

# CANADA LYNX UPDATE



*Photo courtesy of Feline Conservation Center*

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## **PROJECT OVERVIEW**

Canada lynx (*Lynx canadensis*) are the most abundant felid species inhabiting North America's boreal forest. However, southern populations of lynx have declined dramatically in the last century, and in 2000, they were listed as a threatened species by the US Fish and Wildlife Service. While lynx historically extended well into the northern continental US, anthropogenic activities (e.g. trapping, habitat destruction) and climate change have dramatically reduced most US populations.

In order to develop effective conservation strategies and management plans for Canada lynx, it is critical that we develop a stronger understanding of the physiology and behavioral ecology of this species. The goals of this study are 1) to establish basic knowledge about the reproductive and stress physiology of Canada lynx, and 2) to understand how patterns of hormone expression correlate with behavioral and environmental factors.

## PROJECT STATUS

### Brief Recap

Data collection and lab-work for this project is now complete. I am currently focusing on statistical analysis and writing up the results. In the past year and a half, we added two exciting new facets to the project: keeper surveys and behavioral observations. These additions will enhance our understanding of lynx endocrinology and its relationship to lynx behavior and environmental conditions.

### Fecal Sample Collection

Sample collection is now complete for all populations in the study (captive, wild/naturally-occurring, and reintroduced; Table 1). There were 25 captive institutions that participated in the project. The ‘naturally-occurring’ group includes lynx from Maine, Minnesota, Montana, and Washington, and the ‘reintroduced’ group consists of cats reintroduced to Colorado. A grand total of 6,441 fecal samples were analyzed for this project. This extensive amount of data is helping us establish a strong understanding of Canada lynx physiology. We cannot emphasize enough how grateful we are to *everyone* involved in the glamorous job of collecting fecal samples!

**Table 1.** Tally of lynx and fecal samples included in the study.

	Males		Females		Unknown
	# lynx	# samples	# lynx	# samples	# samples
<b>Captive</b>	26	1024	26	2059	---
<b>Naturally-Occuring</b>	---*	---	---	---	282
<b>Reintroduced (pens)</b>	77	724	93	1224	---
<b>Reintroduced (field)</b>	44	357	61	604	167

*\*Although several samples from naturally-occurring populations were collected from known males or females, at this point we have not yet determined exactly how many samples are from known lynx.*

### Hormone Assays

All hormone assays have been completed. Fecal hormone metabolites were quantified using enzyme-immunoassays (EIAs), and all assays were conducted at Brookfield Zoo’s Endocrinology Lab. We monitored fecal metabolites of estrogens, progestogens, androgens (e.g. testosterone), and glucocorticoids (e.g. cortisol).

### Keeper Surveys

Surveys about the husbandry and behavior of individual lynx were distributed to 63 institutions. The goal of this component of the project was to determine if individual differences in patterns of hormone expression were related to individual differences in husbandry or behavior. Because of the methods used to analyze behavior types, we included several institutions that didn’t participate in the fecal hormone collection so that we could have a better understanding of the range of behavioral types that exist for captive Canada lynx.

A total of 42 institutions responded, providing survey data for 81 lynx. We had an overall response rate of 67%, and among institutions that also collected fecal samples, the response rate was 96%. Our sincere thanks to everyone who took the time to complete surveys!

### Behavioral Observations

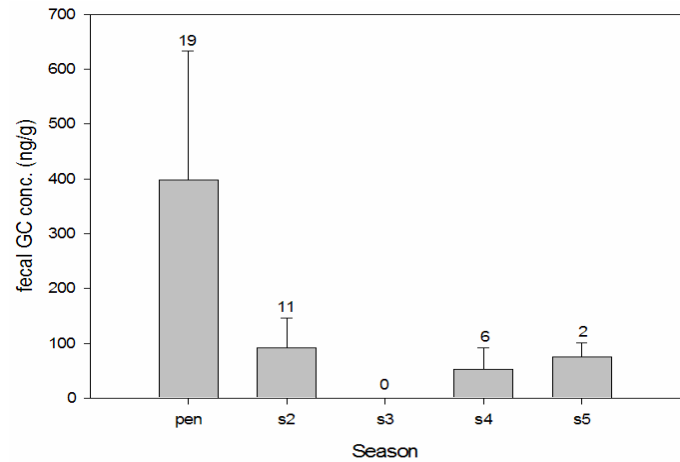
A series of behavioral observations were conducted as part of an undergraduate senior honors thesis. The objective of this study was 1) to assess how qualitative assessments of behavior (keeper surveys) align with qualitative assessments (direct observations), and 2) to monitor the response of individual lynx to 3 different stimuli, specifically a mirror, beaver castor scent, and a snowshoe hare distress cry. We visited 6 institutions and collected data from 14 cats.

