University of Nevada, Reno

Problem-Solving Capabilities as a Test of Predator Adaptability: A Comparison of Bobcats (*Lynx rufus*) and Canada Lynx (*Lynx canadensis*)

A thesis submitted in partial fulfillment of the
requirements for the degree of Master of Arts in
Psychology

By

Michael Alex Worsley

Dr. Michael A. Crognale/Thesis Advisor

December, 2013

University of Nevada, Reno
Statewide • Worldwide

THE GRADUATE SCHOOL

We recommend that the thesis
prepared under our supervision by

MICHAEL WORSLEY

entitled

Problem-Solving Capabilities As A Test Of Predator Adaptability: A Comparison Of Bobcats (Lynx Rufus) And Canada Lynx (Lynx Canadensis)

be accepted in partial fulfillment of the
requirements for the degree of

MASTER OF ARTS

Dr. Michael A. Crognale, Advisor

Dr. Michael Webster, Committee Member

Dr. Vladimir Pravosudov, Graduate School Representative

Marsha H. Read, Ph. D., Dean, Graduate School

December, 2013

Abstract

Canada lynx (*Lynx canadensis*) and bobcats (*Lynx rufus*) are two closely related felids occurring naturally in North America. Bobcats are generalized hunters across their range while Canada lynx are specialized to hunt lagomorphs, especially snowshoe hare (*Lepus americanus*). Many wildlife professionals anecdotally report vast behavioral differences between these two species, but no empirical juxtaposition of the two has been published. This study proposes a means to provide qualitative and quantitative data regarding the behavior of these two species. Such data may inform important management and care considerations such as enclosure designs, enrichment programs, and husbandry protocols. In this study, we compared performance on a problem-solving task in which subjects must obtain food rewards by avoiding traps designed to catch the food. All subjects showed significant place conditioning and food trap avoidance. Bobcats were more likely to obtain food than Canada lynx and were faster than Canada lynx to enter the testing area, to insert their paw into a selected tube, and to complete the trial. While there are a number of factors that may be involved in these behavioral differences, this study provides both qualitative and quantitative data on these differences, which can influence future research and care of these felids.

Dedication

To my ever-supportive parents.

Acknowledgements

First, I would like to thank my advisor and committee members for their advice and direction in running this project. Thank you to Diana, Aaron, Jan and all of the staff and volunteers at Animal Ark for helping with all aspects of this project. Finally, thank you to my family for your patience and support.

Table of Contents

List of Tables

Table **Page**

List of Figures

Introduction

Canada lynx (*Lynx canadensis*) and bobcats (*Lynx rufus*) are two closely related felids occurring naturally in North America. Canada lynx occur throughout Canada and in northern-most portions of the continuous United States. Bobcats occur in Mexico, throughout the continuous U.S. and in southern-most portions of Canada. There is relatively little geographic overlap between these species. However, where the two species do occur together, researchers have reported fertile hybrids (Homyack et al., 2007).

Bobcats are generalized hunters across their range, taking prey from insects to white-tailed deer (*Odocoileus virginianus*; Baker et al., 2001; Beasom & Moore, 1977; Maehr & Brady, 1986; McLean & McCay, 2005). As much as 67.5% of their prey is burrowing rodents (Hass, 2009; Litvaitis, 1981; Maehr & Brady, 1986; Neale & Sacks, 2001). Baker et al. (2001) further demonstrate that bobcats are flexible in both prey selection and hunting strategies according to season, weather, prey abundance, and variability.

Canada lynx, however, are predators specialized to hunt lagomorphs, especially snowshoe hare (*Lepus americanus*). Their phase-locked status with the snowshoe hare is the subject of reports by many ecologists and wildlife biologists (e.g. Blasius & Stone, 2000; Stenseth et al., 1997). While lynx may take other prey such as squirrels, their use of alternative prey species is primarily limited to areas of their range where lagomorphs are lacking (Roth et al., 2007). Even in these areas, snowshoe hare remains the dominant prey item (up to 97% of biomass consumed; Squires & Ruggiero, 2007).

One study of lynx habitat further demonstrated that climate may greatly affect lynx abundance (Stenseth et al., 2004). This research team demonstrated that lynx primarily remained in habitats where temperatures would not fluctuate too severely, thus maintaining a harder snow surface across which lynx could walk without sinking, a trait which allows the lynx to catch hares floundering in drifts.

These two felid species are quite close phylogenetically, yet demonstrate distinctly different hunting patterns, prey selection, and niche fulfillment. Further, many keepers report vast differences in behavioral patterns between bobcats and Canada lynx. Bobcats are casually described as higher energy, faster learners, and more excitable, where as Canada lynx descriptions are frequently synonymous with aloof and stubborn. However, we could find no published empirical behavioral comparison of these two species.

