

# **The Curious Case of the Amur Leopard Sofiya**

Robert Schwartz

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Fairfield University  
Department of Biology  
1073 North Benson Road  
Fairfield, CT 06824

## **Abstract:**

The Amur leopard (*Panthera pardus orientalis*) is a critically endangered subspecies of leopard. One of these rare leopards resides at the Beardsley Zoo in Bridgeport, CT. In order to preserve rare species, zoos around the world have implemented the Species Survival Plan (SSP), which involves conservation and controlled breeding of critically endangered species. Sofiya, the female Amur Leopard at the CT Beardsley Zoo is a prospect for the SSP. However, it was observed that Sofiya displayed inexplicable and potentially nervous or anxious behaviors, such as staying indoors in her enclosure and excessive pacing. It was initially suspected that her behavior was prompted by some unknown environmental cue(s). With a wild and captive population of less than 300 individuals world wide, concerns about Sofiya's behavior resulted in my service learning research project. Data were collected from February to April 2014, largely through weekly observations from a hunter's blind set up across from the leopard's enclosure. We observed that Sofiya's anxious behavior typically stopped between the hours of 2:30 and 4:30 pm during which she emerged into the enclosure and displayed more social behavior. By integrating observational data with information from zoo staff and medical records, we suggest that Sofiya's behavior may not be influenced by external cues, as was initially hypothesized. Medical records and Sofiya's history indicate that a hormone imbalance may be at least partly responsible for her nervous behavior.

## **Introduction:**

The Amur Leopard (*Panthera pardus orientalis*) is an extremely rare, critically endangered species of big cat, with between 25 and 40 individuals remaining in the wild of the Russian Far East (Uphyrkina, et al 2002). There are approximately 200 Amur Leopards in

captivity across Europe, North America, and parts of the former Soviet Union. Sofiya is an Amur Leopard born on May 10, 2008 at the St. Louis Zoo. She moved in 2009 to the Fort Wayne Children's Zoo in Indiana. Since January 2013, she has resided at the Beardsley Zoo in Bridgeport, CT (Held 2008). Staff at the Beardsley Zoo noticed that Sofiya displays potentially problematic and unnatural behaviors. These behaviors include incessant, aggravated pacing, as well as staying indoors in her enclosure for the majority of the day. Pacing is considered a stereotypic behavior of animals in zoos, meaning that while not natural, it is not an uncommon behavior (Schaul 2012). However, the severity and relentlessness of the behaviors in question led the zoo staff to question the causes. These behaviors are especially problematic because Sofiya belongs to such a rare species. It will be very difficult to mate her if she keeps constantly displaying these behaviors. With this in mind, research was designed to identify the cause of these behaviors. The initial hypothesis of zoo staff and researchers was that there was an environmental cue or something external happening that was triggering her strange behaviors.

### **Methods:**

Starting on February 4, 2014, Sofiya was observed between the hours of 8:30 and 11:30 every Tuesday morning. Observations were made from a hunter's blind set up across the way



*Figure 1: Sofiya and her indoor enclosure*

from the leopard's enclosure. The purpose of the blind was to blend in with the surroundings and not alert Sofiya to our presence. The blind was left permanently as weather permitted so that Sofiya would acclimate to its presence. During observation periods, all environmental conditions were recorded, including weather,

temperature, noises, human interaction, animal interaction, and any other

activity at the zoo. All conditions and activities were recorded and placed into a composite calendar. As the experiment went on, observations were also taken outside of the designated period, during weekend afternoons between the hours of 2:00 and 4:30.

An ethogram was designed at the start of the experiment. As more observations were made, it was revised. Behaviors were noted and tallied on the ethogram during observation. The ethogram included the behavioral categories locomotion, aggression,

*Table 1: Ethogram*

defense, resting, and play (Table 1).

Eventually, other behaviors, such as “head poking out of indoor shelter” were also noted.

Additionally, a motion-activated camera trap was set up on a post directly outside of Sofiya’s enclosure. The time stamped photos from the trap were collected and examined at the start of each observation period.

Date	Time	
<b>LOCOMOTION</b>		
		pacing
<b>AGGRESSION</b>		
		glaring
		jumping
		running/sprinting
		pouncing
		crouching
		chasing
<b>DEFENSE</b>		
		fleeing
		growling/rasping
<b>RESTING</b>		
		sleeping
		eyes closed
		no action
		grooming
<b>PLAY</b>		
		tumbling
		chasing
		climbing

Data were also collected from medical observations and histories obtained from zoo staff, both from the CT Beardsley Zoo and the Fort Wayne Children’s Zoo in Indiana. Information about Sofiya’s medical history and life history, including where and how she was reared, medical procedures, and illnesses were collected from the zoos. Information about a specific drug she was given, Deslorelin, was collected mainly from veterinarians, and information about the effects of the drug was collected from veterinarians and zoo staff. Phone and e-mail interviews were conducted with Fort Wayne veterinary staff and CT Beardsley Zoo staff.

