
An Introduction to Managing
Captive Breeding Programs
Sander van der Wel







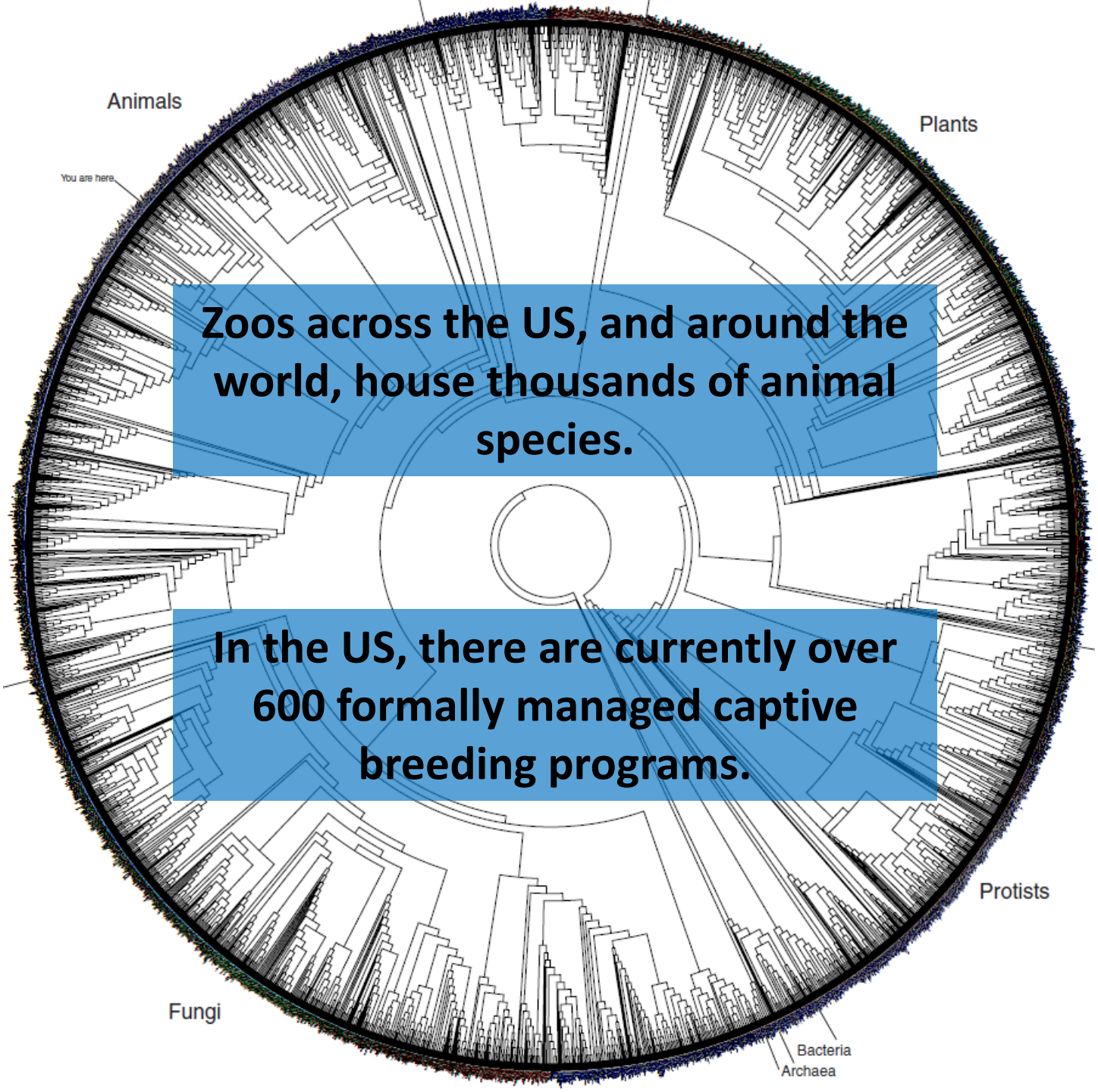












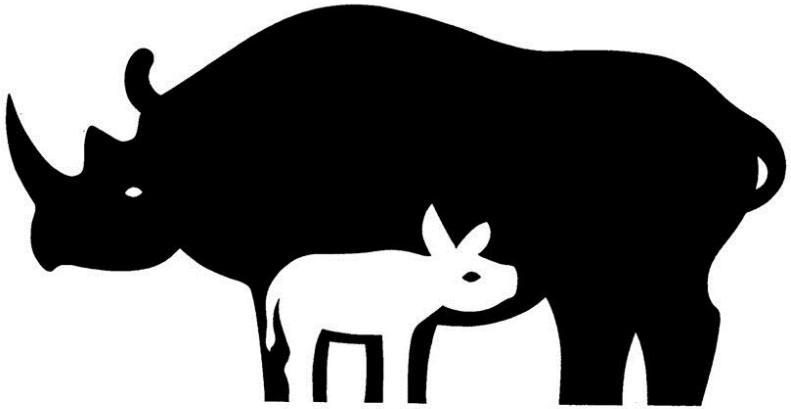
Zoos across the US, and around the world, house thousands of animal species.

In the US, there are currently over 600 formally managed captive breeding programs.