This current study proposes a means of testing the behavioral differences between bobcats and Canada lynx as well as aims to provide qualitative and quantitative data on these differences. An apparatus designed by Visalberghi & Limongelli (1994) and later modified by Tebbich et al. (2007) lends itself well to this investigation. The basic apparatus requires subjects to remove an item from a transparent tube with visible food traps. The subject may perform the task correctly, avoiding the food traps and retrieving the food, or incorrectly, dropping the food into a visible trap. This apparatus has been used in primates (e.g. Visalberghi & Limongelli, 1994; Seed et al., 2009), birds (New Caledonian Crows: Taylor et al., 2009; Rooks: Tebbich et al., 2007), and even stingrays (Kuba et al., 2010). However, this procedure has yet to be extended to felids.

Methods

Subjects

The subjects were three bobcats, Micah (male, 16 years of age at start of the experiment), Whiston (male, 8 years of age), and Piper (female, 8 years of age), and two Canada lynxes, Legend (male, 12 years of age) and Kaleb (male, 13 years of age). All subjects were hand-raised as part of the pet industry and arrived at Animal Ark in Reno, Nevada, United States at least 2 years prior to the start of the experiment. Micah was the only de-clawed subject. All subjects were naïve to the conditions of the current experiment, yet readily performed similar tasks as part of Animal Ark's enrichment program.

Micah was born in captivity and sold as a pet. After serious encounters with his owner, the cat was returned to the breeder. Another home was found, but this location did not work well as Micah did not respond well to men. Animal Ark was then contacted for placement. Reports indicate there may have been some mishandling or aggressive discipline of Micah. He arrived at Animal Ark on July 31, 2000.

Piper was originally purchased from a breeder in Montana. After an unsuccessful attempt at a breeding program, Piper's former owner decided it was time to find a new home. Whiston came to Animal Ark from the same owner, having been purchased from a zoo. Piper and Whiston both arrived at Animal Ark on January 17, 2006.

Legend, purchased by a private individual as a pet, was confiscated by California Fish and Game due to illegal possession and transferred to Animal Ark. The original owner sought to have Legend returned to her with plans to place the animal into the care of a friend with the proper space and permits in Nevada. Officials decided to return the lynx. After 8 years, the new owner in Nevada decided he could no longer commit to Legend's long term care and returned Legend to Animal Ark on June 6, 2008.

In 1998, Animal Ark's co-founders began a nation-wide search for a female companion for a male Canada lynx already housed at Animal Ark. After several false starts, a pair of sickly kittens was found needing placement. Kaleb and his sister arrived at Animal Ark in August 1998, although his sister later passed away due to the earlier health issues.

As part of Animal Ark, Inc.'s enrichment program, all cats were occasionally presented with tubes containing scents and bits of food. Generally, these tubes were cardboard and not mounted to any structure so that food was retrieved by shredding the tube or knocking the food out during play. Occasionally these tubes were PVC in which case inserting paws in one end was common, although the task was generally solved by knocking the food out during play. All tubes either had an opening diameter smaller or significantly larger than the animal's paw to prevent the tube from getting stuck on the animal. Each subject had been observed to reach into holes in the enclosures, such as made by small rodents, or through chain link fences.

Experimental Apparatus

The apparatus was made of transparent tubes with 10.16 centimeters diameter openings arranged such that they intersected perpendicularly and created a cross or "x" (See Figure 1). Each arm of the cross was 15.24 centimeters in length from opening to intersection. Three of the four arms had food traps: tubes attached to the underside of the respective arm such that the outer edge of the trap was 5.08 centimeters from the opening of the arm and was 5.08 centimeters in depth.

Given the rotational abilities of felid forelegs, each subject could avoid the food traps by grasping the food and withdrawing the food along the sides or even ceiling of the tube, bypassing the trap. A fourth non-trapped tube provided an alternative means by which each subject could avoid the food traps. The entire cross was mounted on a 45.72-centimeters tall post with a large, 0.45 kilogram concrete weight on the bottom. For analysis, the non-trapped tube was designated Tube 1, with the three trapped tubes being Tubes 2 through 4 in clockwise order.

As the orientation of the tubes could be rotated, the positions where a subject could stand were designated 1 through 4 as well. The position nearest the animal's access gate was Position 1, with the other three positions being designated successively in clockwise order.

Training

All cats were fed exclusively from a 10.16-centimeters opening diameter opaque tube until they would, upon entering the feeding/testing enclosure, immediately and directly approach the tube and pull food from the tube with a paw without hesitation or pause. The training tube was mounted as described above, and rotated randomly such that it was not in any orientation for more than two consecutive feedings. Feedings occurred daily at approximately 24-hour intervals in each animal's normal feeding area, which would also serve as the testing area.

Procedures

With the subject locked in a separate holding area, Experimenter 1 placed a plywood barrier such that the subjects would be unable to see the Experimenter and/or the apparatus during set-up. Then, Experimenter 1 installed the apparatus in the subject's enclosure such that there was at least two feet between the apparatus and any wall or fence. Experimenter 1 then placed a 10-gram chunk of chicken breast at the center of the intersection of the apparatus.

For the first 10 days, a second experimenter, blind to which tube Experimenter 1 used to bait the apparatus, wiped down the entire apparatus with rubbing alcohol to control for scent cues. Following the tenth day, Animal Ark management requested a protocol adjustment to better align with safety procedures; two different experimenters moving through enclosure gates and safety points created an unacceptable chance of animal escape or an unsafe encounter between subjects and researchers. Beginning the 11th day, Experimenter 1 controlled for scent cues by baiting the apparatus using tube openings at random, such that no single tube opening was used more than 2 times consecutively and such that all tube openings were used an approximately equal number of times.

