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**Popularity of Zoo Mammals Related to Size, Home Range, Feeding Habits and Social  
Groupings at the Peterborough Riverview Park and Zoo**

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As zoos begin to shift their focus towards wildlife conservation there is a higher demand to make the public aware of conservation efforts. In order to accomplish this, visitor interest must be considered when choosing mammals to populate exhibits. It may be beneficial for a zoo to focus on a specific group of mammals, but if the visitors are not interested in this group the zoo's attendance may drop and the effect of conservation initiatives lowered. This study attempts to analyze the public's interest in mammals of various body sizes, native ranges, social groups, and feeding habits at the Peterborough Riverview Park and Zoo. Popularity was measured by the amount of time, in seconds, each viewer stopped to look at an exhibit. Using paired t-tests and a two test Anova with equal replication, popularity was analyzed and was then compared to body size, native ranges, social groups and feeding habits of the animals at each designated exhibit. It was found that the overall visitor population preferred small, exotic, herbivorous and gregarious mammals. Therefore, when zoos are choosing mammals to represent wildlife conservation, results suggest that zoos should focus on these specific types of mammals in order to capture the visitors interest and increase the chances for success with wildlife conservation efforts.

## **Introduction**

People attend zoos all over the world to learn about both familiar and exotic mammals, while exploring aspects of wildlife conservation. Many zoos have recently shifted their focus towards wildlife conservation in order to increase the knowledge of conservation in their visitors (Ballantyne et al. 2007). Conservation promotion and education is a great way for visitors to learn about species first hand, although it may come at some cost to the zoo if careful consideration is not taken. The species distribution of a zoo is an important aspect that must be considered when looking to promote conservation initiatives. If the species chosen are not

popular within the visitor community, there is a lower chance that the conservation initiatives will be successful in broadening visitors understanding and learning (Ballantyne et al. 2007).

There are many aspects that contribute to zoo mammal popularity, the first of these being the overall size of the mammal. Large mammals are often more expensive to maintain in zoos and breed at a slower rate than small mammals (Balmford et al. 1996). In respect to that, it may be beneficial for zoos to focus on small mammals rather than large mammals in terms of saving money, and contributing to conservation efforts. Although small mammals may be best to focus on for the zoo, it is also possible the zoo may lose visitors if the community prefers large mammals over small (Balmford et al. 1996). The mammals native range may also be a deciding factor when considering which mammals to populate exhibits with, because exotic mammals are likely to be more expensive in terms of food and habitat, than native mammals, but if exotic mammals are more popular, the mammal popularity may outweigh the costs. The similar situation may be for social groupings and feeding habits, which also play a role in zoos decisions to have an exhibit or not. If one mammal social group or feeding habits are more expensive than the other to maintain, knowing which ones are more popular can help decide whether the added costs, if applicable, are worth it to the zoo and the viewer community.

This study attempts to analyze the public's interest in mammals of various body sizes, native ranges, social groups and feeding habits at the Riverview Park and Zoo. This was done in an effort to promote a better visitor experience with the hopes of increasing zoo traffic; so as to maximize the potential for both wildlife tourism and conservation efforts. It is hypothesized that mammal popularity will change depending on body size, native range, social groupings and feeding habits. It is predicted that there will be a difference in mammal popularity when comparing body size, native range, social groupings and feeding habits.