Why Cooperative Management?

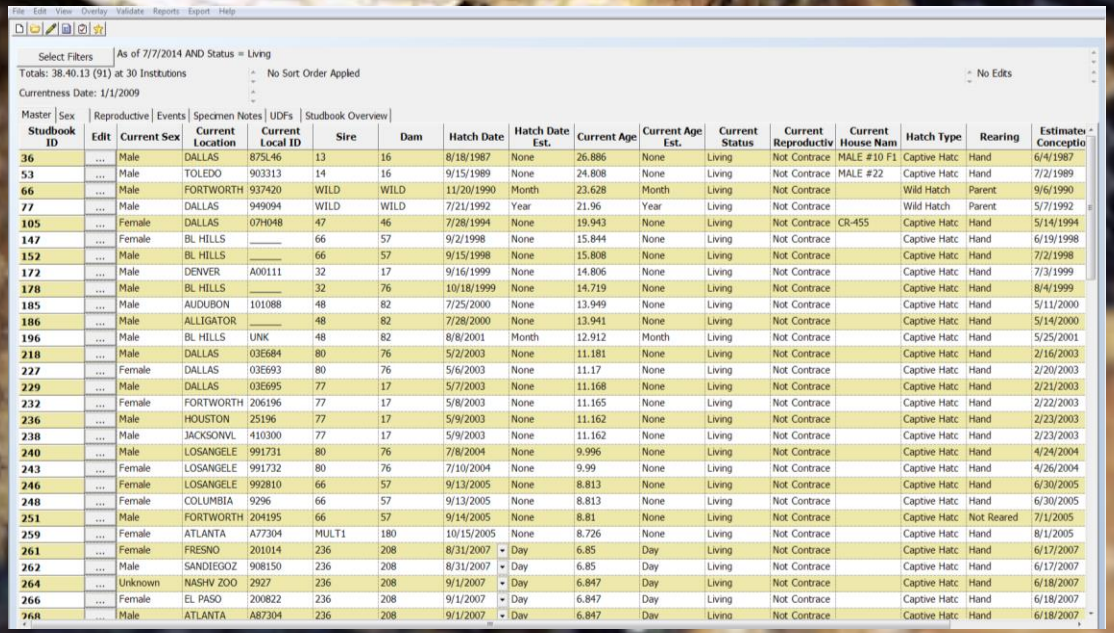
A single zoo can usually only keep a small number of animals of a particular species…

…but a group of zoos can hold a viable population if those zoos work together to cooperatively manage their animals.