The orientation of tube openings was counterbalanced in a pseudorandom manner such that the non-trap arm was on each side for an approximately equal portion of trials, but also on one side for no more than 2 consecutive trials.

Experimenter 1 placed a video camera (GoPro Hero HD™) on the enclosure's ceiling directly over the apparatus to record the trial. Once ready, the Experimenter started the video camera, moved the plywood barrier out of the experimental area, moved the subject into the experimental area, and hid behind the plywood blind. The experimenter monitored remote feed from the video camera throughout the entire trial.

Upon successful completion of the task (i.e. the subject obtained the piece of food), the experimenter immediately moved from behind the blind, placed a 10-gram chunk of chicken breast in the holding area visible to the subject, and moved the subject into the holding area. If the cat had dropped the food into a trap, the experimenter waited 15 seconds before beginning the movement procedure. Once the subject was locked in the holding area, the procedure repeated for a total of 10 trials per subject per day.

Approximately one hour following the last trial, the subject would be fed its remaining meal. The amount of food fed during the course of the trials was taken into account when determining daily rations. During the course of the study, each subject was fed 98% of its pre-study daily rations to maintain a level of hunger. Further, trials occurred at about the same time each day, meaning each subject had gone approximately 22.5 hour since last eating.

Coding and Analyses

Experimenters reviewed each trial’s videotape and recorded the following measures: Position of Tube 1, latency to approach in seconds (measured from time subject given access into experimental area to time of first approach within 1 foot of the apparatus), latency from first approach to first paw insertion in seconds, number of paw insertions per position, total trial time in seconds, and final result.

Considerations

Animal Ark, Inc. is a wildlife sanctuary accredited by the American Sanctuary Association and permitted by the United States Department of Agriculture to house, care for, and work with bobcats, *Lynx rufus*, and Canada lynx, *Lynx canadensis* (USDA License 88-C-0027). The full protocols of this study were reviewed and approved by the University of Nevada, Reno Institutional Animal Care and Use Committee (IACUC Protocol #00517).

Results

All three bobcats immediately approached the training apparatus upon first presentation. Within 8 feedings, all bobcats were immediately pulling food from the tube upon approach. Each Canada lynx left their food in the tube for the first three feedings. For these subjects, the food was moved to the top of the tube for two feedings to elicit the cats to approach and interact with the tube as a food source. The food was then presented just inside the opening of the tube for two feedings and then moved slightly deeper upon each successive presentation. Within 20 presentations, both lynx were immediately withdrawing food upon approach.

Table 1 provides a summary of each subject's success in obtaining food from the apparatus. Subjects did not avoid the tubes with traps, performing at or below chance (See Figure 2). Bobcats used the non-trapped tube an average of 25.6% of each day's trials (SD 9.37; [Whiston avg. 27.2%, SD 10.0; Piper avg. 23.5%, SD 9.88; Micah avg. 26.0% SD 8.21]). Canada lynx used the non-trapped tube an average of 17.9% of each day's trials (SD 10.8; [Kaleb avg. 15.0%, SD 9.85; Legend avg. 20.8%, SD 11.1]).

Instead, all cats showed strong place preference (See Figure 3). Bobcat, Whiston, used Place 4 almost to the exclusion of all others (binomial probability < 0.0001) while Piper used Place 2 (binomial probability < 0.0001) and Micah used Place 2 (binomial probability < 0.0001). Canada lynx, Kaleb, used Place 1 (binomial probability < 0.001) and Legend used Place 2 (binomial probability < 0.0001).

Subjects did obtain food from tubes containing traps by various means such as grasping the meat, rotating their paw, and sliding the meat along the side and/or ceiling of the tube, bypassing the food trap altogether. Bobcats obtained food from trapped tubes an average of 46.6% of each day's trials (SD 22.7; [Whiston avg. 59.1%, SD 15.6; Piper avg. 43.5%, SD 26.6; Micah avg. 38.0%, SD 19.9]). Canada lynx only obtained food from trapped tubes an average of 16.9% of each day's trials (SD 16.5; [Kaleb avg. 22.2%, SD 19.0; Legend avg. 11.7%, SD 12.0]).

Altogether, as demonstrated in Figure 4, bobcats obtained food an average of 72.4% of each day's trials (SD 22.6; [Whiston avg. 86.3%, SD 10.4; Piper avg. 67.0%, SD 28.1; Micah avg. 64.0%, SD 19.6]). Canada obtained food an average of 34.9% of each day's trials (SD 19.1; [Kaleb avg. 37.2%, SD 22.2; Legend avg. 32.5%, SD 15.7]).