## Materials and Methods

Data collection took place at the Peterborough Riverview Park and Zoo in Peterborough Ontario for four days over a period of two weeks. The North American river otter (*Lontra canadensis*), black and white ruffed lemur (*Varecia variegata*), squirrel monkey (*Saimiri sciureus*) and slender-tailed meerkats (*Suricata suricatta siricata*) were observed as small mammals (<15 kg) and the bactrian camel (*Camelus bactrianus*), bobcat (*Lynx rufus*), domestic yak (*Bos grunniens*) and serval (*Leptailurus serval*) will be observed for large mammals (>15kg) (See appendix table 2 for other groupings). Each exhibit was observed for 30 minutes from approximately 20-30 feet away. Every person who walked by or stopped to observe an exhibit was timed in seconds for the duration of the viewing time with a stopwatch and recorded based on gender and age (adult or child) (Ward et al. 1998). 200 people were observed during this study. The observation time during the day at the different exhibits was random throughout the days in order to account for factors such as variation due to changes in weather, and time of day (Balmford 2000). People with small children unable to walk on their own (being carried or pushed in strollers) were not recorded, in order to avoid bias, but the presence of the child was recorded. Number of mammals in the enclosure and whether they are generally a pack or solitary mammal will also be noted.

All mammals in the zoo were ranked smallest to largest, small being less than 15kg and large being 15kg and higher (Roemer et al. 2009). An F-test for two sample variances was used, as well as either a two sample t-test for equal or unequal variances. Both tests were conducted in order to assess mammal popularity by examining mammal body size (kg), native ranges, social groupings and feeding habits for males, females and the total number of visitors observed. Bonferroni Correction for multiple T-tests was also used in order to account for type-1 errors. A two factor ANOVA without replication was also completed for the average time males and

females spent at each exhibit. Management of wildlife tourism and conservation efforts will also be analyzed.

## Results

Table 1. Specific statistical parameters (mean, variance, P value and t-critical) from a two sample t-test using the Bonferroni method ( $\alpha = 0.016952$ ), for total, male and female observers for each comparison of small vs. large, exotic vs. native, carnivore vs. herbivore and social vs. solitary at the Peterborough Riverview Park and Zoo.

Observer Type	Statistical Parameters	Small	Large	Exotic	Native	Carnivores	Herbivores	Social	Solitary
Total	Mean (s)	91	58	84	45	43	96	89	39
	Variance	4356	3237	4573	1141	1019	4920	4642	771
	P(T<=t) two-tail	0.0002		0.0003		1.7113E-09		2.0330E-07	
	t Critical two-tail	2.4081		2.4081		2.4081E+00		2.4081E+00	
Male	Mean (s)	88	67	86	46	44	95	88	42
	Variance	4241	4396	4923	947	805	5262	4949	683
	P(T<=t) two-tail	0.1410		0.0009		0.0006		0.0060	
	t Critical two-tail	2.4375		2.4562		2.4357		2.4357	
Female	Mean (s)	94	52	82	44	42	98	90	37
	Variance	4512	2398	4337	1302	1157	4675	4427	829
	P(T<=t) two-tail	0.0003		0.0002		0.0000008		0.000009	
	t Critical two-tail	2.4280		2.4375		2.4243		2.4243	

Small mammals are significantly more popular than large mammals when considering total observers at the Peterborough Riverview Park and Zoo (Table 1). When considering only the male observers there was no preference between small or large mammals (Table 1). Females preferred small mammals compared to large mammals (Table 1). Exotic mammals were more popular than native mammals when looking at total visitor observers and both female and male observers (Table 1). Compared to carnivores, herbivores are significantly more popular when considering total observers as well as with both male and female observers (Table 1). Solitary mammals are significantly more popular than social mammals when considering total observers and in the case of both male and female observers (Table 1).