Species Survival Plan

Studbooks



File Edit View Overlay Validate Reports Export Help

Select Filters | As of 7/7/2014 AND Status = Living

Totals: 38.40.13 (91) at 30 Institutions | No Sort Order Appled | No Edits

Currentness Date: 1/1/2009

Master | Sex | Reproductive | Events | Specimen Notes | UDFs | Studbook Overview

Studbook ID	Edit	Current Sex	Current Location	Current Local ID	Sire	Dam	Hatch Date	Hatch Date Est.	Current Age	Current Age Est.	Current Status	Current Reproductiv	Current House Nam	Hatch Type	Rearing	Estimate Conceptio
36	...	Male	DALLAS	875L46	13	16	8/18/1987	None	26.886	None	Living	Not Contrace	MALE #10 F1	Captive Hatc	Hand	6/4/1987
53	...	Male	TOLEDO	903313	14	16	9/15/1989	None	24.808	None	Living	Not Contrace	MALE #22	Captive Hatc	Hand	7/2/1989
66	...	Male	FORTWORTH	937420	WILD	WILD	11/20/1990	Month	23.628	Month	Living	Not Contrace		Wild Hatch	Parent	9/6/1990
77	...	Male	DALLAS	949094	WILD	WILD	7/21/1992	Year	21.96	Year	Living	Not Contrace		Wild Hatch	Parent	5/7/1992
105	...	Female	DALLAS	07H048	47	46	7/28/1994	None	19.943	None	Living	Not Contrace	CR-455	Captive Hatc	Hand	5/14/1994
147	...	Female	BL HILLS	_____	66	57	9/2/1998	None	15.844	None	Living	Not Contrace		Captive Hatc	Hand	6/19/1998
152	...	Male	BL HILLS	_____	66	57	9/15/1998	None	15.808	None	Living	Not Contrace		Captive Hatc	Hand	7/2/1998
172	...	Male	DENVER	A00111	32	17	9/16/1999	None	14.806	None	Living	Not Contrace		Captive Hatc	Hand	7/3/1999
178	...	Male	BL HILLS	_____	32	76	10/18/1999	None	14.719	None	Living	Not Contrace		Captive Hatc	Hand	8/4/1999
185	...	Male	AUDUBON	101088	48	82	7/25/2000	None	13.949	None	Living	Not Contrace		Captive Hatc	Hand	5/11/2000
186	...	Male	ALLIGATOR	_____	48	82	7/28/2000	None	13.941	None	Living	Not Contrace		Captive Hatc	Hand	5/14/2000
196	...	Male	BL HILLS	UNK	48	82	8/8/2001	Month	12.912	Month	Living	Not Contrace		Captive Hatc	Hand	5/25/2001
218	...	Male	DALLAS	03E684	80	76	5/2/2003	None	11.181	None	Living	Not Contrace		Captive Hatc	Hand	2/16/2003
227	...	Female	DALLAS	03E693	80	76	5/6/2003	None	11.17	None	Living	Not Contrace		Captive Hatc	Hand	2/20/2003
229	...	Male	DALLAS	03E695	77	17	5/7/2003	None	11.168	None	Living	Not Contrace		Captive Hatc	Hand	2/21/2003
232	...	Female	FORTWORTH	206196	77	17	5/8/2003	None	11.165	None	Living	Not Contrace		Captive Hatc	Hand	2/22/2003
236	...	Male	HOUSTON	25196	77	17	5/9/2003	None	11.162	None	Living	Not Contrace		Captive Hatc	Hand	2/23/2003
238	...	Male	JACKSONVL	410300	77	17	5/9/2003	None	11.162	None	Living	Not Contrace		Captive Hatc	Hand	2/23/2003
240	...	Male	LOSANGELE	991731	80	76	7/8/2004	None	9.996	None	Living	Not Contrace		Captive Hatc	Hand	4/24/2004
243	...	Female	LOSANGELE	991732	80	76	7/10/2004	None	9.99	None	Living	Not Contrace		Captive Hatc	Hand	4/26/2004
246	...	Female	LOSANGELE	992810	66	57	9/13/2005	None	8.813	None	Living	Not Contrace		Captive Hatc	Hand	6/30/2005
248	...	Female	COLUMBIA	9296	66	57	9/13/2005	None	8.813	None	Living	Not Contrace		Captive Hatc	Hand	6/30/2005
251	...	Male	FORTWORTH	204195	66	57	9/14/2005	None	8.81	None	Living	Not Contrace		Captive Hatc	Not Reared	7/1/2005
259	...	Female	ATLANTA	A77304	MULT1	180	10/15/2005	None	8.726	None	Living	Not Contrace		Captive Hatc	Hand	8/1/2005
261	...	Female	FRESNO	201014	236	208	8/31/2007	Day	6.85	Day	Living	Not Contrace		Captive Hatc	Hand	6/17/2007
262	...	Male	SANDIEGOZ	908150	236	208	8/31/2007	Day	6.85	Day	Living	Not Contrace		Captive Hatc	Hand	6/17/2007
264	...	Unknown	NASHV ZOO	2927	236	208	9/1/2007	Day	6.847	Day	Living	Not Contrace		Captive Hatc	Hand	6/18/2007
266	...	Female	EL PASO	200822	236	208	9/1/2007	Day	6.847	Day	Living	Not Contrace		Captive Hatc	Hand	6/18/2007
268	...	Male	ATLANTA	A87304	236	208	9/1/2007	Day	6.847	Day	Living	Not Contrace		Captive Hatc	Hand	6/18/2007

Studbooks

- document the history and pedigree of each individual in a captive population
- regional – contain records for animals in a region, International contains the records for several regions
  - also contains all ancestors in the pedigree, even if some of those animals never lived in that region (US studbook includes some Indonesian ancestors)
- managed by Studbook Keepers
- form the basis of captive population management
- must be able to identify individuals-ear tags, etc.