Finally, as demonstrated in Table 2, bobcats were faster to approach the apparatus, insert their paw into the apparatus, and to complete the trial. On average, bobcats approached the apparatus in 2.92 seconds from start of trail (SD=1.37), inserted their paw into a tube in 5.01 seconds from first approach (SD=5.87), and completed the trial in 13.3 seconds from start of trial (SD=9.85). Canada lynx approached the apparatus in 13.6 seconds from start of trial (SD=11.1), inserted their paw into a tube in 10.4 seconds from first approach (SD=8.09), and completed the trial in 40.8 seconds from start of trial (SD=35.5).

Discussion and Conclusions

Bobcats and Canada lynx are quite close phylogenetically, yet demonstrate distinctly different hunting patterns, prey selection, and niche fulfillment. Further, many keepers report vast differences in behavioral patterns between bobcats and Canada lynx. However, this researcher could find no published empirical behavioral comparison of these two species. This current study proposed a means of testing the behavioral differences between these two species, as well as provided qualitative and quantitative data on these differences. Such data as these may inform important management and care considerations such as enclosure designs, enrichment programs, and husbandry protocols. It is important in planning such wildlife management decisions to consider species-specific behavior patterns in addition to morphological factors.

Bobcats were faster than Canada lynx to exhibit the reaching behavior during training and then to enter the testing area, to insert their paw into a tube, and to complete the trial during testing. This may be attributed to levels of motivation, but it is worthy to note that the Canada lynx lost more weight than bobcats during the course of the study. A subsequent study may investigate effects of changes in diet on learning curves in these two species.

Generally, bobcats chose a location, visually oriented to the food, and inserted and maneuvered their paw to retrieve the food. Often, the bobcat would rotate their paw and slide the food along the walls of the tube past a trap, avoiding food traps. Canada lynx were slower to exhibit the behavior of reaching into the training tube for food and then took longer to complete each stage of the process during testing. Moreover, Canada lynx would approach the apparatus, select a tube, sniff the opening, visually orient to the food, flop their paw in, and then look around while holding their paw in the apparatus before finally withdrawing their paw, still looking around the environment.

In the end, bobcats avoided the food traps almost immediately while Canada lynx were less likely to avoid food traps, even after 180 trials. All subjects seemed place conditioned, using one position significantly more than any other position, regardless of the orientation of tubes ($p \leq 0.0001$ for each subject). Bobcats obtained food quickly, avoiding the negative consequences of the food trap regardless of which tube they used.

All subjects were tested in familiar feeding locations by familiar animal keepers. Hence, conditions of the experiment environment itself should not have affected the outcomes.

It is possible morphological differences affected the outcomes of this study. Canada lynx have larger paws with more insulating fur than bobcats. These broad paws or additional fur may have influenced the abilities of Canada lynx to complete the trials in the current apparatus. An additional study should reduce the diameter of tubes presented to bobcats to be in similar proportion as the current tubes to Canada lynx paws. During piloting of feeding tubes, those larger than 10 centimeters in diameter permitted subjects to insert their entire head to obtain food.

Nonetheless, these data can begin informing future research and wildlife management decisions. An increasing number of organizations and enclosure designs are taking species-specific behaviors into account during design, leading to better care of wildlife and improved understanding for the public. Often, these decisions are based upon observations of the workers at the given facility, with animals already housed at the facility. However, elucidating the differences among species can provide baseline information for new facilities or those obtaining their first resident of a given species.

In conclusion, it is possible to test differences in behavior patterns of two or more species. The apparatus utilized in this design produced results which could lead to further research and begin informing wildlife management and husbandry. For example, with these data, one may create an enrichment device or enclosure installation that would encourage bobcats to explore tubes made to look like rodent burrows. These tubes could be baited by keepers at random to increase enrichment quality. Such a device would likely be less successful in a Canada lynx enclosure.

References

Baker, L. A.; Warren, R. J.; Diefenbach, D. R.; James, W. E.; & Conroy, M. J. 2001. Prey selection by reintroduced bobcats (*Lynx rufus*) on Cumberland Island, Georgia. American Midland Naturalist. Vol. 145: 80-93. University of Notre Dame, Notre Dame, Indiana, U.S.A.

Beasom, S. L. & Moore, R. A. 1977. Bobcat food habit response to a change in prey abundance. The Southwestern Naturalist. Vol. 21, No. 4: 451-457. Southwestern Association of Naturalists, Durant, Oklahoma, U.S.A.

Blasius, B. & Stone, L. 2000. Chaos and phase synchronization in ecological systems. International Journal of Bifurcation and Chaos. Vol. 10, No. 10: 2361-2380. World Scientific Publishing Company, Singapore.

Hass, C. C. 2009. Competition and coexistence in sympatric bobcats and pumas. Journal of Zoology. Vol. 278: 174-180. The Zoological Society of London, London, United Kingdom.

Homyack, J. A.; Vashon, J. H.; Libby, C.; Lindquist, E. L.; Loch, S.; McAlpine, D. F.; Pilgrim, K. L.; & Schwartz, M. K. 2008. Canada lynx-bobcat (*Lynx canadensis* X *L. rufus*) hybrids at the southern periphery of lynx range in Maine, Minnesota and New Brunswick. American Midland Naturalist. Vol. 159, No. : 504-508. University of Notre Dame, Notre Dame, Indiana, U.S.A.