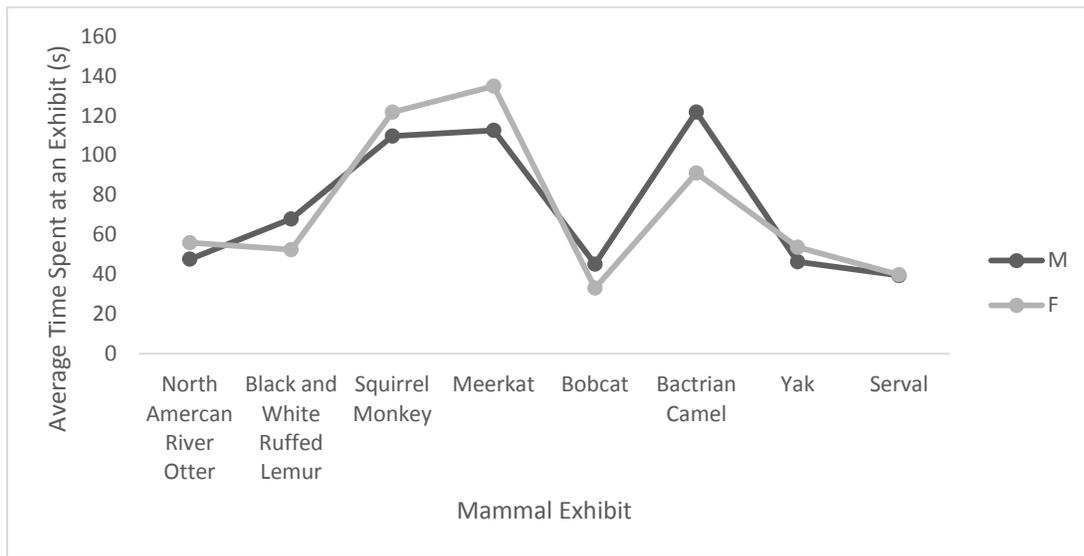


Figure 1. The average time, in seconds, male(M) and female(F) observers spent per mammal exhibit at the Peterborough Riverview Park and Zoo.

Males and females spent a similar amount of time at the otter, bobcat, yak and serval exhibits (Fig. 1). Males spent more time at the lemur and camel exhibits than females, where females spent more time at the squirrel monkey and meerkats exhibit compared to males (Fig. 1). Both males and females spent the least amount of time at the bobcat and serval exhibit (Fig. 1).

## Discussion

The hypothesis that mammal popularity will change depending on body size, native ranges, social groupings and feeding habits, and the prediction that there will be a difference in mammal popularity when comparing body size, native range, social groupings and feeding habits were supported.

When comparing body size, overall small mammals were significantly more popular than large mammals at the Riverview Park and Zoo (Table 1). During observation the small mammals were more active and may have influenced the viewer to stay longer due to their high energy and

intriguing movements (Johnson 1998). Three out of the four small mammals were also exotic which may have played a factor in lengthening viewing time as well (Kleiman et al. 2010). All of the small mammals were also gregarious mammals and therefore there were multiple mammals per exhibit which could have also persuaded visitors to stay longer (Johnson 1998). Similar to the overall visitor viewing time, female observers spent significantly more time at small mammal exhibits compared to large mammal exhibits, although males did not (Table 1). It appeared that it did not make a difference for men if the mammal was small or large although when looking at the small mammal average, it is higher than the large mammals (Table 1). This suggests that although the difference was not significant, there still was a slight difference between small and large mammals, with small mammals being slightly more popular (Table 1). The small mammals were slightly more interesting to men but if zoos want to capture all aspects of the viewing community they should think about keeping some large mammals in order to appeal to some of the men that may have preferred large mammals over small.

Exotic mammals were more popular than native mammals to all of the viewers. This could be due to the fact that exotic mammals are less common in this area and are new to many viewers. Viewers are known to more likely to be drawn to, and captivated by species they are not familiar with and are less likely to see often (Kleiman et al. 2010).

Herbivores were more popular in all viewing groups when compared to carnivores (Table 1). This is possibly because herbivores are foragers (Belovsky 1997). Herbivores such as the Domestic yak rely on grass as a main part of its diet so they must walk around the enclosure in order to sustain that food requirement (Belovsky 1997). Although most of the herbivores food is provided for them daily by the keepers, during observation the food was scattered around the enclosure so it provided a more realistic feeding approach. This may cause the herbivores to be more active while foraging for food thus causing them to be more appealing and entertaining to

the viewers. Carnivores rely on hunting as a main food source but hunting is very hard, if not impossible to replicate within the confines of a zoo, so the carnivore is usually provided with the meat source but requires little to no hunting activity. This doesn't force the carnivore to be active and therefore does not make it as interesting as herbivores to viewers. During observation the serval was eating its meal and some visitors were even disgusted by this sight. This is a natural way of life but in terms of feeding, carnivores are less popular possibly due to the lack of activity and the level of discomfort it may cause the viewer to see the mammal consume the meat.