LachesisMuta_March2014 - 209

Specimen Report

Show Descendents | Export

Studbook ID: 209 Go | Location | Local ID Go

Current/Last

Status	Dead
Age	1.834
Age Est.	None
Sex	Female
Reproductive	Not Contracepted
Location	SANDIEGOZ
Local ID	NHXX
House Name	

Origin

Sire	80	Go
Dam	76	Go
Hatch Type	Captive Hatch	
Hatch Date	2/21/2002	
Hatch Date Est.	None	
Est. Conception Date	12/8/2001	
Rearing	Hand	
Owner	Not Reported	
First Location	DALLAS	

Main

Sex

#	Sex	Event Date	Event Date Est.
1	Female	2/21/2002	None

Reproductive

#	Reproductive	Event Date	Event
1	Not Contracepted	2/21/2002	None

Events

#	Transaction Code	Location	Local ID	Transaction Date	Transaction Date Est.
1	Hatch	DALLAS	02E254	2/21/2002	None
2	Transfer	SANDIEGOZ	903258	12/11/2003	None
3	Death	SANDIEGOZ	NHXX	12/23/2003	None

Specimen Notes

#	Description	Comment
1	Note	enclosure (DZ) ZNRE
2	Transponder ID	00-0064-3873
3	Old Studbook Number	L202

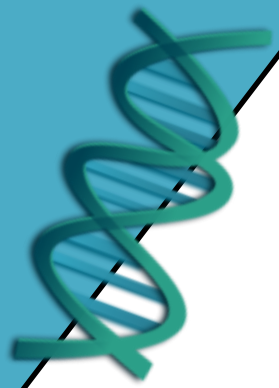
User Defined Fields

#

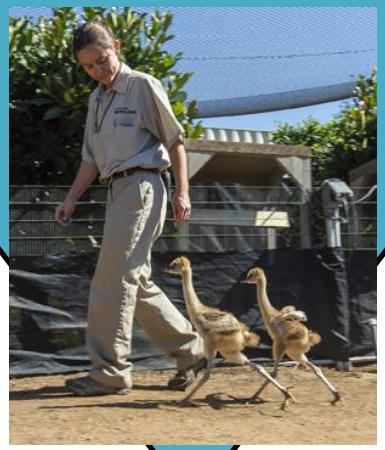
Management is a combination of…

demography

genetics



husbandry

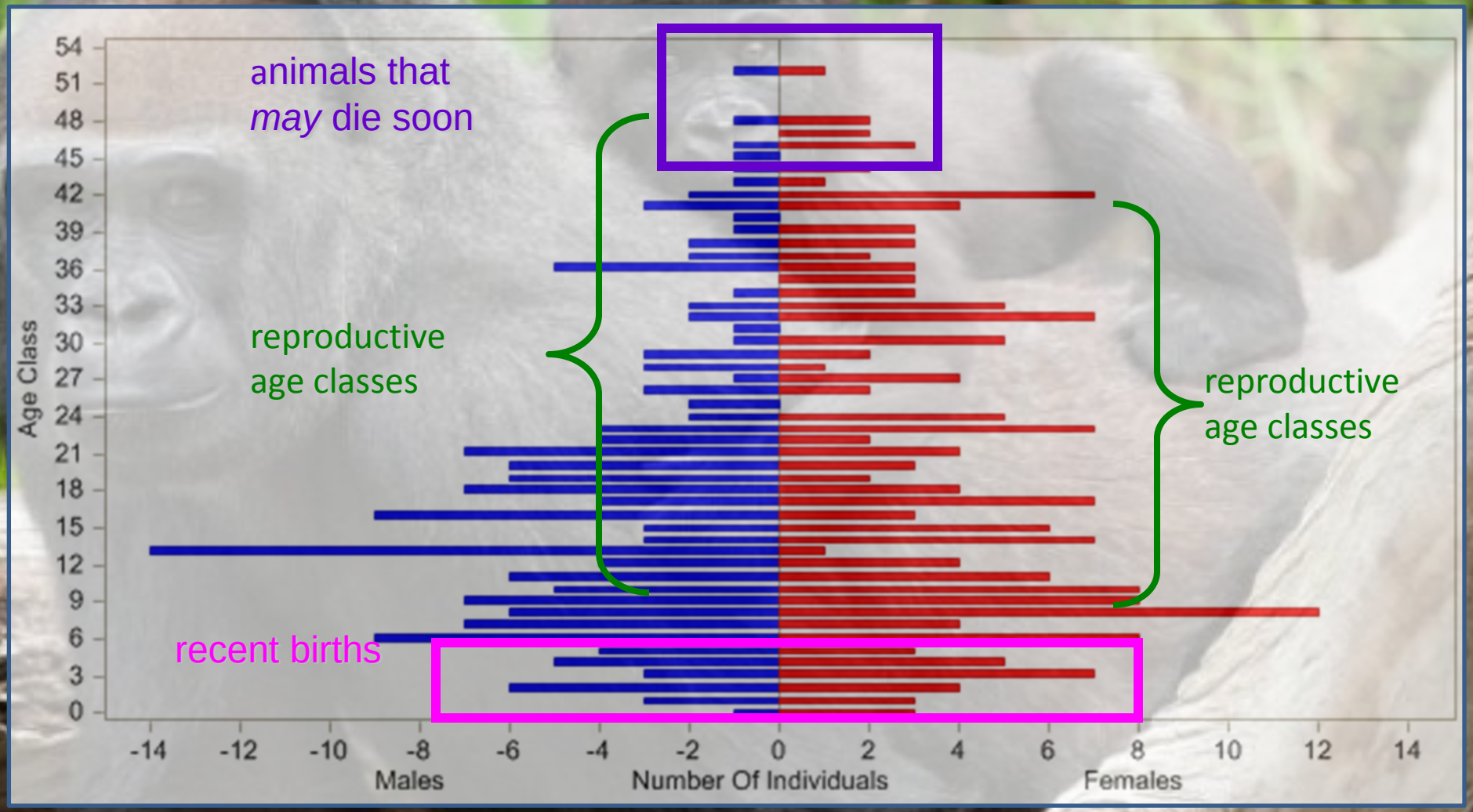


Demography

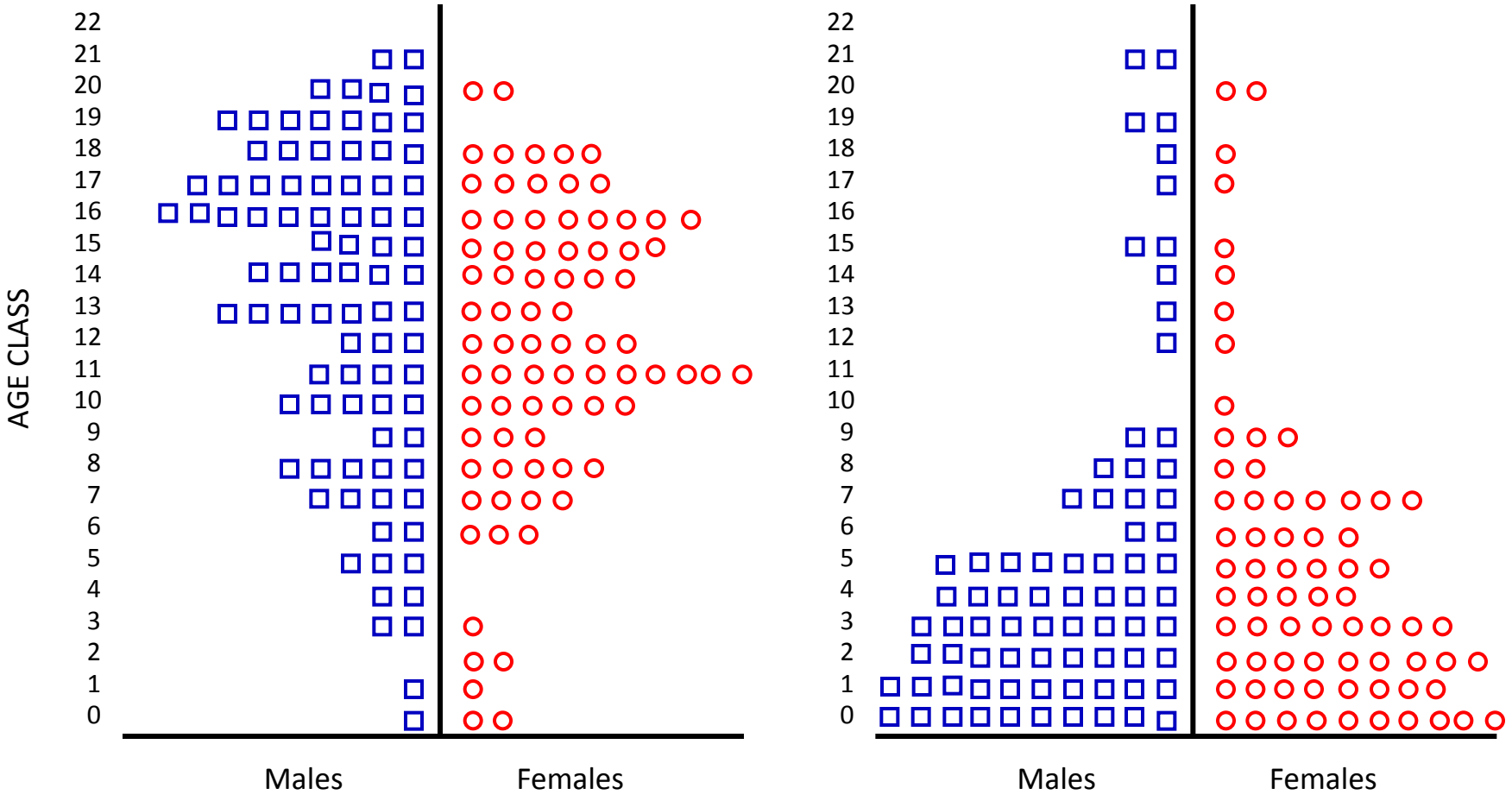
the study of a population's size, distribution, and structure

