Curator Presentation

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Background

Project Goal: To collect behavioral data across a large taxonomic group in order to establish a baseline of behaviors observed in 25 species of carnivores in the zoo's collection, and to further develop a holistic view of animal welfare.

- Behavioral diversity can be defined as a measure of behavioral richness and frequency.
- Animals with high behavioral diversity would be engaged in a variety of species-specific behaviors.
- Animals that have low levels of behavioral diversity are likely stereotyping, neither of which would suggest a positive state of welfare (Mason & Latham 2004).

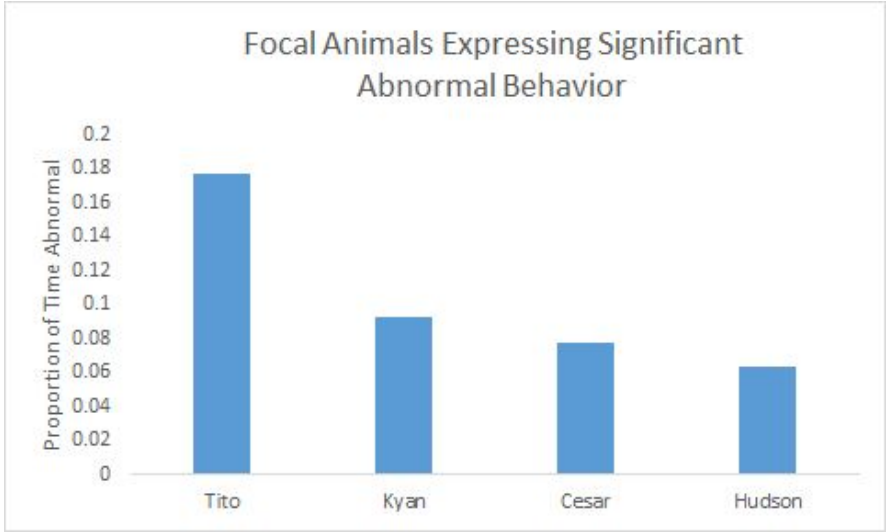



Methodology

- Winter behavioral observations began on January 30, 2017 and concluded March 24, 2017
- Over 200 hours of data were collected throughout the eight weeks, Monday through Friday
    - Morning observations: 10:00 AM - 1:30 PM
    - Afternoon observations: 1:00 PM - 4:00 PM
- 60 carnivores spanning 25 species were observed using instantaneous sampling for a duration of five minutes with one minute intervals
- Observations conducted utilizing an ethogram consisting of 24 behavioral states applicable to all carnivores at Brookfield Zoo

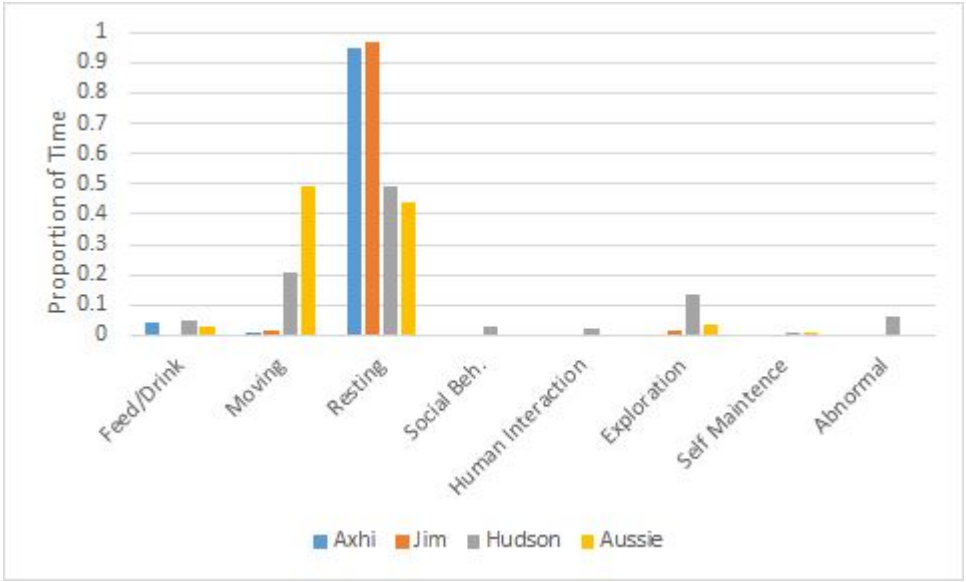
Abnormal Behaviors

- Abnormal behavior typically includes behaviors observed only under human care or those observed at higher rates in human care than in wild populations (Hooper, Freeman, & Ross, 2016).
- Abnormal Behavior as defined by this study can include abnormal or stereotypic behavior including
  - Pacing
  - Route Tracing
  - Head Rolling/Weaving
  - Self-Injurious Behaviors
  - R/R
  - Over-Grooming

