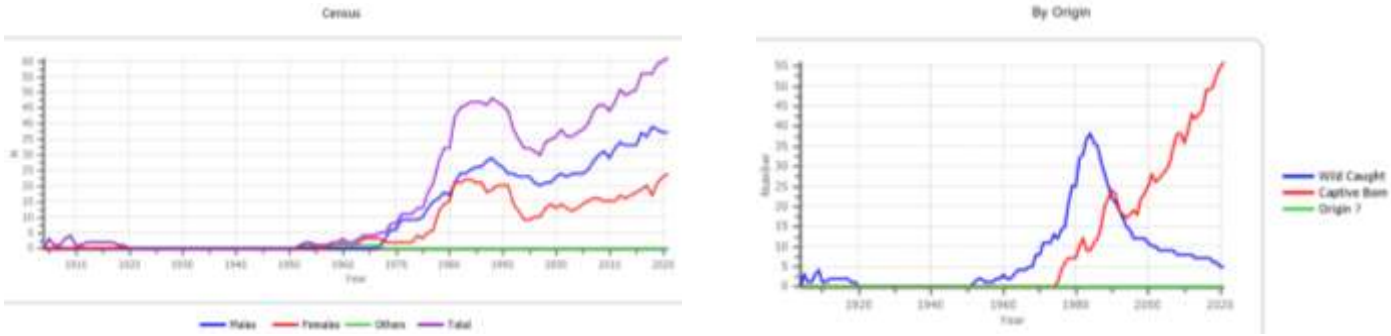

Figure 1. *Census of North Island Brown Kiwi SSP from 1900 to 2022 by sex (left) and hatch type (right)*

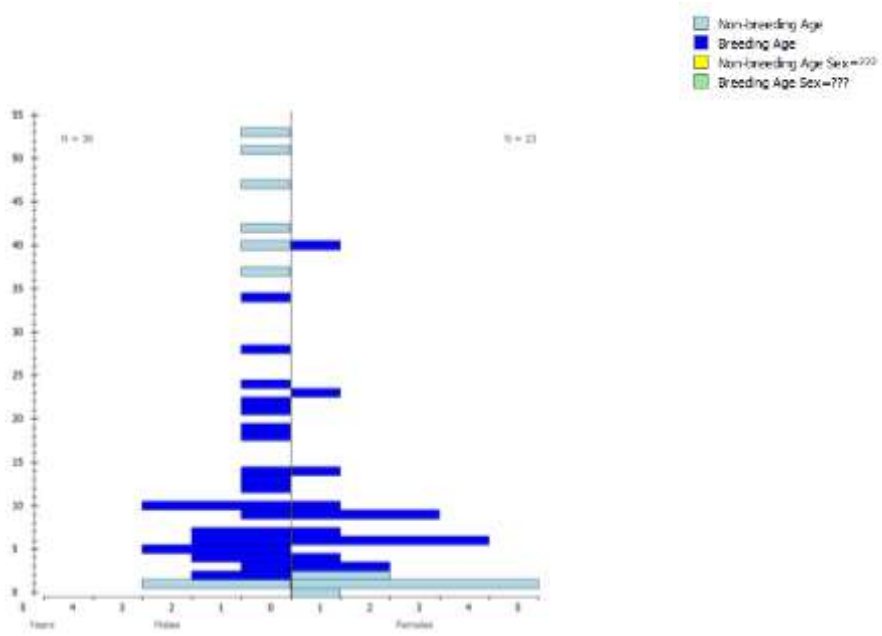

Figure 2. *Age distribution of the total SSP population. While N= 60 (36.23.1) in the North Island Brown Kiwi SSP, 0.0.1 is not shown in the graph because it hatched after the analysis.*

See the AZA Animal Population Management Committee Disclaimers in Appendix G for more info.

The age structure illustrates the number of males and females in each age class (Figure 2). Based on its current age structure and growth rate, if the population continues on its current trajectory, this population is expected to increase over time (Table 1).

Table 1: *Demographic status of SSP population, according to studbook.*

Demography Summary		
Current size of SSP population (N) – Total (Males.Females.Unknown Sex)	60 (36.23.1)	
Number of individuals excluded from genetic analyses	5 (3.1.1)	
Population size following exclusions	55 (33.22.0)	
Target population size (Kt) from Struthioniformes TAG 2010 RCP	25 in AZA	
Mean generation time (T, years)	14	
Population growth rates (λ; lambda)*: Life Table / 5-year / Projected	1.002 / 1.017 / 1.009	
Percentage (%) of living population hatched ex situ	86.6%	
Survival/Mortality	**Males**	**Females**
Observed first year mortality rate (Q_x)	0.212	0.269
Median life expectancy (MLE), excluding first year mortalities (years) (from PopLink Survival Statistics Report (https://www.aza.org/species-survival-statistics))	12.6	
Observed maximum longevity (L_x) (Studbook ID # of individual)	53.8 (SB#6) currently living	42 (SB#10)
Reproduction		
Observed reproductive age range	2–36	3–41
Incubation time	63-90 days	
Median clutch size hatched	1	

* Life table (No restriction, 1976-present); 5-year from studbook census; Projected from PMx stochastic 20-year projections

Genetics: The studbook pedigree indicates that this SSP is descended from 17 founders with 1 potential founder remaining (Table 2). The gene diversity of the population is 90.03%, which is equivalent to that found in 5 founders (FGE = 5.01). Typical AZA program goals include thresholds for tolerance of gene diversity loss over time; 90% gene diversity retention for 100 years is a common management goal. Decreases in gene diversity below 90% of that in the founding population have been associated with reproduction increasingly compromised by, among other factors, lower birth/hatch weights, smaller litter/clutch sizes, and greater neonatal mortality in some species. Based on current population parameters and recent growth rate trends, gene diversity is projected to decline to 67% over the next 100 years if the current population grows to a reasonable long-term target size of 75 at its projected growth rate of 1%.

Table 2: *Genetic status and projections for the North Island Brown Kiwi SSP population.*

Genetics Summary*			
	2019	**2022**	**Potential**
Founders	*18*	17	1
Founder genome equivalents (FGE)	*4.80*	5.01	12.56
Gene diversity (GD %)	*89.58*	90.03	96.02
Population mean kinship (MK)	*0.1042*	0.0997	--
Mean inbreeding (F)	*0.0499*	0.0411	--
Effective population size relative to population size (N_e/N)	*0.1324*	0.1711	--
Percentage of pedigree known before / after assumptions and exclusions	*100% / 100%*	100% / 100%	--
Projections			
Years to 90% gene diversity	*N/A*	0	0
Years to 10% loss of gene diversity	*31*	38	40
Gene diversity at 100 years (%)	*61.3*	67.1	67.5
Gene diversity in 10 generations (%)	*53.7*	59.8	60.2
	Assuming λ = 1.03, Target size = 75, Generation length =13.6, Starting population size = 58	Assuming λ = 1.01, Target size = 75, Generation length = 14, Starting population size = 59	Assuming λ = 1.03, Target size = 75, Generation length = 14, Starting population size = 59

*Genetic statistics may not be comparable across years due to changes in software and parameters used for projections from year to year.