How and why do these characteristics change over time?

Age Structures

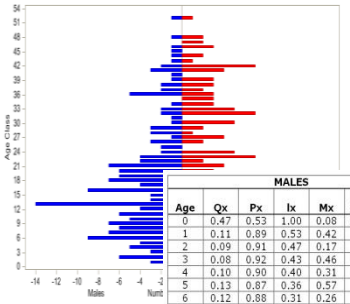


Predicting the Future…



Reproductive Planning

Or, how many births are needed in the next year to meet population goals?



MALES						
Age	Qx	Px	lx	Mx	Risk (Qx)	Risk (Mx)
0	0.47	0.53	1.00	0.08	132.2	76.3
1	0.11	0.89	0.53	0.42	66.3	62.3
2	0.09	0.91	0.47	0.17	56.5	54.8
3	0.08	0.92	0.43	0.46	47.4	45.2
4	0.10	0.90	0.40	0.31	40.7	39.3
5	0.13	0.87	0.36	0.57	32.0	28.3
6	0.12	0.88	0.31	0.26	26.0	25.1
7	0.16	0.84	0.27	0.23	24.6	22.2
8	0.16	0.84	0.23	0.57	19.0	17.1
9	0.06	0.94	0.19	0.55	15.6	15.2
10	0.08	0.92	0.18	0.47	12.9	12.4
11	0.00	1.00	0.17	0.08	8.5	8.5
12	0.25	0.75	0.17	0.08	8.0	7.8
13	0.00	1.00	0.13	0.00	6.0	6.0
14	0.17	0.83	0.13	0.13	5.7	5.0
15	0.81	0.19	0.10	0.72	2.5	1.8
16	1.00	0.00	0.02	0.00	0.0	0.0

Births needed to increase the population from a current size of 75 to a new size of 80 with a growth rate of 1.0217 over the next 3 years.

Assumed sex ratio at birth:

50 % Male 50 % Female

Births Needed 3.9

Year	# Births
0	3.9
1	3.3
2	3.5
3	1.7
4	1.9
5	2.0

Demography Challenges

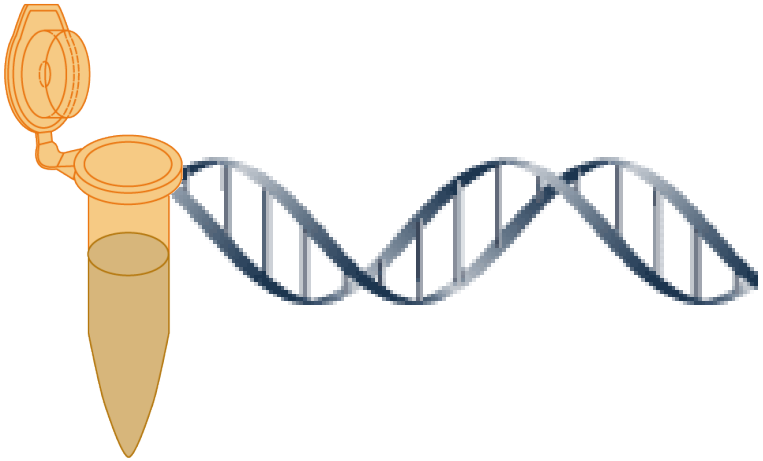
- What do we do with surplus offspring?