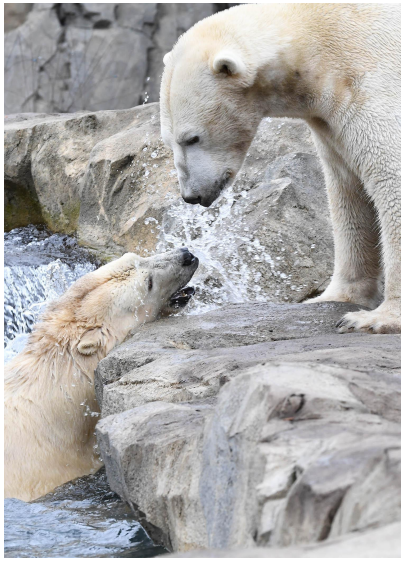


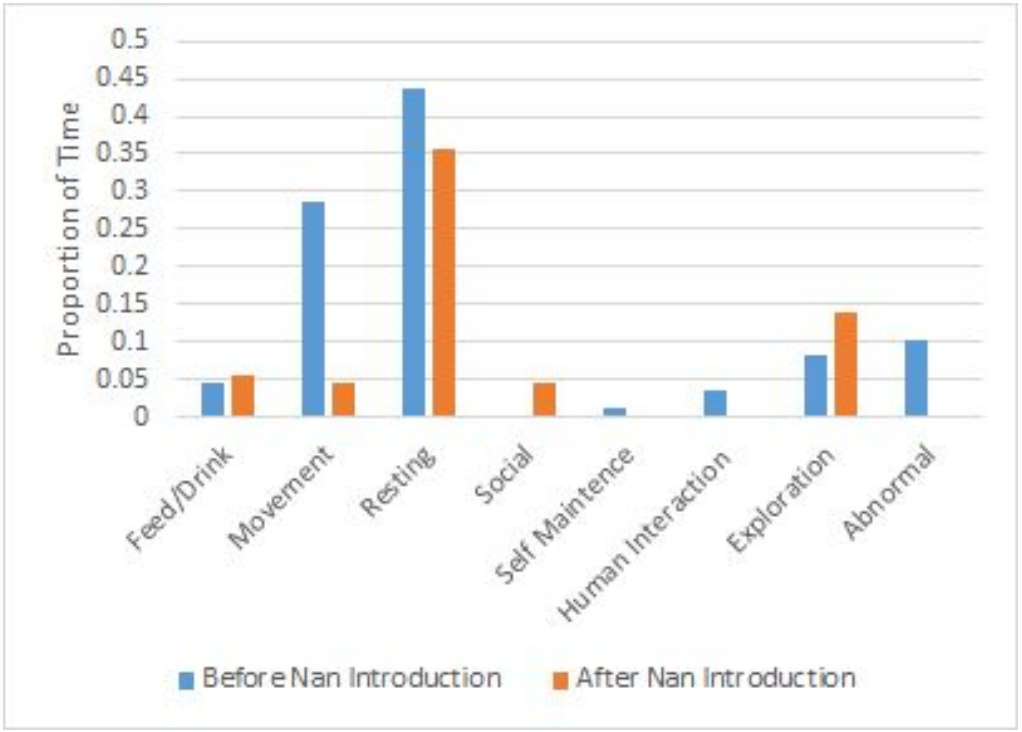
Great Bear Wilderness Bears

- Montaudouin & Le Pape (2005) found in a study of brown bears (*Ursus arctos*) that stereotypic circling was more common in bears housed with other bears related to them. However, stereotypic pacing was more common in bears housed with other unrelated bears
- Comparison of activity level between the four bears in Great Bear Wilderness



Hudson




0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Proportion of Time
Feed/Drink
Movement
Resting
Social
Self Maintence
Human Interaction
Exploration
Abnormal
Before Nan Introduction
After Nan Introduction

Abnormal Behavior in Felids

Mallapur and Chellam (2002) found in a study of Indian leopards (*Panthera pardus*), in four India zoos, that stereotypic behavior was influenced by keeper activity, visitor presence, and enclosure type

- Two peaks of stereotypic behavior were observed for all 16 individuals in the study