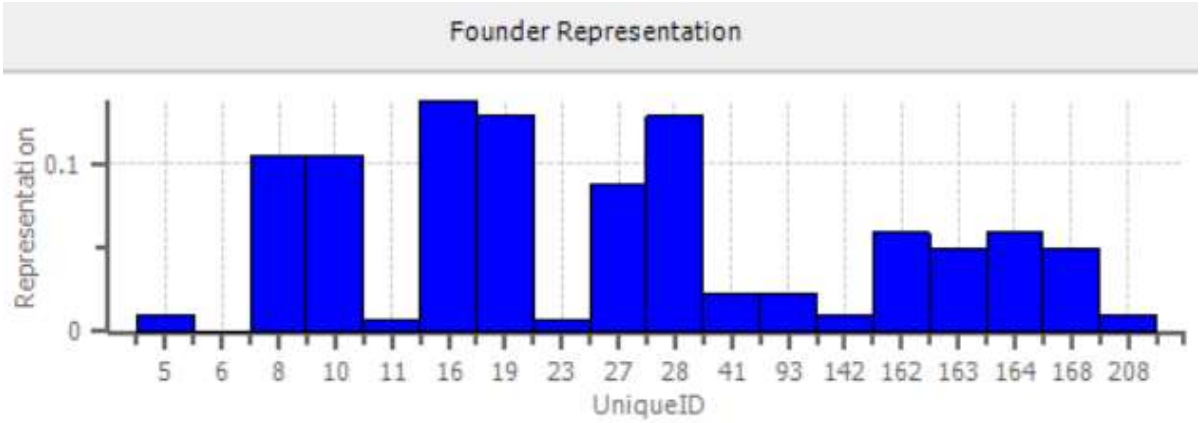

Figure 3. *Founder representation distribution of the North Island Brown Kiwi SSP population.*

Recommendation Outcomes: The website PMCTrack calculates the outcomes for SSP recommendations by comparing Breeding and Transfer Plan recommendations to hatches and transfers recorded in the studbook (Figure 4). There are many reasons that recommendations might not be fulfilled, including interim recommendations issued by the SSP Coordinator; these reasons can be captured using PMCTrack Outcomes Surveys. Note that starting in 2022, SSP Coordinators directly add interim recommendations to PMCTrack to improve the accuracy of recommendation outcomes. The fulfillment rates of any plan that had outcomes calculated in 2022 or after may reflect inclusion of these interim rates; in the graph, this may include the last plan before 2022, such as a 2021 plan, plus any plans with a date of 2022 or after.

Figure 4. Recommendation outcomes by transfers (left) and breeding (right) for the past North Island Brown Kiwi SSP Breeding and Transfer Plans. *N* represents the number of recommendations scored for each recommendation type, per plan, and the number represents the percentage recommendations fulfilled. Please visit PMCTrack.org or contact pmctrack@lpzoo.org for more information or with any questions.

Of the recommendations proposed in the 2019 Breeding and Transfer Plan, 21% of the BREED WITH recommendations were fulfilled, and 0% of SEND TO recommendations were fulfilled as requested by March 2022. During this time, transfers and travel were affected because of Covid and H5N1. SSP participants are always encouraged to attempt to fulfill recommendations and communicate sucesses and challenges to the SSP Coordinator.

Management Strategies: This is a 3-year plan (2022 – 2025). Interim recommendations will continue to be made as needed until another full set of recommendations are produced. Recommendations contained in this plan supersede all previous recommendations.

Table 3: *Historic reproduction and future population goals.*

Current Reproductive Goals Summary		
	Number of Hatches Needed per Year over the next 3 Years	**Target Population Size**
To maintain current population size (λ = 1.00)	3-5	60
To grow to a reasonable long-term target population size of 75 in 8 years (Kt = 75; λ = 1.03) (The TAG target size of 25 for AZA only has already been reached)	6-8	75
Reproductive Goals Summary from the Last BTP (2019)		
Number of females recommended to breed	19	
Number of hatches since then	11	
Average Number of Events in the SSP Population per Year over the Last Five Years		
Average number of hatches per year	4.6	
Average number of deaths per year	3.6	
Average number of imports per year	0	
Average number of exports per year	0	

At this time, the SSP:

1. **Recommends 16 pairs to breed at 12 facilities.** The number of breeding females/pairs/groups recommended is intended to maintain the current population size and slowly fill additional spaces as they can be become available.

2. **Recommends 8 transfers to establish new pairs and meet facility requests.**

3. Institutions interested in obtaining or placing kiwi should contact Kathy Brader, Smithsonian National Zoo (email: braderk@si.edu).

4. The SSP recommends to egg sex if possible. Please contact Kathy Brader for more information.

5. Please check in with the SSP Coordinator as eggs are produced so that the SSP can effectively demographically manage this growing population. Breeding zoos must be able to hold chicks for at least one year, possibly longer.

6. Zoos interested in becoming participants in the SSP must send staff (at least two people) for training at a current kiwi holding facility. This training session will be organized by Kathy Brader (email: braderk@si.edu).

7. If interested in learning the possibility of having an Ambassador kiwi please contact Kathy Brader. Not all kiwi are suited but some turn into great Ambassadors. As kiwi do not imprint but do learn and condition by routine handling (cuddling) and hand feeding, these practices may give one a more relaxed bird. SNZP and SCBI have recently concluded a cortisol study; preliminary results appear to show that some kiwi can tolerate the Ambassador role with no elevated stress hormones.

8. It is recommended that birds are weighed regularly and over-weight females and males are placed on a diet. Obesity can result in infertility. Please consult with Kathy Brader for more information (email: braderk@si.edu).

9. It is requested that kiwi feathers are collected and sent to Kathy Brader to be distributed to Maori cloak weavers. For more information, contact Kathy Brader (email: braderk@si.edu).