Kuba, M. J.; Byrne, R. A.; & Burghardt, G. M. 2010. A new method for studying problem solving and tool use in stingrays (*Potamotrygon castexi*). Animal Cognition. Vol. 13: 507-513. Springer-Verlag, London, United Kingdom.

Litvaitis, J. A. 1981. A comparison of coyote and bobcat food habits in the Wichita Mountains, Oklahoma. Proceedings of the Oklahoma Academy of Science. Vol. 61: 81-81. Oklahoma Academy of Science, Durant, Oklahoma, U.S.A.

Maehr, D. S. & Brady, J. R. 1986. Food habits of bobcats in Florida. Journal of Mammalogy. Vol. 67, No. 1: 133-138. American Society of Mammalogists, Lawrence, Kansas, U.S.A.

McLean, M. L. & Lovallo, M. J. 2005. Influence of age, sex and time of year on diet of the bobcat (*Lynx rufus*) in Pennsylvania. American Midland Naturalist. Vol. 153, No. : 450-453. University of Notre Dame, Notre Dame, Indiana, U.S.A.

Neale, J. C. C. & Sacks, B. N. 2001. Food habits and space use of gray foxes in relation to sympatric coyotes and bobcats. Canadian Journal of Zoology. Vol. 79: 1794-1800. NRC Research Press, Ottowa, Ontario, Canada.

Roth, J. D.; Marshall, J. D.; Murray, D. L.; Nickerson, D. M.; Steury, T. D. 2007. Geographical gradients in diet affect population dynamics of Canada lynx. Ecology. Vol. 88, No. 11: 2736-2743. The Ecological Society of America, Washington, D.C., U.S.A.

Seed, A. M.; Call, J.; Emery, N. J.; & Clayton, N. S. 2009. Chimpanzees solve the trap problem when the confound of tool-use is removed. Journal of Experimental Psychology: Animal Behavior Processes. Vol. 35, No. 1: 23-34. The American Psychological Association, Washington, D.C., U.S.A.

Stenseth, N. C.; Falck, W.; Bjornstad, O. N.; & Krebs, C. J. 1997. Population regulation in snowshoe hare and Canadian lynx: Asymmetric food web configurations between hare and lynx. Proceedings of the National Academy of Science. Vol. 94: 5147-5152. The National Academy of Sciences of the USA, Washington, D.C., U.S.A.

Stenseth, N. C.; Shabbar, A.; Chan, K.; Boutin, S.; Rueness, E. K.; Ehrich, D.; Hurrell, J. W.; Lingjaerde, O. C.; & Jakobsen, K. S. 2004. Snow conditions may create an invisible barrier for lynx. Proceedings of the National Academy of Science. Vol. 101: 10632-10634. The National Academy of Sciences of the USA, Washington, D.C., U.S.A.

Squires, J. R. & Ruggiero, L. F. 2007. Winter prey selection of Canada lynx in Northwestern Montana. The Journal of Wildlife Management. Vol. 71, No. 2: 310-315. The Wildlife Society, Bethesda, Maryland, U.S.A.

Taylor, A. H.; Hunt, G. R.; Medina, F. S. & Gray, R. D. 2009. Do New Caledonian crows solve physical problems through causal reasoning? Proceedings of the Royal Society B: Biological Sciences. Vol. 276: 247-254. The Royal Society, London, United Kingdom.

Tebbich, S.; Seed, A. M, Emery, N. J.; & Clayton, N. S. 2007. Non-tool-using rooks, *Corvus frugilegus*, solve the trap-tube problem. Animal Cognition. Vol. 10: 225-231. Springer-Verlag, London, United Kingdom.

Visalberghi, E. & Limongelli, L. 1994. Lack of comprehension of cause-effect relations in tool-using caphuchin monkeys (*Cebus apella*). Journal of Comparative Psychology. Vol. 108, No. 1: 15-22. The American Psychological Association, Washington, D.C., U.S.A.