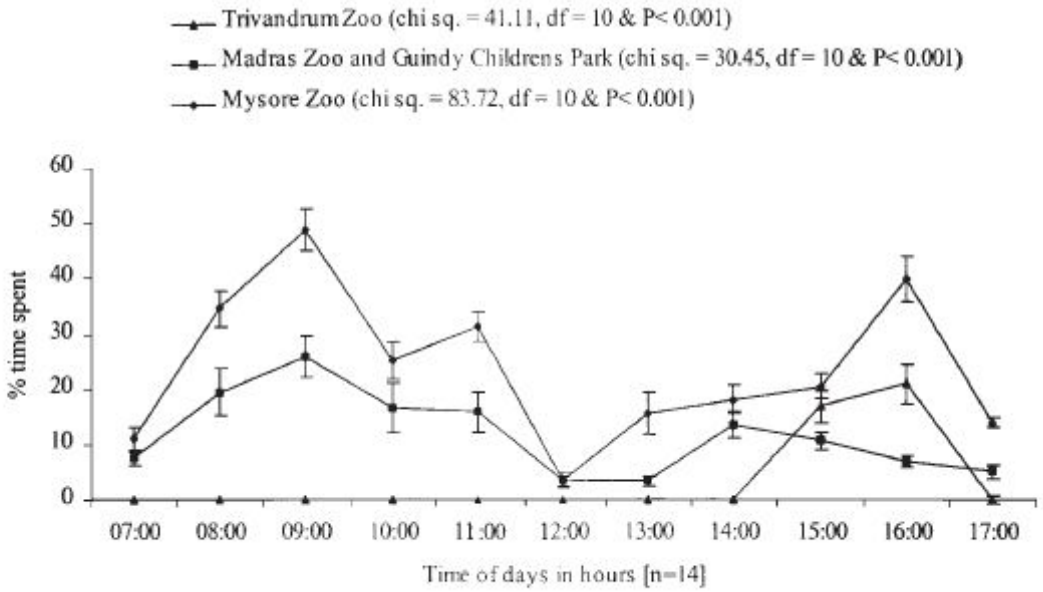
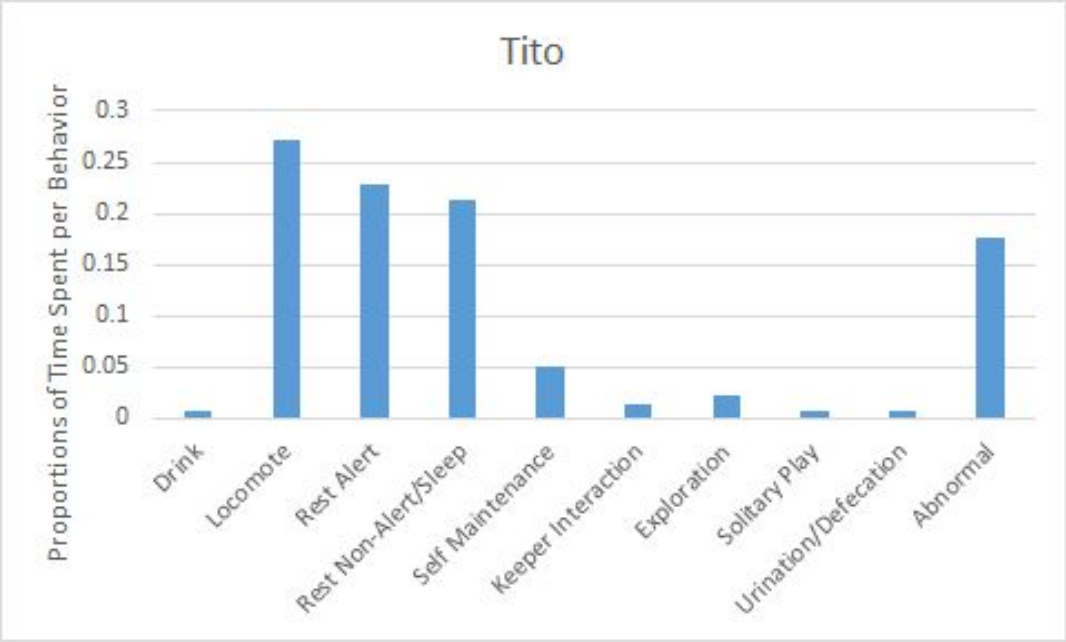