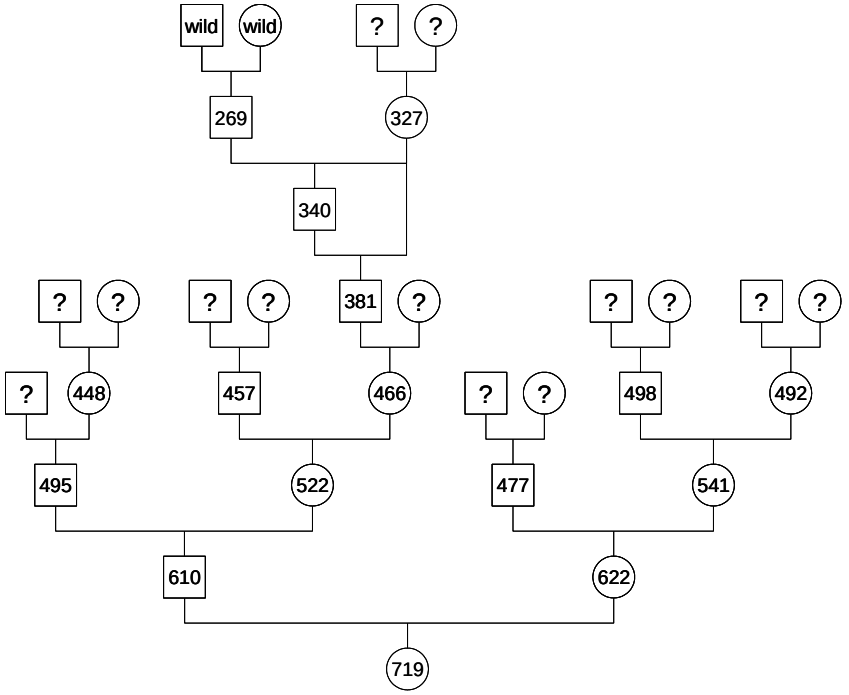
- If we restrict reproduction now, will we be able to increase it again later?

- Can we maintain our target size? Or, can we grow our population as quickly as we'd like?