Tables and Figures

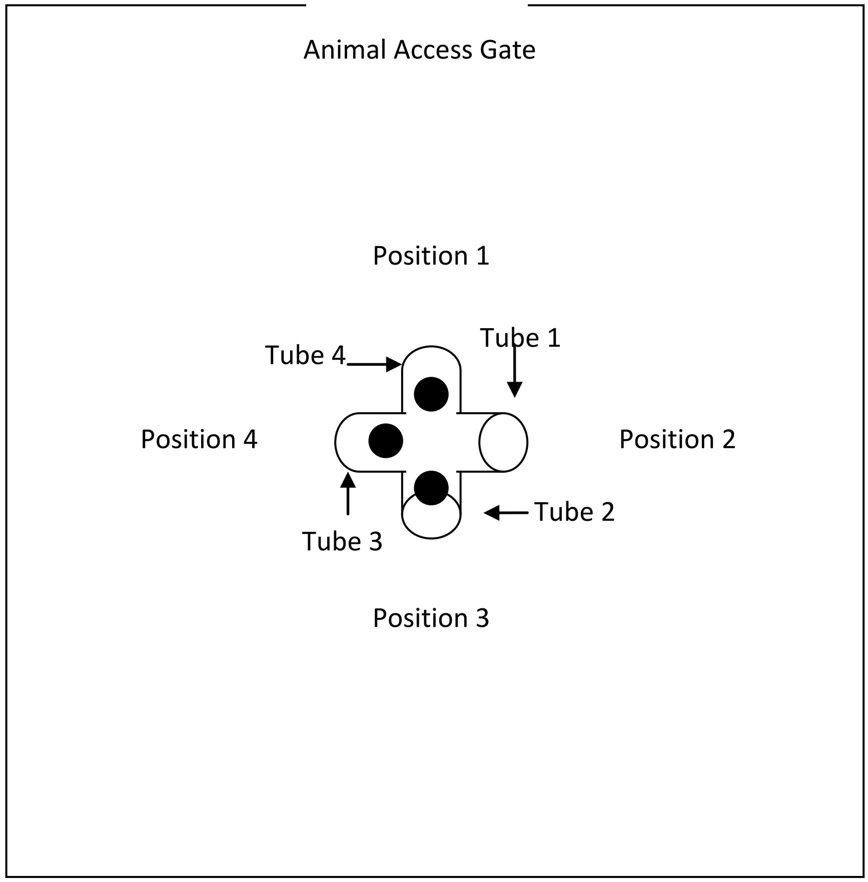


Figure 1: Experimental apparatus and location

Figure 1 demonstrates the layout of the experimental apparatus as well as the labels of the positions a subject may use to interact with the apparatus. The position nearest the subject's access gate was always Position 1, with the other three positions labeled progressively in clockwise order. The tube without a trap was always Tube 1, with the other three tubes labeled progressively in clockwise order. Dimensions are not to scale.

	Bobcats			**Canada lynx**	
	Piper	**Whiston**	**Micah**	**Kaleb**	**Legend**
From tube WITHOUT trap	23.5	27.2	26.0	15.0	20.8
From tubes WITH traps	43.5	59.1	38.0	22.2	11.7
TOTAL	67.0	86.3	64.0	37.2	32.5

Table 1: Summary of each subject's success in obtaining food from the testing apparatus using any tube.

Table 1 provides a summary of each subject's success in obtaining food from the testing apparatus, either by avoiding tubes with food traps, or avoiding the food traps themselves.