## INTRIGUING NEW RESULTS

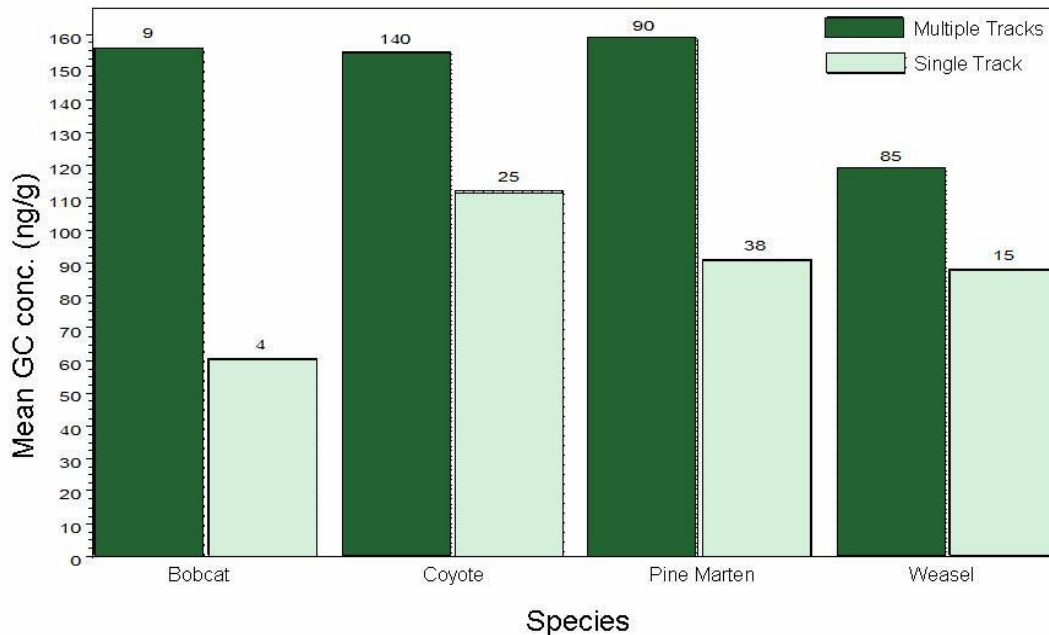
While many new results have emerged in the past year, for this update, I am going to highlight some of the preliminary results from reintroduced lynx. One of the exciting aspects of fecal hormone analysis is our ability to monitor individuals and populations that could not previously be monitored. This is one of very few projects that track physiological changes in reintroduced animals, and such information can be used to improve future conservation efforts.

Preliminary data show that, for both sexes, fecal glucocorticoid (fGC) levels are higher in holding pens than post-release (Figure 1). Within the holding pens, fGC levels are initially quite high following transport, but then decrease to a stable, “baseline” level fairly quickly. Lynx exhibit physiological stress responses to several events in the holding pens (e.g. exams and increased human activity). Post-release, fGC levels are generally much lower than holding pen levels by the following season (Figure 1).

In addition to monitoring how individuals respond physiologically to the reintroduction process, we can also correlate patterns of fGC expression with several different environmental parameters. Using information collected by the trackers in the field, our preliminary data indicate that fGC levels are consistently higher in habitats with higher competitor density (Figure 2) and lower prey density. Although neither result is statistically significant at this time, the trend is very consistent and may become significant once we incorporate the remaining data. Interestingly, we did not observe any trends in mean fGC values across different levels of human activity (e.g., road density, snow-mobiling, skiing). In the future, we will also incorporate other environmental correlates.



**Figure 1. Changes in fGC levels throughout the reintroduction.** The data shown were for one female, but are representative of other lynx. Each season represents 1 winter tracking season (Dec. – Apr.). Number above bar represents number of fecal samples. Error bars = 1 SD.



**Figure 5. Mean fGC levels in relation to density of ‘competitor’ species.** Number above bar represents number of fecal samples. Differences are not statistically significant at this time.

## ACKNOWLEDGEMENTS

We greatly appreciate the hard work of *everyone* involved in collecting fecal samples, completing surveys, and otherwise facilitating this project at all participating institutions:

### Captive Institutions

Alaska Zoo	Hillcrest Park Zoo	Salmonier Nature Park
Animals for Awareness	Jan Van Hoessen	Scovill Zoo
Animals of Montana	Joe and Pat Bergeron	Seneca Park Zoo
Assiniboine Park Zoo	Kroschel Wildlife Center	The Wildcat Sanctuary
Big Cat Rescue	Louisville Zoo	Toronto Zoo
Bitterroot Bobcat and Lynx	Maine Wildlife Park	Triple D Game Farm
Brec's Baton Rouge Zoo	Minnesota Zoological Gardens	Utah's Hogle Zoo
Buttonwood Park Zoo	Montgomery Zoo	Walk on the Wildside Refuge
Cincinnati Zoo & Botanical Garden	NY State Zoo at Thompson Park	Wild Trax Feline Refuge
Connecticut's Beardsley Zoo	N.O.A.H. Feline Refuge Center	Wildcat Valley Sanctuary
Dakota Zoo	North Eastern Wisconsin Zoo	Wildlife Science Center
Dirt Willy Game Bird Farm	Northwest Trek Wildlife Park	Zoo America
Feline Conservation Center	Philadelphia Zoo	Zoo New England (Stone)
Great Plains Zoo	Point Defiance Zoo & Aquarium	Zoo Sauvage de St. Félicien
High Desert Museum	Pueblo Zoo	

### Wild Institutions

Colorado Division of Wildlife  
Maine Division of Inland Fisheries and Wildlife  
USFS Rocky Mountain Research Station (Montana)  
Natural Resources Research Institute (Minnesota)  
Washington Department of Fish and Wildlife

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