Summary of Breeding and Transfer Recommendations

ID	Location	Sex	Age	Disposition	New Location	Breeding	With	Notes
177	ALPHEN	M	9	HOLD	ALPHEN	DO NOT BREED		
180	ALPHEN	M	9	HOLD	ALPHEN	BREED WITH	214	
211	ALPHEN	M	3	SEND TO	SEE NOTES	SEE NOTES		See notes at institution table
214	ALPHEN	F	3	HOLD	ALPHEN	BREED WITH	180	
58	BERLINZOO	M	24	HOLD	BERLINZOO	DO NOT BREED		
160	BERLINZOO	M	12	HOLD	BERLINZOO	BREED WITH	174	
168	BERLINZOO	F	14	HOLD	BERLINZOO	DO NOT BREED		
174	BERLINZOO	F	10	HOLD	BERLINZOO	BREED WITH	160	
186	BERLINZOO	M	7	HOLD	BERLINZOO	DO NOT BREED		
200	BERLINZOO	F	6	SEND TO	SEE NOTES	SEE NOTES		See notes at institution table
204	BERLINZOO	M	6	HOLD	BERLINZOO	DO NOT BREED		
203	COLUMBUS	M	4	HOLD	COLUMBUS	DO NOT BREED		
16	FRANKFURT	M	42	HOLD	FRANKFURT	DO NOT BREED		Excluded
34	FRANKFURT	M	34	HOLD	FRANKFURT	BREED WITH	228	
65	FRANKFURT	F	23	HOLD	FRANKFURT	DO NOT BREED		
83	FRANKFURT	M	18	HOLD	FRANKFURT	DO NOT BREED		
185	FRANKFURT	F	7	HOLD	FRANKFURT	BREED WITH	195	
190	FRANKFURT	F	6	HOLD	FRANKFURT	BREED WITH	192	
192	FRANKFURT	M	6	HOLD	FRANKFURT	BREED WITH	190	
195	FRANKFURT	M	5	HOLD	FRANKFURT	BREED WITH	185	
223	FRANKFURT	F	1	SEND TO	NZP-CRC	BREED WITH	197	
228	FRANKFURT	F	1	HOLD	FRANKFURT	BREED WITH	34	
229	FRANKFURT	F	0	HOLD	FRANKFURT	DO NOT BREED		
181	FRANKLINP	F	9	HOLD	FRANKLINP	DO NOT BREED		
227	FRANKLINP	M	1	HOLD	FRANKLINP	DO NOT BREED		
68	LESNA	M	22	HOLD	LESNA	BREED WITH	213	
213	LESNA	F	3	HOLD	LESNA	BREED WITH	68	
216	METROZOO	M	2	HOLD	METROZOO	DO NOT BREED		
23	NY BRONX	M	40	HOLD	NY BRONX	DO NOT BREED		
101	NY BRONX	M	42	HOLD	NY BRONX	BREED WITH	199	
199	NY BRONX	F	6	HOLD	NY BRONX	BREED WITH	101	
7	NZP-CRC	M	51	HOLD	NZP-CRC	DO NOT BREED		Excluded
9	NZP-CRC	M	47	HOLD	NZP-CRC	BREED WITH	205	
27	NZP-CRC	M	37	HOLD	NZP-CRC	BREED WITH	183	
74	NZP-CRC	M	21	HOLD	NZP-CRC	DO NOT BREED		
176	NZP-CRC	M	10	HOLD	NZP-CRC	DO NOT BREED		Excluded
183	NZP-CRC	F	9	HOLD	NZP-CRC	BREED WITH	27	
197	NZP-CRC	M	5	HOLD	NZP-CRC	BREED WITH	223	
205	NZP-CRC	F	4	HOLD	NZP-CRC	BREED WITH	9	
225	NZP-CRC	M	1	SEND TO	SANDIEGOZ	BREED WITH	218	
226	NZP-CRC	M	1	HOLD	NZP-CRC	DO NOT BREED		

ID	Location	Sex	Age	Disposition	New Location	Breeding	With	Notes
230	NZP-CRC	U	0	HOLD	NZP-CRC	DO NOT BREED		Excluded; see notes
171	PAIGNTON	M	10	HOLD	PAIGNTON	DO NOT BREED		
209	PINOLA	M	4	HOLD	PINOLA	BREED WITH	220	
217	PINOLA	M	2	SEND TO	TOLEDO	BREED WITH	215	
220	PINOLA	F	1	HOLD	PINOLA	BREED WITH	209	
21	SANDIEGOZ	F	40	HOLD	SANDIEGOZ	DO NOT BREED		Excluded
104	SANDIEGOZ	M	14	HOLD	SANDIEGOZ	DO NOT BREED		
109	SANDIEGOZ	M	13	SEND TO	SINGAPORE	BREED WITH	222	
218	SANDIEGOZ	F	2	HOLD	SANDIEGOZ	BREED WITH	225	
194	SD-WAP	M	5	HOLD	SD-WAP	BREED WITH	198	
198	SD-WAP	F	6	HOLD	SD-WAP	BREED WITH	194	
79	SYRACUSE	M	19	HOLD	SYRACUSE	DO NOT BREED		
6	TOLEDO	M	53	HOLD	TOLEDO	DO NOT BREED		
47	TOLEDO	M	28	SEND TO	WALSRODE	DO NOT BREED		
215	TOLEDO	F	2	HOLD	TOLEDO	BREED WITH	217	
179	WALSRODE	F	9	HOLD	WALSRODE	DO NOT BREED		
184	WALSRODE	M	7	HOLD	WALSRODE	BREED WITH	221	
221	WALSRODE	F	1	HOLD	WALSRODE	BREED WITH	184	
222	WALSRODE	F	1	SEND TO	SINGAPORE	BREED WITH	109	or other female

Breeding and Transfer Recommendations by Facility

ALPHEN (Sustainability Partner)
Birdpark Avifauna
Alphen A/D Rijn, Netherlands

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
177	14743	M	9	HOLD	ALPHEN	DO NOT BREED		
180	15555	M	9	HOLD	ALPHEN	BREED WITH	214	
211	17286	M	3	SEND TO	SEE NOTES	SEE NOTES		This bird will be sent to another EAZA zoo who plans to undergo the AZA sustainability process. Breed with F200.
214	18462	F	3	HOLD	ALPHEN	BREED WITH	180	

BERLINZOO (Sustainability Partner)
Zoologischer Garten Berlin AG
D-10787 Berlin, Germany

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
58	990172	M	24	HOLD	BERLINZOO	DO NOT BREED		
160	B10-00006	M	12	HOLD	BERLINZOO	BREED WITH	174	
168	B08-00119	F	14	HOLD	BERLINZOO	DO NOT BREED		
174	B11-00005	F	10	HOLD	BERLINZOO	BREED WITH	160	
186	B14-00012	M	7	HOLD	BERLINZOO	DO NOT BREED		
200	B15-00027	F	6	SEND TO	SEE NOTES	SEE NOTES		This bird will be sent to another EAZA zoo who plans to undergo the AZA sustainability process. Breed with M211.
204	B15-00012	M	6	HOLD	BERLINZOO	DO NOT BREED		

COLUMBUS
Columbus Zoo and Aquarium
Powell, OH, USA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
203	117047	M	4	HOLD	COLUMBUS	DO NOT BREED		

FRANKFURT (Sustainability Partner)
Frankfurt Zoo
Frankfurt am Main, Germany

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
16	38414	M	42	HOLD	FRANKFURT	DO NOT BREED		Excluded
34	21768	M	34	HOLD	FRANKFURT	BREED WITH	228	
65	38870	F	23	HOLD	FRANKFURT	DO NOT BREED		
83	41370	M	18	HOLD	FRANKFURT	DO NOT BREED		
185	44864	F	7	HOLD	FRANKFURT	BREED WITH	195	
190	45145	F	6	HOLD	FRANKFURT	BREED WITH	192	
192	45226	M	6	HOLD	FRANKFURT	BREED WITH	190	
195	46886	M	5	HOLD	FRANKFURT	BREED WITH	185	
223	46449	F	1	SEND TO	NZP-CRC	BREED WITH	197	
228	46631	F	1	HOLD	FRANKFURT	BREED WITH	34	
229	46633	F	0	HOLD	FRANKFURT	DO NOT BREED		