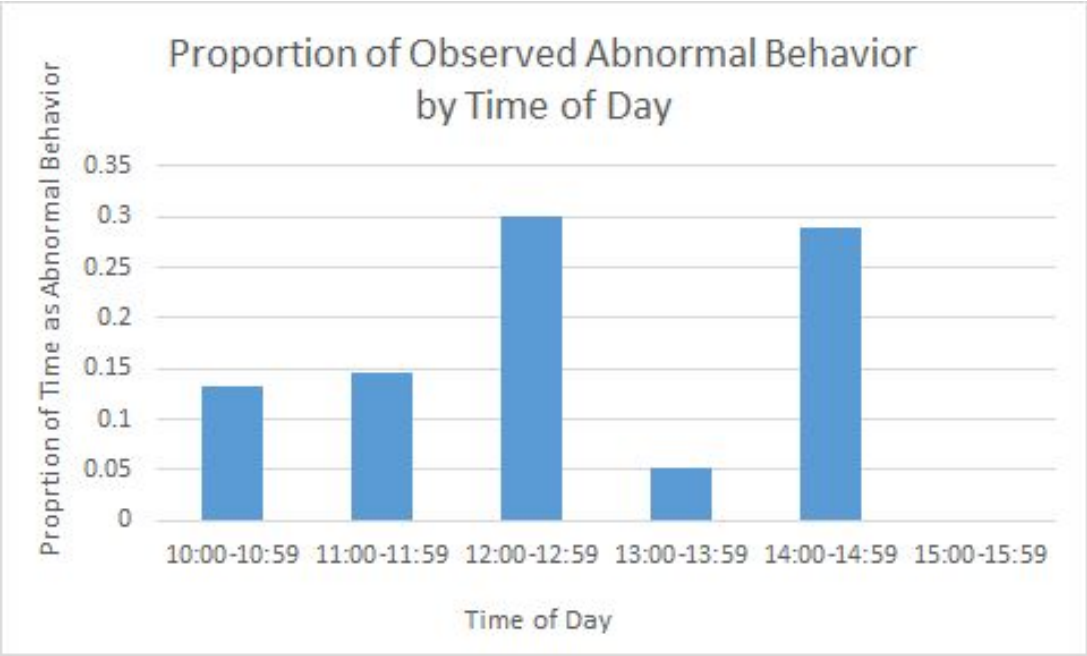
Fig. 3. Stereotypic pacing for leopards in four zoos (November 1998 to March 1999).

Mallapur & Chellam (2002)

Tito

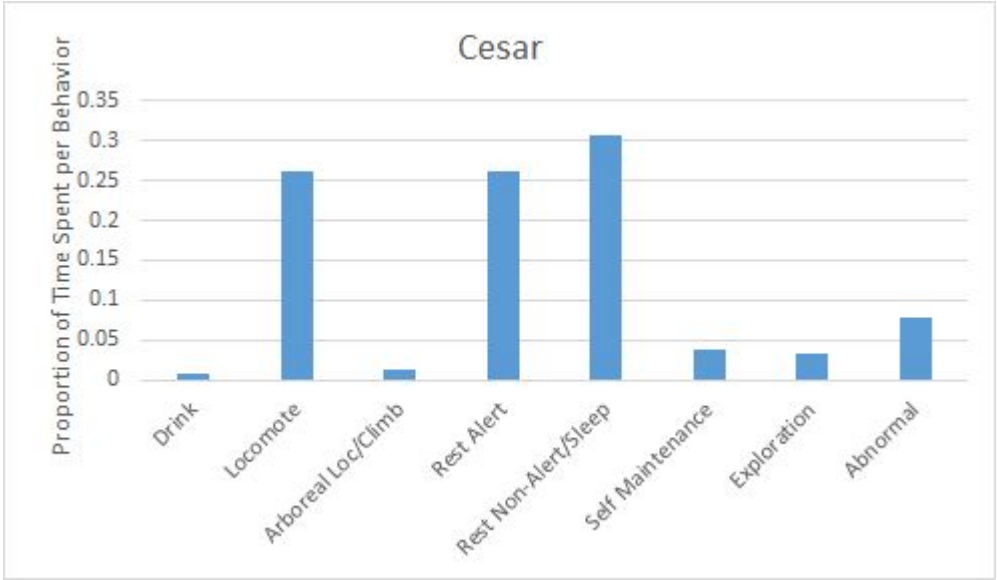

Tito
Proportions of Time Spent per Behavior
0.3
0.25
0.2
0.15
0.1
0.05
0
Drink
Locomote
Rest Alert
Rest Non-Alert/Sleep
Self Maintenance
Keeper Interaction
Exploration
Solitary Play
Urination/Defecation
Abnormal