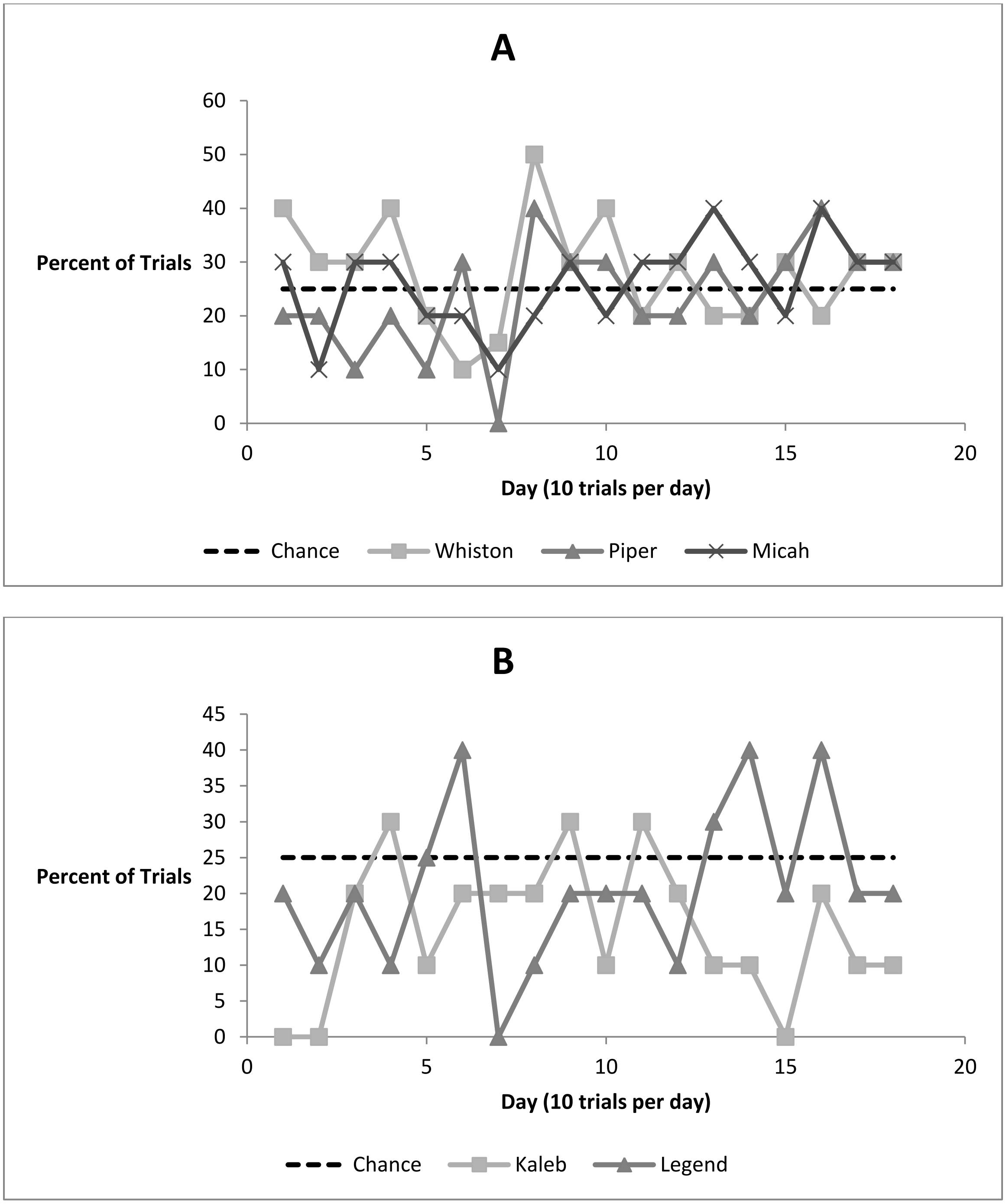


Figure 2: Percent of trials on each day bobcats (Panel A) and Canada lynx (Panel B) used the non-trapped feeding tube.

Figure 2 shows each subject's use of Tube 1 in obtaining food rewards, relative to chance.

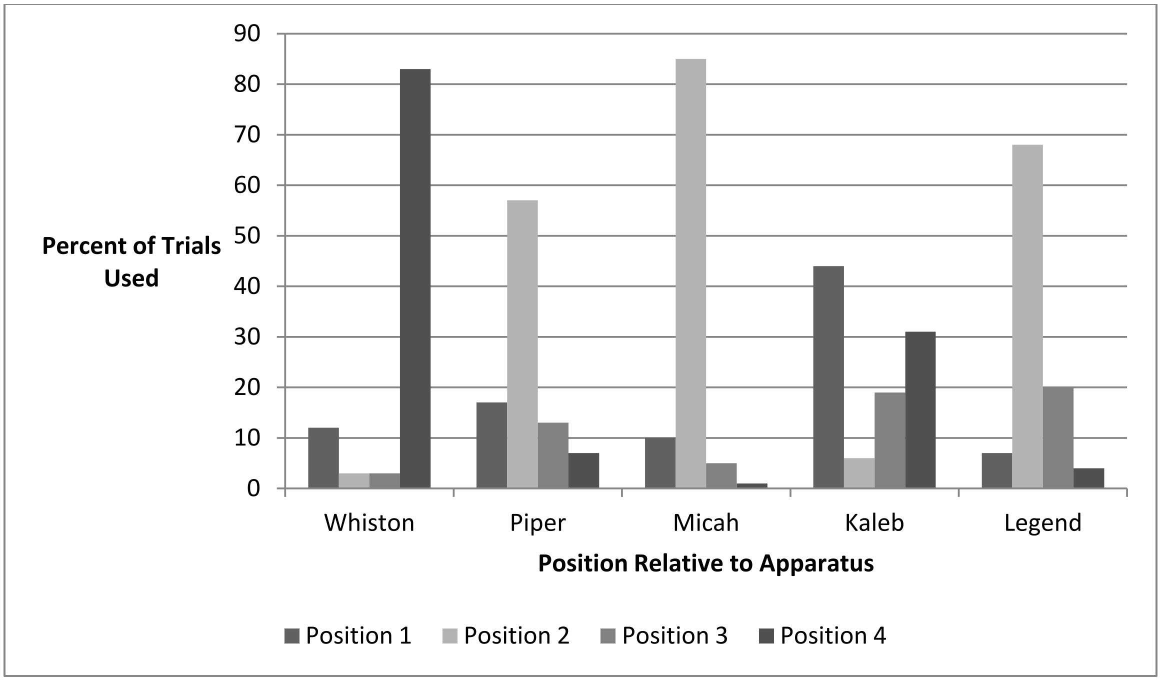
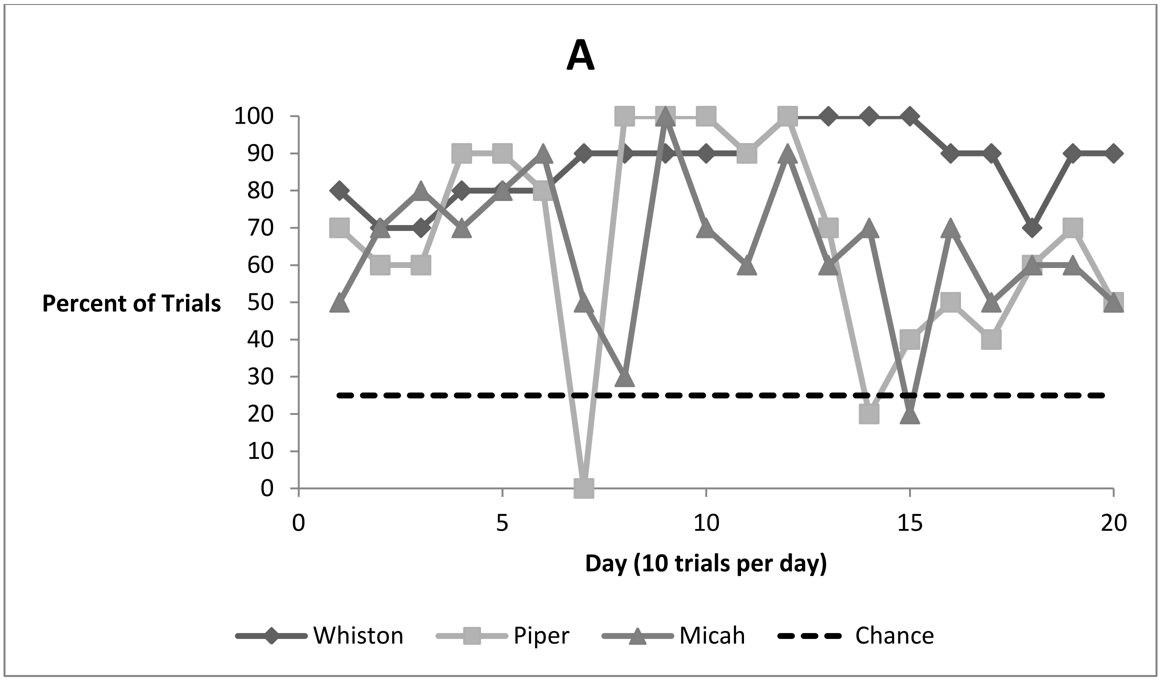