FRANKLINP
Zoo New England
Boston, MA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
181	A14497	F	9	HOLD	FRANKLINP	DO NOT BREED		
227	F20436	M	1	HOLD	FRANKLINP	DO NOT BREED		

LESNA (Sustainability Partner)
Zoologicka garden & Chateau Zlin-Lesna
Zlin-Lesna, Czech Republic

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
68	216187	M	22	HOLD	LESNA	BREED WITH	213	
213	220408	F	3	HOLD	LESNA	BREED WITH	68	

METROZOO
Zoo Miami
Miami, FL

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
216	19B394	M	2	HOLD	METROZOO	DO NOT BREED		

NY BRONX

Wildlife Conservation Society – Bronx Zoo
Bronx, NY, USA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
23	B11052	M	40	HOLD	NY BRONX	DO NOT BREED		
101	B11051	M	42	HOLD	NY BRONX	BREED WITH	199	
199	B18217	F	6	HOLD	NY BRONX	BREED WITH	101	

NZP-CRC

NZP-Conservation & Research Center
Front Royal, VA, USA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
7	201094	M	51	HOLD	NZP-CRC	DO NOT BREED		Excluded
9	203567	M	47	HOLD	NZP-CRC	BREED WITH	205	
27	212220	M	37	HOLD	NZP-CRC	BREED WITH	183	
74	216017	M	21	HOLD	NZP-CRC	DO NOT BREED		
176	216070	M	10	HOLD	NZP-CRC	DO NOT BREED		Excluded
183	216225	F	9	HOLD	NZP-CRC	BREED WITH	27	
197	216543	M	5	HOLD	NZP-CRC	BREED WITH	223	
205	216638	F	4	HOLD	NZP-CRC	BREED WITH	9	
225	217014	M	1	SEND TO	SANDIEGOZ	BREED WITH	218	
226	217080	M	1	HOLD	NZP-CRC	DO NOT BREED		
223	46449	F	1	RECEIVE FROM	FRANKFURT	BREED WITH	197	
230	217378	U	0	HOLD	NZP-CRC	DO NOT BREED		This chick hatched after the planning meeting and is not in the analysis

PAIGNTON (Sustainability Partner)

Paignton Seashore Aquarium
Paignton, Devon, England

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
171	14739	M	10	HOLD	PAIGNTON	DO NOT BREED		

PINOLA

Pinola Conservancy
Shreveport, LA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
209	KIWI1801	M	4	HOLD	PINOLA	BREED WITH	220	
217	PINOLA	M	2	SEND TO	TOLEDO	BREED WITH	215	
220	46470	F	1	HOLD	PINOLA	BREED WITH	209	

SANDIEGOZ

San Diego Zoo
San Diego, CA, USA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
21	300006	F	40	HOLD	SANDIEGOZ	DO NOT BREED		Excluded
104	B11027	M	14	HOLD	SANDIEGOZ	DO NOT BREED		
109	B11028	M	13	SEND TO	SINGAPORE	BREED WITH	222	
218	1000553	F	2	HOLD	SANDIEGOZ	BREED WITH	225	
225	217014	M	1	RECEIVE FROM	NZP-CRC	BREED WITH	218	

SD-WAP

San Diego Zoo Safari Park
San Diego, CA, USA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
194	817187	M	5	HOLD	SD-WAP	BREED WITH	198	
198	818223	F	6	HOLD	SD-WAP	BREED WITH	194	

SINGWRS (Sustainability Partner)

Wildlife Reserves Singapore
Singapore

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
109	B11028	M	13	RECEIVE FROM	SANDIEGOZ	BREED WITH	222	
222	Z2195	F	1	RECEIVE FROM	WALSRODE	BREED WITH	109	

SYRACUSE

Rosamond Gifford Zoo at Burnet Park
Syracuse, NY

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
79	B19150	M	19	HOLD	SYRACUSE	DO NOT BREED		

TOLEDO

Toledo Zoo
Toledo, OH, USA

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
6	8695	M	53	HOLD	TOLEDO	DO NOT BREED		
47	8731	M	28	SEND TO	WALSRODE	DO NOT BREED		
215	13849	F	2	HOLD	TOLEDO	BREED WITH	217	
217	PINOLA	M	2	RECEIVE FROM	PINOLA	BREED WITH	215	

WALSRODE (Sustainability Partner)
Vogelpark Walsrode
D-29664 Walsrode, Germany

ID	Local ID	Sex	Age	Disposition	Location	Breeding	With	Notes
179	Z20216	F	9	HOLD	WALSRODE	DO NOT BREED		
184	Z2193	M	7	HOLD	WALSRODE	BREED WITH	221	
221	Z2194	F	1	HOLD	WALSRODE	BREED WITH	184	
222	Z2195	F	1	SEND TO	SINGAPORE	BREED WITH	109	
47	8731	M	28	RECEIVE FROM	TOLEDO	DO NOT BREED		

Appendices

A. Analytical Assumptions

No assumptions were used in the analyses. The pedigree of the population is 100% known.

B. Summary of Data Exports

Studbook Name	Kiwi, North Island Brown (*Apterix mantelli)*
Studbook Currentness Date	March 09, 2022
Studbook Software and version #	ZIMS for Studbooks release date March 7 2022.
Overlay Name	N/A
PMx version #	1.6.2.20200804
.fed file	None; full data set was exported.
Descriptive Survival Statistics Report	Report is archived with PMC/AZA and Median Life Expectancy can be viewed here: https://www.aza.org/species-survival-statistics

PMx Project: Kiwi2022
Created: 2022-03-09 by PMx version 1.6.2.20200804
File: C:\PMxProjects\Kiwi2022.pmxproj

Primary data file
Data File Name: zims.zims
Common Name: Brown kiwi
Scientific Name: Apteryx mantelli
Data Source: ZIMS for Studbooks
Studbook Name: Kiwi, North Island Brown (Apteryx mantelli)
Exported On: 2022-03-09
Software version: ZIMS for Studbooks 3.0
Current Through: 2022-03-09
Compiled By: Kathy Brader, Stefan G Stadler
Scope: AZA
Dates: 1976-01-01 to 2022-03-09
Location:
Association:
Other Filters: Status = Living
User: Cara Groome Bryan

Moves data file
Scope: AZA
Dates: 1976-01-01 to 2022-03-09
Location:
Association:
Other Filters: Status = None
User: Cara Groome Bryan

Moves data file
Scope: AZA
Dates: 1976-01-01 to 2022-03-09
Location:
Association:
Other Filters: Status = None
User: Cara Groome Bryan

Demographic input files
Census1 file: Exchcens.txt

The full data set was exported to PMx with no filters. Two animals in Japan that are not part of the SSP were de-selected on the PMx selection screen.