Tito


Proportion of Observed Abnormal Behavior by Time of Day
Proprtion of Time as Abnormal Behavior
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
10:00-10:59
11:00-11:59
12:00-12:59
13:00-13:59
14:00-14:59
15:00-15:59
Time of Day

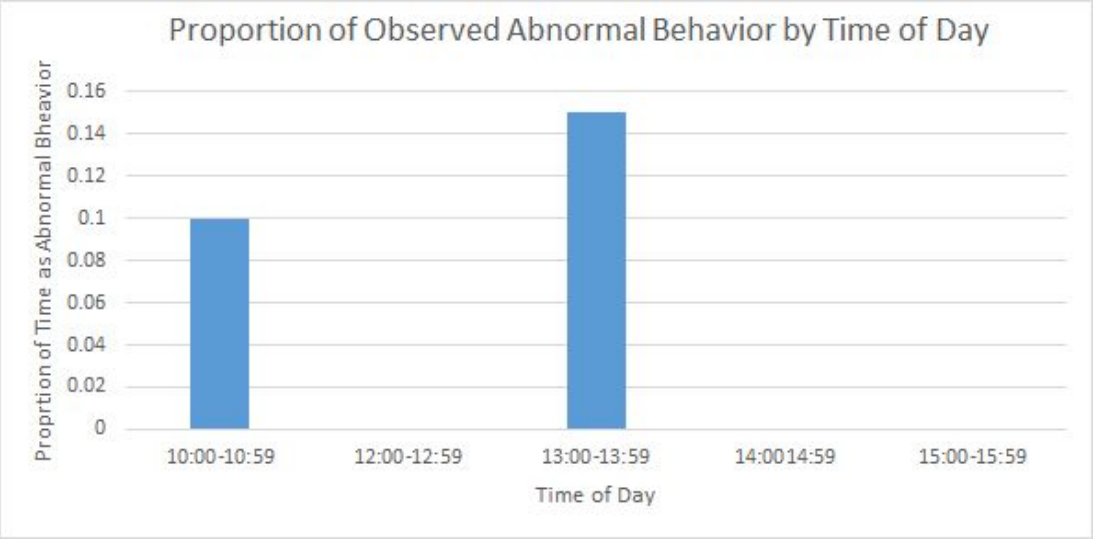
Cesar

- Spent most of his time rest alert or rest non-alert (~57% of his total time visible)
- Locomote was the third highest behavior recorded at ~26.3%
- Displayed abnormal behavior ~7.7%



Cesar

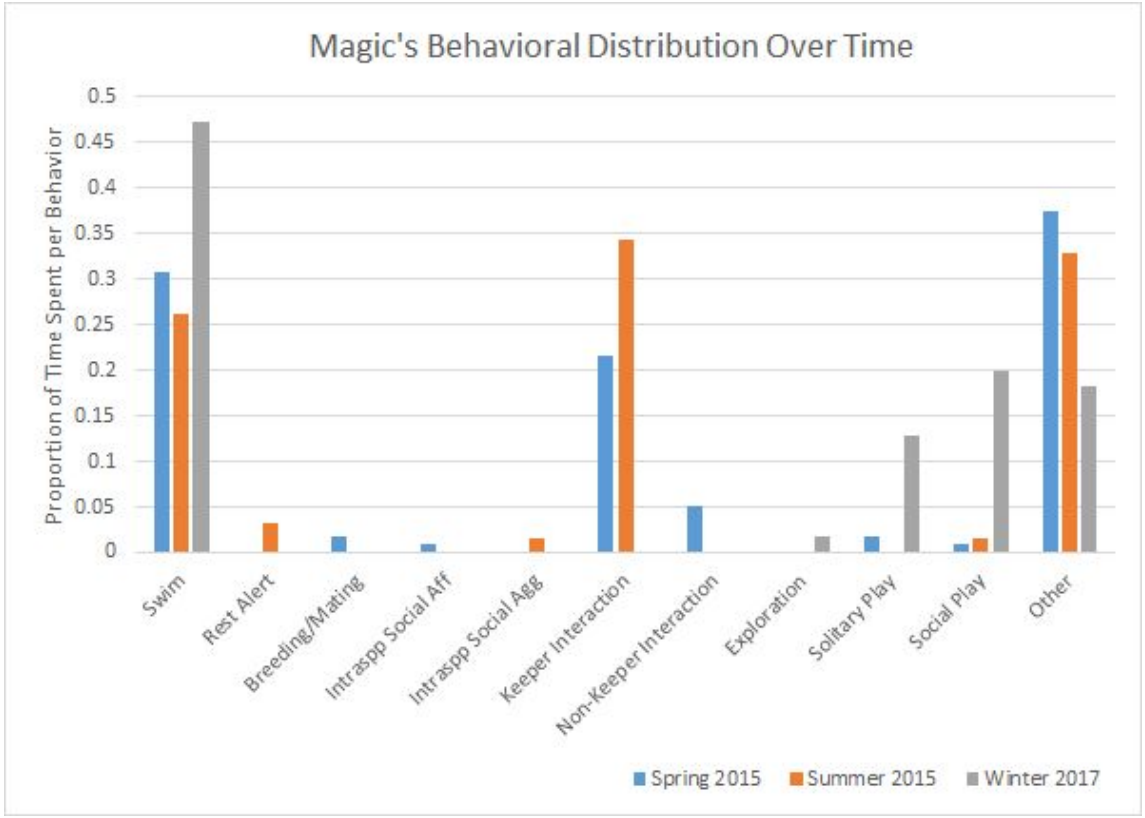
- Pacing was only observed between two times during the day
  - 10:00-10:59
  - 13:00-13:59
  - There were no observations conducted between 11:00-11:59