**Results:**

The Amur Leopard’s behaviors were observed and recorded in conjunction with the environmental conditions, including weather, temperature, human interactions, animal

interactions, and sounds. The goal of this process was to determine if there was some environmental cue triggering Sofiya's abnormal behavior. At the start of the experiment, every detail of her behavior was recorded. Any behavior other than pacing was noted, as pacing was completely incessant during most of the observation. However, no distinguishable pattern of her specific behaviors, such as times she would poke her head out of the door in her enclosure, or times she would step outside briefly only to go back in almost immediately, could be observed. All of her observed behaviors were entirely unpredictable. The camera trap, however, provided a few interesting results. Every afternoon the camera consistently caught pictures of Sofiya coming outdoors around 2:30, and staying active until the zoo closed around 4:30. Observations were then taken on two separate afternoon occasions, on which all behaviors and environmental conditions were noted. During these periods, Sofiya did not seem to have any exaggerated reaction to anything in her environment, including weather, temperature, sound, and interactions. Her behavior did not change at all with any change to the environment. All of her times of activity other than pacing and occasionally poking her head out of the door were recorded in conjunction with the environmental conditions, and placed into a composite calendar, Figure 1. Information in the calendar varies based on what was available: on some dates, zoo staff members were able to provide a detailed zoo schedule, while on some days, only the weather and times of activity were available. In addition, the camera trap was not installed until February 26.

Background research revealed that Sofiya was born in a litter of two at the St. Louis Zoo, but that the other cub was a stillborn. The same research also showed that Sofiya's mother did not provide any maternal care.

Results were also obtained from a medical history of Sofiya, which was acquired from the Fort Wayne Children's Zoo in Indiana. The medical report showed that on May 13, 2010,

Sofiya was immobilized to be given a contraceptive. An email correspondence with staff at Fort Wayne revealed that the contraceptive was an 18.8 mg dose of Deslorelin, a common contraceptive. The report revealed nine instances of vomiting, five of which contained blood, between March 7 and May 31, 2011. The report also revealed three instances of vomiting, one of which contained blood, between November 18 and December 21, 2011. Four instances of vomiting, one of which contained blood, were documented between February 13 and September 14, 2012.

Some results were obtained from staff at the Beardsley Zoo in Bridgeport, CT, as well. Interviews with the staff at the Beardsley Zoo revealed that an artificial insemination procedure was scheduled for March 2, 2013. These interviews also revealed that hormone treatments were given on February 26 and March 3, 2013, as well as February 3 and 6, 2014.

All of the results gathered from observations, interviews, research, and the medical history resulted in the formulation of multiple hypotheses. These hypotheses are described in

Table 2:

*Table 2: Hypotheses formed prior to and during the experiment, and observations pertaining to the hypotheses.*

Hypothesis	Observations pertaining to hypothesis
Some environmental cue is triggering Sofiya's behavior (initial hypothesis).	<ul style="list-style-type: none"> <li>• Conditions changed, behavior did not noticeably change</li> </ul>
Sofiya is suffering from some form of anxiety.	<ul style="list-style-type: none"> <li>• Hesitation to come outside/shyness</li> <li>• Incessant pacing</li> </ul>
The lack of maternal care resulted in some psychological trauma.	<ul style="list-style-type: none"> <li>• Mother gave birth to a stillborn in the same litter</li> <li>• Mother did not display maternal care- Sofiya was hand reared</li> </ul>
Some sort of hormone imbalance is causing Sofiya's strange behavior.	<ul style="list-style-type: none"> <li>• 18.8 mg of Contraceptive administered in 2010</li> <li>• Hormone therapy at the Beardsley zoo in 2013 and 2014</li> </ul>
Something in her internal biological clock prevents Sofiya from being active in the	<ul style="list-style-type: none"> <li>• Bulk of activity occurs after 2:30 pm</li> </ul>

mornings.	<ul style="list-style-type: none"> <li>• Changed to 1:30 pm after daylight savings time ended</li> </ul>
Trauma from being sick younger in life could have some sort of lasting psychological effect.	<ul style="list-style-type: none"> <li>• Multiple instances of bloody vomit and loose stool</li> </ul>