C. Animals Excluded from Genetic Analyses

ID	Location	Sex	Age	Reason for Exclusion
230	NZP-CRC	U	0	Hatched after planning meeting and analysis. Will be included in future plans.
16	FRANKFURT	M	42	Age
7	NZP-CRC	M	51	Age
176	NZP-CRC	M	10	Program animal
21	SANDIEGOZ	F	40	Age

D. Life Tables

Px = survival; Qx = mortality; Lx = cumulative survivorship; Mx = fecundity; Ex = life expectancy; Vx = expected future reproduction, At Risk (Qx and Mx) = number of animals corresponding values are estimated from.

Males

Age (years)	Px	Mid Px	Qx	Risk Qx	Lx	Mid Lx	Mx	Risk Mx	Ex	Vx	Cx	Births	Deaths
0	**0.788**	0.882	**0.212**	73.604	1.000	0.894	**0.000**	73.604	---	1.118	0.046	0.0	18.5
1	**1.000**	0.993	**0.000**	73.255	0.788	0.788	**0.000**	73.255	---	1.266	0.041	0.0	0.0
2	**0.986**	0.964	**0.014**	71.847	0.788	0.783	**0.007**	71.847	---	1.273	0.040	0.5	1.0
3	**0.942**	0.963	**0.058**	67.214	0.778	0.755	**0.015**	67.214	---	1.311	0.039	1.0	4.0
4	**0.984**	0.946	**0.016**	63.638	0.733	0.727	**0.024**	63.638	---	1.343	0.038	1.5	1.0
5	**0.907**	0.935	**0.093**	63.277	0.721	0.688	**0.048**	63.277	---	1.392	0.036	3.0	6.0
6	**0.965**	0.956	**0.035**	55.674	0.654	0.643	**0.125**	55.674	---	1.436	0.033	7.0	2.0
7	**0.947**	0.954	**0.053**	54.858	0.631	0.615	**0.064**	54.858	---	1.369	0.032	3.5	3.0
8	**0.962**	0.952	**0.038**	51.696	0.598	0.586	**0.039**	51.696	---	1.365	0.031	2.0	2.0
9	**0.941**	0.915	**0.059**	49.808	0.575	0.558	**0.080**	49.808	---	1.392	0.029	4.0	3.0
10	**0.888**	0.929	**0.112**	42.792	0.541	0.511	**0.060**	42.792	---	1.431	0.027	2.5	5.0
11	**0.974**	0.947	**0.026**	38.197	0.481	0.474	**0.143**	38.197	---	1.474	0.025	5.5	1.0
12	**0.919**	0.958	**0.081**	35.570	0.468	0.449	**0.125**	35.570	---	1.403	0.024	4.5	3.0
13	**1.000**	0.985	**0.000**	33.964	0.430	0.430	**0.044**	33.964	---	1.332	0.023	1.5	0.0
14	**0.970**	0.969	**0.030**	32.337	0.430	0.424	**0.153**	32.337	---	1.306	0.022	5.0	1.0
15	**0.968**	0.950	**0.032**	30.134	0.417	0.410	**0.100**	30.134	---	1.188	0.022	3.0	1.0
16	**0.932**	0.947	**0.068**	27.756	0.404	0.390	**0.107**	27.756	---	1.143	0.021	3.0	2.0
17	**0.963**	0.943	**0.037**	26.556	0.376	0.369	**0.151**	26.556	---	1.092	0.020	4.0	1.0
18	**0.921**	0.959	**0.079**	23.523	0.362	0.348	**0.171**	23.523	---	0.997	0.018	4.0	2.0
19	**1.000**	1.000	**0.000**	22.090	0.334	0.334	**0.180**	22.090	---	0.859	0.018	4.0	0.0
20	**1.000**	0.952	**0.000**	22.000	0.334	0.334	**0.091**	22.000	---	0.678	0.018	2.0	0.0
21	**0.905**	0.950	**0.095**	20.142	0.334	0.318	**0.122**	20.142	---	0.616	0.017	2.5	2.0
22	**1.000**	1.000	**0.000**	17.458	0.302	0.302	**0.000**	17.458	---	0.519	0.016	0.0	0.0
23	**1.000**	0.969	**0.000**	17.000	0.302	0.302	**0.029**	17.000	---	0.519	0.016	0.5	0.0
24	**0.938**	0.903	**0.063**	15.392	0.302	0.293	**0.000**	15.392	---	0.504	0.016	0.0	1.0
25	**0.867**	0.929	**0.133**	13.879	0.283	0.264	**0.077**	13.879	---	0.557	0.014	1.0	2.0
26	**1.000**	1.000	**0.000**	13.000	0.245	0.245	**0.038**	13.000	---	0.517	0.013	0.5	0.0
27	**1.000**	1.000	**0.000**	13.000	0.245	0.245	**0.077**	13.000	---	0.477	0.013	1.0	0.0
28	**1.000**	0.958	**0.000**	12.603	0.245	0.245	**0.042**	12.603	---	0.400	0.013	0.5	0.0
29	**0.917**	0.913	**0.083**	11.534	0.245	0.235	**0.000**	11.534	---	0.373	0.013	0.0	1.0
30	**0.909**	0.952	**0.091**	10.501	0.225	0.215	**0.000**	10.501	---	0.408	0.012	0.0	1.0
31	**1.000**	0.950	**0.000**	10.000	0.205	0.205	**0.000**	10.000	---	0.428	0.011	0.0	0.0
32	**0.900**	0.947	**0.100**	9.581	0.205	0.194	**0.000**	9.581	---	0.449	0.011	0.0	1.0
33	**1.000**	1.000	**0.000**	9.000	0.184	0.184	**0.000**	9.000	---	0.474	0.010	0.0	0.0
34	**1.000**	1.000	**0.000**	8.986	0.184	0.184	**0.222**	8.986	---	0.473	0.010	2.0	0.0
35	**1.000**	1.000	**0.000**	8.000	0.184	0.184	**0.125**	8.000	---	0.250	0.010	1.0	0.0
36	**1.000**	1.000	**0.000**	8.000	0.184	0.184	**0.125**	8.000	---	0.125	0.010	1.0	0.0
37	**1.000**	1.000	**0.000**	7.715	0.184	0.184	**0.000**	7.715	---	0.000	0.010	0.0	0.0