“Other” Behaviors

- Other Behavior is any behavior that is not defined by the ethogram but not considered Abnormal Behavior.
- Magic has such a behavior.

Magic


Magic's Behavioral Distribution Over Time
Proportion of Time Spent per Behavior
0.5
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Swim
Rest Alert
Breeding/Mating
Intraspp Social Aff
Intraspp Social Agg
Keeper Interaction
Non-Keeper Interaction
Exploration
Solitary Play
Social Play
Other
Spring 2015
Summer 2015
Winter 2017

The impacts of visitor abundance on animal behavior

Kailee's independent project

Background

- Visitor effect studies are key to understanding if the concept of zoos are beneficial to the animals living in one
- Important in creating a positive zoo experience for guests
- Most studies focus on non-human primates
- Results vary among studies, species observed, and implications

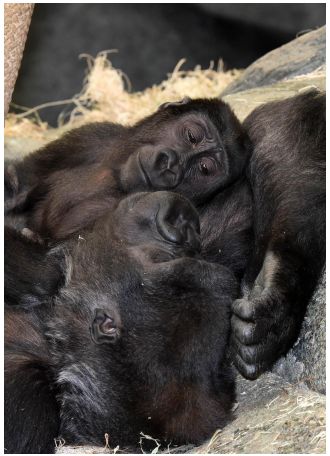
(Mitchell & Hosey, 2005)

Methodology

- Observational data taken on a total of 82 individuals spanning over 27 species
- 3 sessions, 8 weeks each
  - Spring 2015: March 2, 2015- April 24, 2015
  - Summer/Fall 2015: July 27, 2015-September 18, 2015
  - Winter 2017: January 30, 2017-March 24, 2017
- Attendance was averaged weekly
- Data calculated as proportion of time visible
  - Weekly and per individual
- Using SPSS for analyses

Applying Previous Results to My Project

- Primarily looking at over behavioral changes due to influxes in attendance-Are there any patterns?
  - Time, Season, Weather
- Intra or inter-species differences
- Animal Size
  - Smaller species may view visitors as possible predators and are therefore more likely to react with avoidance and defensive behaviours (Margulis, Hoyos, & Anderson, 2003; Hosey, 2000; Chamove & Moodie, 1988).
- Solitary or in group
  - Vigilance is impacted by group size in the wild, does this extend to groups in zoos
- Enclosure Design
  - Inside or outside enclosure



Preliminary Results

- 31 of the 82 individuals included in this study were included in initial SPSS analyses
- Regression analyses were separately performed looking the effect of visitor abundance on the proportion of time an individual spent rest alert, rest non-alert/sleep, and performing some self maintenance behavior

These results are very basic and do not take into account animals that were in holding