**Discussion/Conclusions**

The initial hypothesis that some environmental cue was triggering Sofiya’s strange behavior was one of the first to be disqualified. Observations were taken under all conditions: sunny, rainy, snowy, cold, warm, quiet, and loud. Even with all of this variation in environmental conditions, her behavior did not change. Her seemingly anxious behaviors remained the same. This led to the anxiety hypothesis. This is potentially valid, however, there is no real way of qualifying a leopard as having a chronic anxiety disorder. Nonetheless, because of the subjective nature of the hypothesis, it was not totally disregarded as more progress was made. The same is true of the hypothesis that trauma from sickness left some sort of psychological impact. Animals do often get sick, and there is little data to suggest that it could be a seriously traumatic event. The illness hypothesis was labeled as weak, but not totally thrown away.

One of the more probable initial hypotheses was that the lack of maternal care Sofiya received as a cub had some lasting psychological effect on her. This was supported by some previous research. Another study of zoo animals showed that animals that were hand-reared alone, like Sofiya was, were more prone to aggression toward conspecifics and humans than animals that were hand raised with a conspecific or maternally raised with a conspecific (Mellen 1992). Sofiya was actually characterized as somewhat aggressive toward the male conspecific she was with at the Fort Wayne Children’s Zoo, even though she was not characterized as aggressive toward the zookeepers. It seemed to make sense, then, that other strange behaviors

could be associated with a lack of maternal care. However, there was still the issue of why her behavior changed so suddenly in the afternoons.

The fact that the time of her behavior changed when daylight savings time ended even further negated the “environmental cues” hypothesis. The zoo schedule remained the same, and her behavior shifted. This led to the conclusion that whatever was causing her strange behavior must be internal. It was not until further investigation about her medical history revealed new information that the hormone imbalance was selected as the leading hypothesis.

Sofiya was five years old at the time of the artificial insemination procedure. When the procedure occurred, it had to be stopped midway through. The vet, upon examination, noticed that Sofiya’s reproductive tract was not fully mature. He estimated the reproductive tract to resemble the reproductive tract of a 5-6 month old cat. She was not even close to sexually mature. More investigation led to the realization that Sofiya had been given the contraceptive at too young an age. One of the staff at the Beardsley zoo, Rob Tomas, the animal health manager, mentioned that cats are usually allowed to complete at least one estrus cycle before they are given a contraceptive, but that Sofiya was not allowed to do so. We believe that this did serious damage to her reproductive tract. If her reproductive tract was not fully developed before it was essentially stopped, it had no chance to ever fully develop. Additionally, at the time of the research, the AZA discussed the contraceptive in question, Deslorelin, in a 4.7 mg dose, or a 9.4 mg dose (Saint Louis Zoo, 2003). The fact that Sofiya was given twice the larger dose discussed by the AZA could mean that the contraceptive would last for twice as long as it should. Because data are still being collected about the use of Deslorelin, there is no data to support or disprove the idea that a double dose would double the effective period of the drug, but it is still an important fact to remember, according to veterinarians Joe Smith and Timothy Plunkett.



Regardless, a reproductive tract that could not fully develop surely could not supply Sofiya's body with the hormones she needs to lead a normal lifestyle, including a normal diurnal pattern. The hormone treatments at the Beardsley zoo might have initially contributed to the hormone imbalance as well. There is no way to tell, other than that the first round of therapy seemed unsuccessful. The second round, however, seemed to induce estrus in Sofiya. This led us to the idea that the hormone therapy, at least the second time, was helping to restore Sofiya's hormone balance.

Currently, we believe that Sofiya's strange behavior was caused by a hormonal imbalance. We do not know specifically what aspects of the imbalance led to the behavior, but the importance of Sofiya's hormonal and reproductive health cannot be overstated, both in terms of her behavior and her potential to be part of the SSP. The hormone therapies started at Connecticut's Beardsley Zoo seem to be a step in the right direction. AZA recommendations for how much Deslorelin is necessary to administer for a certain amount of time of contraception can vary by species, and so reversal recommendations can vary by species. Clearly, incredibly careful attention needs to be paid to Sofiya, and her reproductive health needs to be monitored closely. It is our hope that hormone therapies will continue to be successful and allow Sofiya to enter estrus of her own accord, not just via chemical induction.

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### Veterinary Contacts:

Dr. Joe Smith, Fort Wayne Children's Zoo

Dr. Timothy J. Plunkett, Fairfield Veterinary Hospital