38	**1.000**	1.000	**0.000**	7.000	0.184	0.184	**0.000**	7.000	---	0.000	0.010	0.0	0.0
39	**1.000**	1.000	**0.000**	7.000	0.184	0.184	**0.000**	7.000	---	0.000	0.010	0.0	0.0
40	**1.000**	1.000	**0.000**	5.589	0.184	0.184	**0.000**	5.589	---	0.000	0.010	0.0	0.0
41	**1.000**	1.000	**0.000**	5.000	0.184	0.184	**0.000**	5.000	---	0.000	0.010	0.0	0.0
42	**1.000**	1.000	**0.000**	3.427	0.184	0.184	**0.000**	3.427	---	0.000	0.010	0.0	0.0
43	**1.000**	1.000	**0.000**	3.000	0.184	0.184	**0.000**	3.000	---	0.000	0.010	0.0	0.0
44	**1.000**	1.000	**0.000**	3.000	0.184	0.184	**0.000**	3.000	---	0.000	0.010	0.0	0.0
45	**1.000**	1.000	**0.000**	3.000	0.184	0.184	**0.000**	3.000	---	0.000	0.010	0.0	0.0
46	**1.000**	1.000	**0.000**	3.000	0.184	0.184	**0.000**	3.000	---	0.000	0.010	0.0	0.0
47	**1.000**	1.000	**0.000**	2.162	0.184	0.184	**0.000**	2.162	---	0.000	0.010	0.0	0.0
48	**1.000**	1.000	**0.000**	2.000	0.184	0.184	**0.000**	2.000	---	0.000	0.010	0.0	0.0
49	**1.000**	1.000	**0.000**	2.000	0.184	0.184	**0.000**	2.000	---	0.000	0.010	0.0	0.0
50	**1.000**	1.000	**0.000**	2.000	0.184	0.184	**0.000**	2.000	---	0.000	0.010	0.0	0.0
51	**1.000**	1.000	**0.000**	1.222	0.184	0.184	**0.000**	1.222	---	0.000	0.010	0.0	0.0
52	**1.000**	1.000	**0.000**	1.000	0.184	0.184	**0.000**	1.000	---	0.000	0.010	0.0	0.0
53	**1.000**	1.000	**0.000**	0.000	0.184	0.184	**0.000**	0.000	---	0.000	0.010	0.0	0.0
54	**1.000**	1.000	**0.000**	0.000	0.184	0.184	**0.000**	0.000	---	0.000	0.010	0.0	0.0
55	**1.000**	1.000	**0.000**	0.000	0.184	0.184	**0.000**	0.000	---	0.000	0.010	0.0	0.0

r = -0.002; lambda = 0.998; T = 15.6; N(at 20 yrs) = 27

Females

Age (years)	Px	Mid Px	Qx	Risk Qx	Lx	Mid Lx	Mx	Risk Mx	Ex	Vx	Cx	Births	Deaths
0	**0.731**	0.820	**0.269**	67.892	1.000	0.866	**0.000**	67.892	11.764	1.155	0.090	0.0	22.5
1	**0.942**	0.962	**0.058**	66.742	0.731	0.710	**0.000**	66.742	13.126	1.416	0.073	0.0	4.0
2	**0.984**	0.942	**0.016**	63.274	0.689	0.683	**0.000**	63.274	12.599	1.480	0.070	0.0	1.0
3	**0.899**	0.947	**0.101**	55.616	0.678	0.643	**0.027**	55.616	12.316	1.579	0.066	1.5	6.0
4	**1.000**	0.933	**0.000**	52.614	0.609	0.609	**0.057**	52.614	11.954	1.648	0.062	3.0	0.0
5	**0.866**	0.863	**0.134**	48.170	0.609	0.568	**0.134**	48.170	11.742	1.715	0.057	6.5	7.0
6	**0.860**	0.884	**0.140**	39.279	0.527	0.490	**0.213**	39.279	12.447	1.841	0.049	8.5	6.0
7	**0.913**	0.938	**0.087**	32.912	0.453	0.434	**0.194**	32.912	12.946	1.852	0.043	6.5	3.0
8	**0.967**	0.983	**0.033**	29.674	0.414	0.407	**0.136**	29.674	12.731	1.776	0.041	4.0	1.0
9	**1.000**	1.000	**0.000**	27.641	0.400	0.400	**0.129**	27.641	11.933	1.678	0.040	3.5	0.0
10	**1.000**	0.960	**0.000**	25.252	0.400	0.400	**0.138**	25.252	10.933	1.557	0.039	3.5	0.0
11	**0.920**	0.917	**0.080**	24.145	0.400	0.384	**0.291**	24.145	10.347	1.487	0.038	7.0	2.0
12	**0.913**	0.868	**0.087**	22.038	0.368	0.352	**0.229**	22.038	10.197	1.311	0.034	5.0	2.0
13	**0.818**	0.874	**0.182**	20.134	0.336	0.305	**0.169**	20.134	10.598	1.254	0.030	3.5	4.0
14	**0.941**	0.879	**0.059**	16.293	0.275	0.267	**0.153**	16.293	10.988	1.249	0.026	2.5	1.0
15	**0.813**	0.828	**0.188**	13.729	0.259	0.234	**0.184**	13.729	11.366	1.254	0.022	2.5	3.0
16	**0.846**	0.875	**0.154**	11.266	0.210	0.194	**0.223**	11.266	12.525	1.300	0.019	2.5	2.0
17	**0.909**	0.857	**0.091**	10.400	0.178	0.170	**0.236**	10.400	13.171	1.236	0.016	2.5	1.0
18	**0.800**	0.833	**0.200**	8.764	0.162	0.146	**0.063**	8.764	14.200	1.173	0.014	0.5	2.0
19	**0.875**	0.933	**0.125**	7.447	0.129	0.121	**0.196**	7.447	15.840	1.340	0.011	1.5	1.0
20	**1.000**	0.929	**0.000**	7.000	0.113	0.113	**0.143**	7.000	15.900	1.231	0.011	1.0	0.0
21	**0.857**	0.923	**0.143**	6.756	0.113	0.105	**0.226**	6.756	16.046	1.179	0.010	1.5	1.0

22	**1.000**	1.000	**0.000**	6.000	0.097	0.097	**0.167**	6.000	16.300	1.037	0.009	1.0	0.0
23	**1.000**	1.000	**0.000**	5.162	0.097	0.097	**0.100**	5.162	15.300	0.875	0.009	0.5	0.0
24	**1.000**	0.900	**0.000**	5.000	0.097	0.097	**0.000**	5.000	14.300	0.779	0.009	0.0	0.0
25	**0.800**	0.889	**0.200**	5.000	0.097	0.087	**0.100**	5.000	14.778	0.871	0.008	0.5	1.0
26	**1.000**	1.000	**0.000**	4.000	0.078	0.078	**0.000**	4.000	15.500	0.872	0.007	0.0	0.0
27	**1.000**	1.000	**0.000**	4.000	0.078	0.078	**0.125**	4.000	14.500	0.876	0.007	0.5	0.0
28	**1.000**	1.000	**0.000**	4.000	0.078	0.078	**0.000**	4.000	13.500	0.755	0.007	0.0	0.0
29	**1.000**	1.000	**0.000**	4.000	0.078	0.078	**0.000**	4.000	12.500	0.759	0.007	0.0	0.0
30	**1.000**	1.000	**0.000**	4.000	0.078	0.078	**0.000**	4.000	11.500	0.764	0.007	0.0	0.0
31	**1.000**	1.000	**0.000**	4.000	0.078	0.078	**0.000**	4.000	10.500	0.768	0.007	0.0	0.0
32	**1.000**	1.000	**0.000**	4.000	0.078	0.078	**0.000**	4.000	9.500	0.772	0.007	0.0	0.0
33	**1.000**	1.000	**0.000**	3.384	0.078	0.078	**0.125**	3.384	8.500	0.776	0.007	0.5	0.0
34	**1.000**	1.000	**0.000**	3.000	0.078	0.078	**0.333**	3.000	7.500	0.654	0.007	1.0	0.0
35	**1.000**	1.000	**0.000**	3.000	0.078	0.078	**0.000**	3.000	6.500	0.323	0.007	0.0	0.0
36	**1.000**	1.000	**0.000**	3.000	0.078	0.078	**0.000**	3.000	5.500	0.325	0.007	0.0	0.0
37	**1.000**	1.000	**0.000**	3.000	0.078	0.078	**0.000**	3.000	4.500	0.326	0.007	0.0	0.0
38	**1.000**	0.833	**0.000**	3.000	0.078	0.078	**0.000**	3.000	3.500	0.328	0.007	0.0	0.0
39	**0.667**	0.800	**0.333**	2.734	0.078	0.065	**0.000**	2.734	3.000	0.396	0.005	0.0	1.0
40	**1.000**	1.000	**0.000**	1.510	0.052	0.052	**0.000**	1.510	2.500	0.497	0.004	0.0	0.0
41	**1.000**	0.500	**0.000**	1.000	0.052	0.052	**0.500**	1.000	1.500	0.500	0.004	0.5	0.0
42	**0.000**	0.000	**1.000**	0.068	0.052	0.026	**0.000**	0.068	1.000	0.000	0.002	0.0	1.0
43	**0.000**	0.000	**1.000**	0.000	0.000	0.000	**0.000**	0.000	0.000	0.000	0.000	0.0	0.0