Rest Alert

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	VAR00002[b]	.	Enter
2	VAR00003[b]	.	Enter

a. Dependent Variable: VAR00012

b. All requested variables entered.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.497[a]	.247	.246	.17231
2	.509[b]	.259	.257	.17107

a. Predictors: (Constant), VAR00002

b. Predictors: (Constant), VAR00002, VAR00003

c. Dependent Variable: VAR00012

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	5.970	1	5.970	201.086	.000[b]
	Residual	18.171	612	.030		
	Total	24.141	613			
2	Regression	6.260	2	3.130	106.953	.000[c]
	Residual	17.881	611	.029		
	Total	24.141	613			

a. Dependent Variable: VAR00012

b. Predictors: (Constant), VAR00002

c. Predictors: (Constant), VAR00002, VAR00003

Rest Non-Alert/ Sleep

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	VAR00002[b]	.	Enter
2	VAR00003[b]	.	Enter

a. Dependent Variable: VAR00013

b. All requested variables entered.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.315[a]	.099	.098	.26949
2	.322[b]	.103	.101	.26906

a. Predictors: (Constant), VAR00002

b. Predictors: (Constant), VAR00002, VAR00003

c. Dependent Variable: VAR00013

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	4.887	1	4.887	67.288	.000[b]
	Residual	44.447	612	.073		
	Total	49.334	613			
2	Regression	5.103	2	2.552	35.249	.000[c]
	Residual	44.231	611	.072		
	Total	49.334	613			

a. Dependent Variable: VAR00013

b. Predictors: (Constant), VAR00002

c. Predictors: (Constant), VAR00002, VAR00003

Self Maintenance

Regression

Variables Entered/Removed[a]

Model	Variables Entered	Variables Removed	Method
1	VAR00002[b]	.	Enter
2	VAR00003[b]	.	Enter

a. Dependent Variable: VAR00019

b. All requested variables entered.

Model Summary[c]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.124[a]	.015	.014	.03735
2	.125[b]	.016	.012	.03738

a. Predictors: (Constant), VAR00002

b. Predictors: (Constant), VAR00002, VAR00003

c. Dependent Variable: VAR00019

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	.013	1	.013	9.597	.002[b]
	Residual	.854	612	.001		
	Total	.867	613			
2	Regression	.014	2	.007	4.848	.008[c]
	Residual	.854	611	.001		
	Total	.867	613			

a. Dependent Variable: VAR00019

b. Predictors: (Constant), VAR00002

c. Predictors: (Constant), VAR00002, VAR00003

Inter and IntraSpecies Personality

Amanda's Independent Project

Personality

- Is defined as individual behavioral differences observed constantly over time and situations (Freeman & Gosling, 2010).
- Individual differences may reflect personality traits in marine mammals, primates, birds, fish, and invertebrates (Highfill, Hanbury, Kristiansen, Kuczaj, & Watson, 2009)
- Can be used as a tool to promote animal welfare and management (Razal, Pisacane, & Miller, 2016).
    - Assessments may identify and aid individuals that are vulnerable to environmental and social stress (Horback, Miller, & Kuczaj, 2013)
- The key component of personality is the consistency of individual behavioral differences across time (Horback, et al., 2013)

Methods

- Observational data collected on 11 species containing 27 individuals over two periods:
  - March 2, 2015 through April 24, 2015
  - January 30, 2017 through March 24, 2017
- Individuals were observed 5 minutes each day, Monday-Friday, for the 8 week period using instantaneous sampling technique
- An ethogram consisting of 24 behavioral states applicable to all carnivores at Brookfield Zoo
- Microsoft Excel was used to generate a random observation pattern prior to the start of observations
- Data is represented as Proportion of Time Visible
- SPSS was used to calculate Spearman's correlation

