CANADA LYNX UPDATE

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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. The preliminary results from Goal 1 are presented below. Final results for both goals are expected by June 2008.

SAMPLE COLLECTION

To date, samples have been collected from 42 captive lynx (19 males and 23 females) from 21 institutions across North America. Over 3,500 fecal samples have been collected. This extensive amount of data is helping us establish a strong understanding of Canada lynx physiology. We plan to continue sample collection from a few targeted individuals through summer 2007. We are particularly interested in getting more samples from pregnant females, so if you are aware of any breeding lynx pairs, please contact Kerry Fanson. We have also obtained ~3,000 samples from wild or reintroduced lynx, and sample collection will continue through this winter field season. Approximately 1,500 samples have been analyzed so far.

MALE REPRODUCTIVE PHYSIOLOGY

By comparing samples from castrated males and intact males, we determined that the assay we were using to measure fecal androgens (e.g. testosterone) was valid. Castrated males had significantly lower levels of testosterone than intact males.

In contrast to many other felids, we found that male lynx have strong seasonal changes in androgen expression (Fig. 1). In February and March (the core of the breeding season), fecal androgen concentrations were significantly higher than in May, June, or July. Since lynx inhabit temperate-to-arctic environments, it should be very adaptive to time breeding so that kittens are raised when environmental conditions are the most favorable. Environmental constraints may completely prevent females from becoming receptive outside of the breeding season, and thereby also favor seasonal variation in male reproductive physiology. Interestingly, Canada lynx exhibit more dramatic seasonal fluctuations in androgen expression than Eurasian lynx, which inhabit similar climates. We are working with Drs. Katarina Jewgenow and Katey Pelican, who are conducting similar studies with Eurasian lynx and Iberian lynx respectively, to enhance our understanding of comparative lynx physiology.

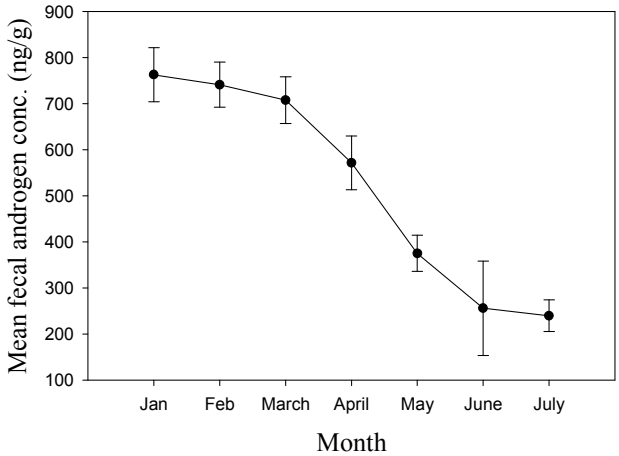

Figure 1. *Seasonal pattern of androgen expression.*

Another intriguing finding is that fecal androgen concentrations increase slightly with age. All males in this study should be reproductively mature (the youngest was 3 years old), so this trend is not caused by the process of reproductive maturation. There is very little literature that describes the trajectory of androgen expression in animals after sexual maturity, so it is unclear why androgen levels would increase.

FEMALE REPRODUCTIVE PHYSIOLOGY

To validate the assay used to quantify fecal estrogens, we compared samples collected from intact and spayed females. Although estrogen concentrations in spayed females were lower than intact females, we have failed to detect estrogen peaks associated with estrus behavior. Similarly, validation of the progestogen assay has so far been unsuccessful. To validate this assay, we compared samples collected from pregnant and non-pregnant females. However, we have only had 1 successful pregnancy (out of 10 breeding females), so our sample size is very small. For the one pregnant female, fecal progestogens did not show the expected increase during the pregnancy.

Interestingly, similar results have been described for Iberian lynx and Eurasian lynx. There are two explanations for these results. First, it could be that our hormone assays are failing to bind to the appropriate fecal hormones. As hormones pass through the liver and gut, they are metabolized by the body. Although these same assays have been used successfully with other felid species, it is possible that unique aspects of hormone metabolism in lynx may interfere with the assay. We are currently testing several other assays to determine if this explanation is likely. Second, it is possible that female lynx exhibit different patterns of hormone expression during estrous and pregnancy than other felid species. Such a result would be highly intriguing and would raise several questions about the reproductive physiology and evolutionary history of lynx. We are working with Dr. Pelican (Iberian lynx) and Dr. Jewgenow (Eurasian lynx) to determine whether this is a unique characteristic of hormone metabolism in lynx, or of lynx reproductive physiology.

STRESS PHYSIOLOGY

We validated the corticoid assay by injecting a synthetic hormone (ACTH) that stimulates the release of corticoids. We did see a significant increase in corticoid concentration following the administration of ACTH, so the assay is detecting relevant changes in corticoid expression. To further validate our methodology, we also compared serum and fecal profiles for 2 females during an ACTH challenge. This ensured that known changes in circulating hormone levels were being reflected in the fecal hormone concentration. As predicted, there was a corresponding increase in both serum and fecal corticoids following the injection.

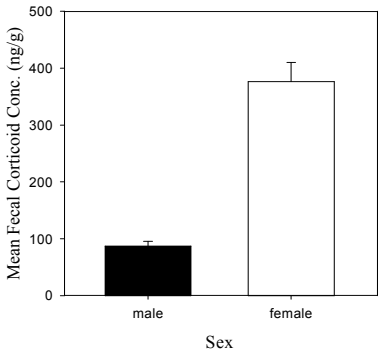

Figure 2. *Gender differences in fecal corticoid concentrations.*

Results show that females have significantly higher corticoid concentrations than males (Fig. 2). However, gender differences in corticoid expression have been documented for a wide range of species, and in at least some cases, this has been linked to differences in steroid hormone metabolism between males and females. Another hypothesis that has been advanced, and which is not necessarily mutually exclusive with the first hypothesis, is that these differences may reflect differences in stress sensitivity. We are still working to determine which may be the case for Canada lynx.

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Pueblo Zoo
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Zoo America
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