r = 0.005; lambda = 1.005; T = 12.3; N(at 20 yrs) = 27

E. Ordered Mean Kinship List

These lists are current to March 2022 and values are subject to change with any hatch, death, import, export, inclusion, exclusion, or changes in pedigree or pedigree assumptions.

Population MK = 0.0997
(as indicated by the black line)

Males

ID	MK	Known	Age	Location
6	0	1	53	TOLEDO
23	0.0037	1	40	NY BRONX
101	0.0098	1	42	NY BRONX
184	0.0294	1	7	WALSRODE
9	0.0337	1	47	NZP-CRC
194	0.0343	1	5	SD-WAP
195	0.0343	1	5	FRANKFURT
197	0.0343	1	5	NZP-CRC
203	0.0343	1	4	COLUMBUS
217	0.0343	1	2	PINOLA
192	0.0392	1	6	FRANKFURT
27	0.0441	1	37	NZP-CRC
216	0.0957	1	2	METROZOO
225	0.0957	1	1	NZP-CRC
226	0.0957	1	1	NZP-CRC
227	0.0957	1	1	FRANKLINP
211	0.0964	1	3	ALPHEN
47	0.0993	1	28	TOLEDO
68	0.1137	1	22	LESNA
74	0.1195	1	21	NZP-CRC
79	0.1195	1	19	SYRACUSE
177	0.1206	1	9	ALPHEN
34	0.1287	1	34	FRANKFURT
83	0.1391	1	18	FRANKFURT
109	0.1399	1	13	SANDIEGOZ
160	0.1399	1	12	BERLINZOO
180	0.1399	1	9	ALPHEN
186	0.1399	1	7	BERLINZOO
204	0.1399	1	6	BERLINZOO
58	0.1403	1	24	BERLINZOO
171	0.1411	1	10	PAIGNTON
209	0.1411	1	4	PINOLA
104	0.1423	1	14	SANDIEGOZ

Females

ID	MK	Known	Age	Location
168	0.0245	1	14	BERLINZOO
185	0.0294	1	7	FRANKFURT
174	0.03	1	10	BERLINZOO
205	0.0343	1	4	NZP-CRC
213	0.0957	1	3	LESNA
214	0.0957	1	3	ALPHEN
215	0.0957	1	2	TOLEDO
220	0.0957	1	1	PINOLA
222	0.0996	1	1	WALSRODE
223	0.0996	1	1	FRANKFURT
228	0.0996	1	1	FRANKFURT
229	0.0996	1	0	FRANKFURT
218	0.1021	1	2	SANDIEGOZ
181	0.1181	1	9	FRANKLINP
65	0.1333	1	23	FRANKFURT
183	0.1377	1	9	NZP-CRC
179	0.1399	1	9	WALSRODE
200	0.1399	1	6	BERLINZOO
198	0.1411	1	6	SD-WAP
199	0.1411	1	6	NY BRONX
221	0.1411	1	1	WALSRODE
190	0.1509	1	6	FRANKFURT

F. Definitions

Management Terms (as of December 2021)

Green Species Survival Plan® (Green SSP) Program – A Green SSP Program has a population size of 50 or more animals and is projected to retain 90% gene diversity for a minimum of 100 years or 10 generations. Green SSP Programs are subject to AZA's Full Participation and Sustainability Partner Policies.

Yellow Species Survival Plan® (Yellow SSP) Program – A Yellow SSP Program has a population size of 50 or more animals but cannot retain 90% gene diversity for 100 years or 10 generations. Yellow SSP participation by AZA facilities is voluntary. Yellow SSP Programs are subject to AZA's Sustainability Partner Policy.

Red Species Survival Plan® (Red SSP) Program – A Red SSP Program has a population size of twenty or more animals managed among three or more participating AZA facilities. If a population does not meet these minimum criteria, but has an IUCN designation of Critically Endangered, Endangered, or Extinct in the Wild, and the TAG has developed three goals to sustain this population, then the population will be considered a Red SSP Program. Red SSPs cannot retain 90% gene diversity for 100 years or 10 generations and participation by AZA facilities is voluntary. Red SSP Programs are subject to AZA's Sustainability Partner Policy.

Candidate Program – A Candidate Program either has a population size of fewer than twenty individuals and/or found at fewer than three AZA facilities or it does not yet have a completed studbook so the population size is unclear. A Candidate Program is overseen by the TAG, with no additional AZA accountability requirements.

Sustainability Partners – AZA Animal Population Management (APM) Committee approved wildlife facilities that regularly exchange animals with AZA-accredited facilities and certified related facilities, typically as part of the Species Survival Plan® (SSP) Program Breeding and Transfer Plan or other SSP Program management process.

Full Participation – AZA policy stating that all AZA accredited facilities and certified related facilities having a Green SSP animal in their collection are required to participate in the collaborative SSP planning process (e.g., provide relevant animal data to the AZA Studbook Keeper, assign an Institutional Representative who will communicate facility wants and needs to the SSP Coordinator and comment on the draft plan during the 30-day review period, and abide by the recommendations agreed upon in the final plan).

All AZA member facilities and Animal Programs, regardless of management designation, must adhere to the AZA Policy on Responsible Population Management and the AZA Code of Professional Ethics. For more information on AZA policies, see https://www.aza.org/board-approved-policies-and-position-statements.

Currentness Date – The date when the entire studbook is updated. This equates to the first date you received an update after requesting updates from all the facilities included in your studbook.

Demographic Terms

Age Distribution – A visual representation of the numbers or percentages of individuals in various age and sex classes.