Gregarious mammals were more popular than solitary mammals (Table 1). This may be due to the fact that there are multiple mammals within the enclosure providing the viewer with lots to observe and take in (Johnson 1998). If one of the mammals was hiding there were others for people to observe. With multiple mammals one could view how they interact with each other as well as be entertained with their natural movements and activities. Solitary mammals were not as active and during all observations there was very little movement.

When observing the average time spent at each mammal exhibit the female observers stayed at the meerkats exhibit the longest suggesting that among female observers, the meerkats were the most popular mammal observed (Fig. 1). The meerkats seem to be popular for both genders, this may be due to the fact that during all of the multiple observation periods the meerkats were very active and there were approximately 5 meerkats, within a small area where they could all be very easily observed. The Bactrian Camel was also very popular for both genders but it was specifically more popular in males (Fig. 1). The exotic factor most likely plays a large role in this preference because most people have never seen a camel, they were also quite active during all the observation periods. Overall the meerkats, squirrel monkeys and the Bactrian camels were the most popular mammals observed (Fig. 1). It seems that for both males and females the least popular mammals were the otter, bobcat and serval (Fig. 1). Both the bobcat and

serval are large mammals and their lack of popularity may have contributed to the higher popularity in small mammals (Table 1). There were also no otters observed during any of the data collection observation times so this most likely contributed to their low observation time and lack of popularity.

A similar study was conducted at the London zoo that measured the proportion of visitors at various exhibits and found no relationship between body size and mammal popularity, and thus concluded that zoos will not be penalized in terms of community attendance if their focus was to be switched to smaller mammals (Balmford et al. 1996). These findings support this study completed at the Peterborough Riverview Park and Zoo. Ward et al. (2008) conducted a similar study at the Zurich Zoo and found that large mammals were more popular than small mammals over all. Large animal exhibits were also more cost effective in terms of the cost to popularity ratio than small mammal exhibits, suggesting zoos would be penalized both financially and in terms of community attendance if they were to switch their focus to small mammals. This study found the opposite results the Peterborough Riverview Park and Zoo study found.

These mixed results may be due to the fact that the Riverview Park and Zoo is a very small zoo and it does not have many exhibits. People can easily see all of the exhibits, compared to a larger zoo where people may have to choose a large versus a small mammal to view. The small scale of the zoo also did not allow for even numbers of species related to home ranges, feeding habits and social groupings, so in most situations there was an uneven number of mammals in a specific group that most likely caused a bias in the data. Although results comparing home ranges, feeding habits and social groupings were significant there were not enough mammals of each category to confidently report these results.

In order to obtain more accurate results and conclusions further studies are highly suggested. A similar study should be conducted at a larger zoo, possibly the Toronto Zoo, in

order to gain further information and more accurate data. An even number of mammals for both parameters being considered should be taken into account in order to confidently report the results.

During data collection it was also noted that adults with children stayed longer at exhibits in comparison to adults without children. This is most likely due to the children being more interested in the mammals compared to the adults. This may have created a bias for the adult time measurements because the adults were more inclined to stay because their children were having fun, as opposed to them actually observing the mammal exhibit. Further studies should consider adults with and without children in order to avoid that bias.

Some mammals, such as the lemurs, had multiple species within the exhibit so it was hard to determine the viewing time for one specific mammal when there were multiple in the enclosure. Further studies should evaluate exhibits with only one species of mammal in order to make more confident conclusions.