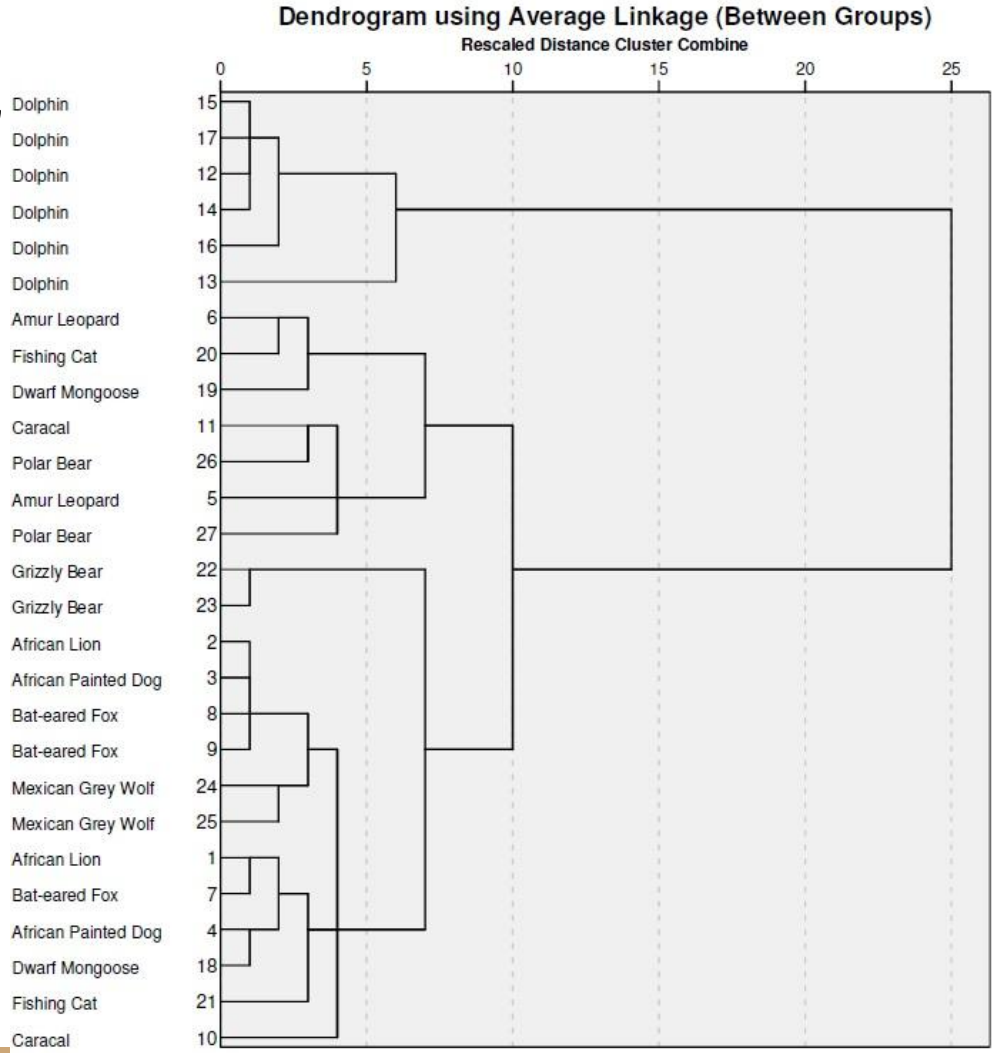
Family	Species	Focal
Canidae	African Painted Dog (*Lycaon pictus*)	Chebacca
		Voltron
	Bat-eared Fox (*Otocyon megalotis*)	Otis
		Stella
		Thokoza
	Mexican Grey Wolf (*Canis lupus baileyi*)	Flint
		Zana
Catacea	Bottlenose Dolphin (*Tursiops truncatus*)	Allison
		Magic
		Merlin
		Noelani
		Spree
		Tapeko
Felidae	African Lion (*Panthera leo*)	Isis
		Zenda
	Amur Leopard (*Panthera pardus orientalis*)	Kasha
		Lisa
	Caracal (*Caracal caracal*)	Cesar
		Dominique
	Fishing Cat (*Prionailurus viverrinus*)	Anna
		Chet
Herpestidae	Dwarf Mongoose (*Helogale parvula*)	Gimbi
		Lord Grantham
Ursidae	Grizzly Bear (*Ursus arctos*)	Axhi
		Jim
	Polar Bear (*Ursus mariltimus*)	Aussie
		Hudson

Preliminary Results

- Spearman's Correlation is a nonparametric measure of the strength and direction of association that exists between two variables measured on at least an ordinal scale
- Preliminary significant results using Spearman correlation coefficients
  - Correlation is significant at 0.01
  - n=27

Behavior	Correlation Behavior	Correlation Coefficient	Sig. (2-tailed)
Rest Non-Alert	Rest Non-Alert 2	0.886	0.000
Swim	Swim 2	0.871	0.000
Rest Alert	Rest Alert 2	0.833	0.000
Social Play	Social Play 2	0.827	0.000
Locomote	Locomote 2	0.781	0.000
Drink	Drink 2	0.766	0.000
Keeper Interaction	Keeper Interaction 2	0.654	0.000
Float	Float 2	0.561	0.002
Solitary Play	Solitary Play 2	0.517	0.006
Exploration	Exploration 2	0.506	0.007
Arboreal Locomote/ Climb	Arboreal Locomote/ Climb 2	0.502	0.008
Abnormal	Abnormal 2	0.494	0.009

Visualizing Personality



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