Ex, Life Expectancy – The 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. A lambda of 1.11 means an 11% per year increase; a lambda of 0.97 means a 3% decline in size per year. The three lambdas highlighted in this BTP are: 1) Life Table, from the PMx life tables, the change in the population based on the demographic regional and date window exported from the studbook, the life table lambda is the rate at which the population would be expected to grow (in the future) given the birth and death rates reported in the life tables and assuming a stable age distribution (does NOT factor in imports or exports); 2) 5-year, from the studbook census, the 5-year lambda is calculated from observed changes in population size over the last 5 years and includes births, deaths, imports and exports; and 3) Projected, from the PMx stochastic 20-year projections (includes confidence intervals), models how the population is predicted to grow or decline over the next 20 years given the birth and death rates from the life tables and the age structure of the current population.

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.

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.

Median Life Expectancy (MLE) – The 'typical' age at which an average animal is expected to live; 50% will die before the median life expectancy and 50% die after. The MLE reported in Breeding and Transfer Plans (BTPs) and Survival Stats Reports, does excludes individuals that did not survive to their first birthday. The MLE obtained from population management software (PM2000, PMx, ZooRisk) or from life tables in BTPs (e.g., where Lx = 0.5) will be lower because they include those individuals that did not survive to their first birthday in order to project the correct number of births needed. A Survival Statistics Library is maintained for most AZA Animal Programs on the AZA website: https://www.aza.org/species-survival-statistics.

Maximum Longevity – The maximum age at which we have observed a species to live. If the oldest observed animal is currently living, we do not yet know the maximum longevity.

Mx, Fecundity – The average number of same-sexed offspring born to animals in that age class. Because studbooks typically have relatively small sample sizes, studbook software calculates Mx as 1/2 the average number of offspring 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 an age class; is conditional on an individual being alive at the beginning of the age class. Alternatively, the proportion of individuals that survive from the beginning of one age class to the next.

Qx, Mortality – The probability that an individual of age *x* dies during an age class (Qx = 1-Px). Alternatively, 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").

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.

Target Population Size (TPS) – The desired number of SSP animals to be held across AZA and approved partner facilities over a specific, stated timeframe. This number is determined with consideration for program roles and goals (genetic, demographic, and others), logistical constraints, spatial competition with other TAG-managed species, and other population-specific concerns. Target Population Size is determined by the Taxon Advisory Group (TAG) and published in their Regional Collection Plan (RCP).

Vx, **Reproductive Value –** The expected number of offspring produced this year and in future years by an animal of age *x*.

Genetic Terms

Allele – Alternate forms of DNA at a particular position in a genome (genetic locus). Alleles represent the most basic form of genetic diversity.

Gene Diversity (GD) – The probability that two alleles randomly sampled from the same genetic locus across a population are not identical by descent. Gene diversity is calculated relative to a population’s founders, which are assumed to be unrelated and not inbred, and is the proportional diversity retained by the current, descendant population.

Effective Population Size (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 allele 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 allele frequency drift is measured in the current generation). More specifically, PMx software uses the definition as the size of the current population that have produced offspring, assuming that there are current breeders, that these current breeders have a Poisson distribution of family sizes, that none of the current breeders are now post-reproductive, and none of the not-yet-breeding adults will breed.

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 Genome Equivalents (FGE) – The number of wild-caught individuals (founders) that represent the same amount of gene diversity as does the population under study. The gene diversity of a population is 1 - 1 / (2 * FGE).

Founder Representation – The proportion of the alleles in the living, descendant population that are derived from that founder.

Inbreeding Coefficient (F) – The probability that the two alleles present at an individual’s genetic locus are identical by descent (i.e., both alleles originated from an ancestor common to both the individual’s parents).

Mean Kinship (MK) – The mean (or average) kinship coefficient between an animal and all animals (including itself) in the living, captive-born population. An individual’s mean kinship is a measure of how well its alleles are represented within a population. Animals with low mean kinships have few relatives, are from under-represented founder lineages, and have transmitted few of their alleles to the next generation; these individuals should be prioritized for breeding to slow a population’s gene diversity loss.

Percent Known – The percentage of an animal's genome that is traceable to known founders. Thus, if an animal has an UNK sire, its % Known = 50. If it has an UNK grandparent, its % Known = 75.

Percent Certain – The percentage of the living individuals' pedigree that can be completely identified as *certain:* (exact identity of both parents is known) and traceable back to known founders. Individuals that are 100% *certain* do not have any MULTs or UNKs in their pedigree. *Certainty* represents a higher degree of knowledge than *Known* and therefore is always less than or equal to *Known.*

G. AZA Animal Population Management (APM) Committee Disclaimers

as of June 2019

This Animal Program is currently a Yellow SSP and recommendations proposed are non-binding – participation is voluntary. Transfers to non-AZA facilities must comply with each facility's acquisition/transfer policy, in accordance with the AZA Policy on Responsible Population Management. APM Committee-approved Sustainability Partners are expected to agree and abide by AZA's Code of Professional Ethics, SSP Full Participation Policy, Policy on Responsible Population Management, and Accreditation Standards related to animal care and welfare.

See the AZA Animal Population Management Committee Disclaimers in Appendix G for more info.

H. Directory of Institutional Representatives

Facility Name	Mnemonic	Contact Name (IR or Advisor)	Email
Berlin Zoo	BERLINZOO	Ragnar Kuhne Heiner Klos	h.kloes@zoo-berlin.de r.kuehne@zoo-berlin.de
Bronx Zoo	NY BRONX	Chuck Cerbini	ccerbini@wcs.org
Franklin Park Zoo	FRANKLINP	Edward O'Brien	eobrien@zoonewengland.com
Paignton Zoo	PAIGNTON	Jo Gregson	jo.gregson@paigntonzoo.org.uk
Pinola Conservancy	PINOLA	Jessica Cockrell	jcockrell@pinola.net
Rosamond Gifford Zoo at Burnet Park	SYRACUSE	April Zimpel	AprilZimpel@ongov.net
San Diego Zoo	SANDIEGOZ	Nicole LaGreco	nlagreco@sdzwa.org
San Diego Zoo Safari Park	SD-WAP	Andrew Stehly	astehly@sdzwa.org
Smithsonian's Conservation Biology Institute	NZP-CRC	Warren Lynch	Lynchw@si.edu
Toledo Zoo & Aquarium	TOLEDO	Monica Blackwell	monica.blackwell@toledozoo.org
Vogelpark Avifauna	ALPHEN	Joost Lammers	curator@avifauna.nl
Weltvogelpark Walsrode	WALSRODE	Andreas Frei	andreas.frei@weltvogelpark.de
Zoo Frankfurt	FRANKFURT	Stefan Stadler	stefan.stadler@stadt-frankfurt.de
Zoo Miami	METROZOO	Matt McHale	matthew.mchale@miamidade.gov
Zoologicka Garden & Chateau Zlin-Lesna	LESNA	Marketa Horska	straub@zoozlin.eu horska@zoozlin.eu
Smithsonian National Zoological Park	NZP-WASH	Kathleen Brader	braderk@si.edu
Wildlife Reserves Singapore	SING WRS	Luis Neves	luis.carlos@wrs.com.sg

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