## **Conclusion**

Mammal popularity is very important for zoos to assess due to the fact that not all mammals are as popular as others and not all mammals will generate an equal amount of public concern. This means not all mammals will effectively highlight conservation efforts and concerns, so they must be chosen carefully (Shackley 1996).

When considering implications for management of wildlife tourism and conservation efforts, zoos should focus specifically on small mammals. After further studies confirming the results of home ranges, feeding habits and social groupings, zoos should narrow their focus further and consider exotic, herbivore and gregarious mammals when considering wildlife popularity and conservation.

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## Appendix

Table 1. The observation times (s) for total observers, male observers (light gray) and female observers (dark gray) in seconds for each mammal exhibit at the Riverview Park and Zoo.

Small					Large				
North American River Otter	Black and White Ruffed Lemur	Squirrel Monkey	Meerkat		Bobcat	Bactrian Camel	Yak		Serval
5	9	124	108		99	68	24		10
23	47	239	92		54	30	8		67
58	45	189	14		41	83	59		87
67	27	69	48		56	27	67		72
95	17	107	48		62	55	66		36
90	9	30	128		17	71	88		39
0	127	133	62		19	211	40		20
46	55	47	260		13	188	26		31
45	94	18	135		34	61	39		31
91	85	94	140		10	330	7		20
75	200	232	204		11	101	54		20
29	100	41	46		35	237	62		6
0	47	88	45		39	28	90		14
0	28	124	42		26	22	97		80
0	24	111	34		40	50	12		92
76	51	223	256		6	23			72
102	12	276	146		22	28			76
49	21	187	190		21	23			78
114	35	180	207		86	159			100
121	80	177	210		76	72			50
16	114	183	160		27	180			35
54	80	91	148		30	54			8
	50	106				145			9
	87	89				192			7
		74				220			63
		75				80			64
		80							29
		15							45
		78							14
		62							9
		98							40
		81							10
		118							5
		121							10
		122							

Table 2. The groups each mammal was considered in during observations and statistical analysis at the Riverview Park and Zoo.

Mammal	Groups
North American River Otter	Small, native, carnivore, social
Black and white ruffed lemur	Small, exotic, herbivore, social
Squirrel monkey	Small, exotic, social
Meerkat	Small, exotic, social
Bobcat	Large, native, carnivore, solitary
Bactrian camel	Large, exotic, herbivore, social
Domestic yak	Large, exotic, herbivore, social
Serval	Large, exotic, carnivore, solitary

Table 3. The average time(s) for male(M) and female(F) observers for the selected exhibits at the Riverview Park and Zoo.

	North American River Otter	Black and White Ruffed Lemur	Squirrel Monkey	Meerkat	Bobcat	Bactrian Camel	Yak	Serval
M	48	68	110	113	45	122	46	39
F	56	52	122	135	33	91	54	40

Table 4. Two factor Anova summary without replication for the average time males and females spent at each exhibit at the Riverview Park and Zoo.

<i>SUMMARY</i>	<i>Count</i>	<i>Sum</i>	<i>Average</i>	<i>Variance</i>
M	8	590.6	73.8	1226.7
F	8	582.8	72.8	1475.3
North American River Otter	2	103.6	51.8	34.1
Black and White Ruffed Lemur	2	120.3	60.2	120.1
Squirrel Monkey	2	231.5	115.8	72.8
Meerkat	2	247.5	123.8	248.0
Bobcat	2	78.2	39.1	72.6
Bactrian Camel	2	213.0	106.5	471.0
Yak	2	100.0	50.0	26.9
Serval	2	79.2	39.6	0.1

Table 5. Two factor without replication Anova output for the average time males and females spent at each exhibit at the Riverview Park and Zoo.

ANOVA						
Source of Variation	SS	df	MS	F	P-value	F crit
Rows	3.9	1	3.9	0.03	0.8767	5.6
Columns	17872.0	7	2553.1	17.16	0.0007	3.8
Error	1041.8	7	148.8			
Total	18917.6	15				