Figure 3: Position preference

Figure 3 demonstrates the percent of trials each subject used a given position of the apparatus. Position 1 was always the position closest to the animal's access gate, with the other positions numbered sequentially in a clockwise direction.



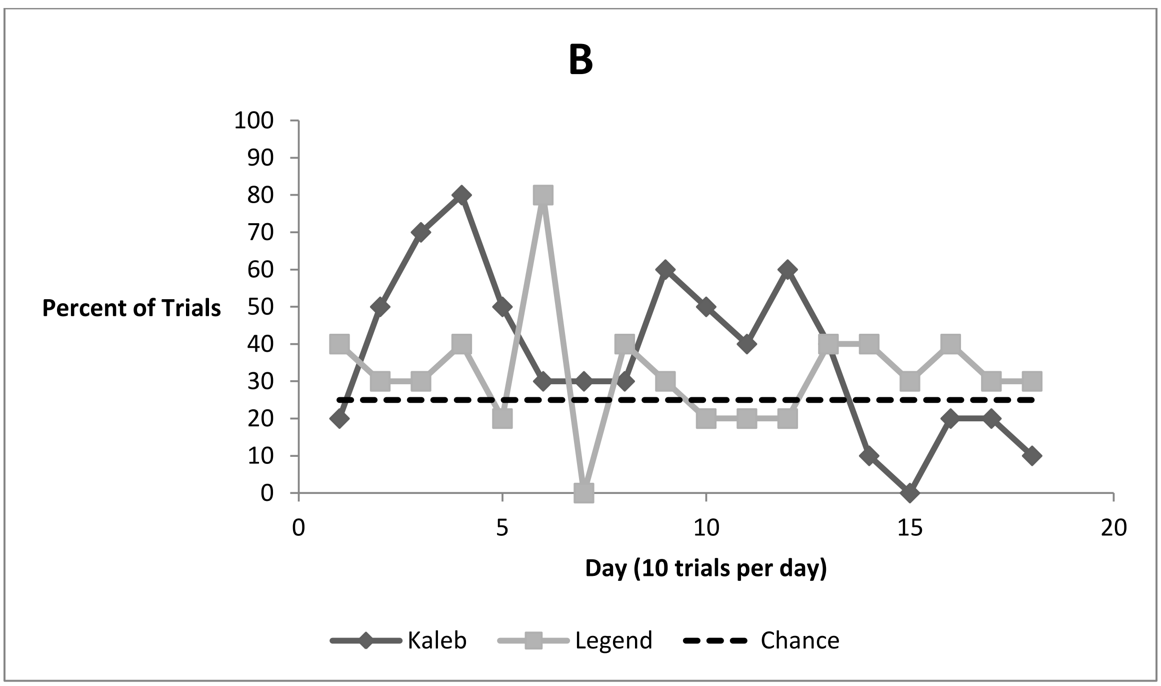


Figure 4: Overall successful performance for bobcats (Panel A) and Canada lynx (Panel B)

Figure 4 shows the percent of trials on each day bobcats and Canada lynx successfully obtained food from any tube. Such success includes using Tube 1, the non-trapped tube, or by obtaining food from a trapped tube by some means.

	Bobcats	**Canada lynx**
Access to 1st Approach	2.92	13.6
1st Approach to 1st Paw Insertion	5.01	10.4
Access to Completion	13.3	40.8

Table 2: Average length of time, in seconds, for subjects to complete each phase of a single trial

Table 2 provides the average lengths of time required for subjects of each species to approach the apparatus upon being given access to the testing area, to insert a paw for the first time following said approach, and to complete the trial upon being given access to the testing area.