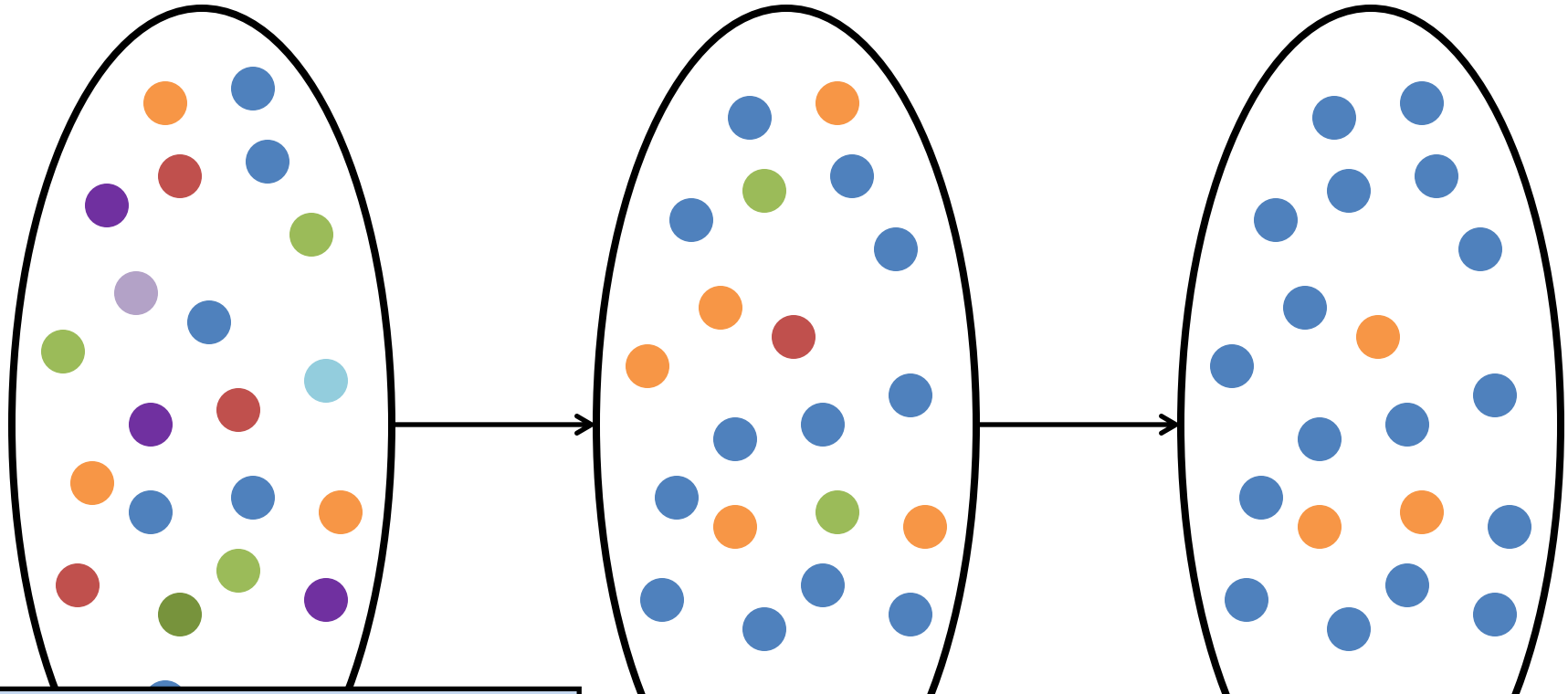
Genetics

Goal: to maintain a population with high levels of genetic diversity and low inbreeding.





When genetic diversity is lost



- reproductive success
- survival
- litter/clutch size
- disease resistance

and inbreeding increases

Selecting Breeding Pairs

Mean Kinship: a measure of how related one individual is to the rest of the population.

(lower values = less related)

MALES					FEMALES				
SB#	MK	% Known	Age	Location	SB#	MK	% Known	Age	Location
166	0.0000	1.00	53	SEDGWICK	176	0.0000	1.00	45	BUSCH TAM
74	0.0000	1.00	35	SEDGWICK	40	0.0000	1.00	32	BUSCH TAM
139	0.0000	1.00	33	HONOLULU	277	0.0000	1.00	32	BATONROUG
251	0.0000	1.00	33	SACRAMNTO	240	0.0000	1.00	27	HONOLULU
71	0.0147	1.00	35	HOUSTON	112	0.0294	1.00	32	HOUSTON
437	0.0294	1.00	18	DALLAS WA	408	0.0294	1.00	19	SEDGWICK
497	0.0294	1.00	17	SEDGWICK	451	0.0294	1.00	18	DALLAS WA
566	0.0294	1.00	14	SAN ANTON	587	0.0294	1.00	14	SEDGWICK
45	0.0368	1.00	32	DENVER	52	0.0368	1.00	32	DENVER
482	0.0368	1.00	17	SEDGWICK	605	0.0368	1.00	13	SEDGWICK
50	0.0441	1.00	32	DENVER	46	0.0441	1.00	32	DENVER
589	0.0441	1.00	14	LOWRY	554	0.0441	1.00	15	SD-WAP
533	0.0515	1.00	15	PITTS CA	564	0.0441	1.00	15	SAN ANTON
546	0.0588	1.00	15	SD-WAP	655	0.0588	1.00	7	SANDIEGOZ
667	0.0588	1.00	2	SANDIEGOZ	656	0.0588	1.00	7	DES MOINE
661	0.0662	1.00	5	SANDIEGOZ	611	???	0.00	15	SEDGWICK

Selecting Breeding Pairs

- breed animals with low *mk*s to maximize gene diversity retention
- breed pairs that will produce offspring with low inbreeding coefficients
- breed pairs with similar *mk*s to avoid linking rare and common alleles in offspring, which helps improve future management

Challenges to Selecting Breeding Pairs

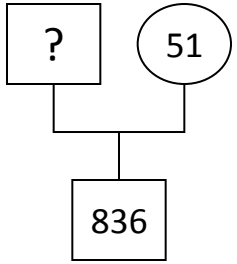
- individual characteristics

  age, health, behavior, location

- social structure- managed through husbandry

- institutional needs- Wants and Needs Survey

- unknown pedigree



Selecting Breeding Pairs
- its not just about mean kinship!

- age
- health
- behavior
- proven vs. non-proven breeders
- location
- institutional needs
- social structure