

Monitoring the snow leopard population in the Altai Mountains (Chikhachev Ridge, Siberia)

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Abstract

The snow leopard population has been monitored on the Chikhachev Ridge for 10 years since 2011 using camera traps. In 2021, a male was recorded. We recorded several concurrent predatory species, like red fox, Pallas's cat, wolverine, and brown bear, and prey species Altai marmots. The snow leopards performed visual and olfactory marking at their area. We concluded that snow leopards in this trans-boundary mountain area were active at temperatures up to 3 °C in summer period.

Keywords

Snow leopard, Altai mountain country, Chikhachev Ridge, IUCN, population count, camera trap, Altai Reserve

Introduction

The snow leopard (*Panthera uncial* Schreber, 1776) or ounce (Kitchener et al. 2016, 2017; Korablev et al. 2021) is one of the specially protected, rare, and poorly studied large predators, whose numbers are decreasing for various reasons, including a decrease in the food base (Janecka et al. 2018, 2019, 2020; Johnson et al. 2006). Stand-

ing at the top of the food pyramid, the ounce can serve as a kind of indicator of the state of the ecosystem as a whole. To assess the state of the snow leopard population and analyze its distribution, it is necessary to have detailed information about its habitats. In the future, with the help of this information, it is possible to plan new specially protected natural areas. It is important to know and understand the main causes and factors of the reduction of its number and range for the development of methods and ways of preserving the ounce (Wozencraft 2005).

Ounce inhabits mountainous and foothill areas and is widespread in the following countries: Russia, Nepal, Kazakhstan, Uzbekistan, Kyrgyzstan, China, Afghanistan, and Mongolia (Chelyshev 2014; Chelyshev, Gabdullina 2018; Gabdullina, Amanbaev 2019; Gabdullina et al. 2021). In Russia, it lives in the Republic of Altai, Tyva, Khakassia, Buryatia, and Irkutsk region. The snow leopard is listed in the IUCN Red Data Book in all habitat countries (McCarthy et al. 2017). Rarity category: 1 – endangered (Red Data Book of Russia 2023). The patterns of snow leopard behavior and distant habitats do not allow direct observations; however, only indirect observations with camera traps and traces are available to study their life activity.

The influence of abiotic, biotic, and anthropogenic factors does not allow the snow leopard population to increase on the territory of the Russian Federation, in particular, in the Altai Republic. In this regard, there is an urgent need to monitor the species number, study the habitat and trophic relationships in the area of the Chikhachev Ridge.

The purpose of the study was to monitor the snow leopard population on the Chikhachev Ridge by analyzing photo and video from camera traps, including the number of food competitors, spatial distribution, stability of trails, and frequency of use.

Materials and methods

The twelfth volunteer expedition "Tracing the snow leopard" from June 4 to June 13, 2021 was conducted under the guidance of S.V. Spitsyn, a senior researcher at the Altai Biosphere Reserve. The purpose of the expedition was to install a network of camera traps on the Chikhachev Ridge and to take the previous material from them. The material was collected from 13 previously installed camera traps. Of all collected material, 12 photo frames and 6 video clips were obtained. The cameras recorded snow leopard, Pallas's cat *Otocolobus manul* (Pallas, 1776), wolverine *Gulo gulo* (Linnaeus, 1758), red fox *Vulpes vulpes* (Linnaeus, 1758), Altai marmot *Marmota baibacina* Kastschenko, 1899, and little owl *Athene noctua* (Scopoli, 1769). Photo and video recording was carried out with Seelock and Reconyx cameras of different models located along the boundaries of territorial areas of the snow leopards (Spitsyn 2021, 2023).

Result

A snow leopard named Khorgai was recorded on the Chikhachev Ridge. He is 13 years old (Fig. 1).

In the shot from June 17, the male *Khorgay* is making urinary marks. Animals usually make urinary marks on the boundaries of their area to demonstrate their right on this territory). Urinary marks are one of the varieties of olfactory markings of the territory. The peculiarity of olfactory marks is that they need to be renewed; otherwise, the odor escapes and they lose their informative value. That is why it is so important to place camera traps exactly on the border of the territory of animals, because it is there that the probability of meeting them will be maximized. On the video, which was made on the same day as the previous photos, but from a different trap, it can be seen that before applying the urine mark, a male snow leopard made a mark with the secretion of the cheek gland. Below is the picture of ounce nocturnal activity (Fig. 2), where it sniffed some scent.



Figure 1. Snow leopard (17 June 2021, Chikhachev Ridge, Altai Biosphere Reserve).

Ounce patrols their area several times a day and marks it with cheek glands (rubbing the vertical objects), interfinger glands (scraping the ground with their hind paws), tree scrapes (clawing trees with their front paws), urine and fecal marks. In a video from August 13, 2021, a male *Horgai* first sniffed olfactory marks left by other animals and then interspersed them, using the cheek gland and spraying urine.

In addition to the snow leopard, other vertebrate species were recorded by the cameras (Fig. 3). The following species were recorded in the area where the camera traps were installed: little owl, red fox, and Altai marmot (1 recording each), wolverine and snow leopard (2 recordings each), Pallas's cat (3 recordings).



Figure 2. The nocturnal photo of the snow leopard (August 13, 2021, Chikhachev Ridge, Altai Biosphere Reserve).

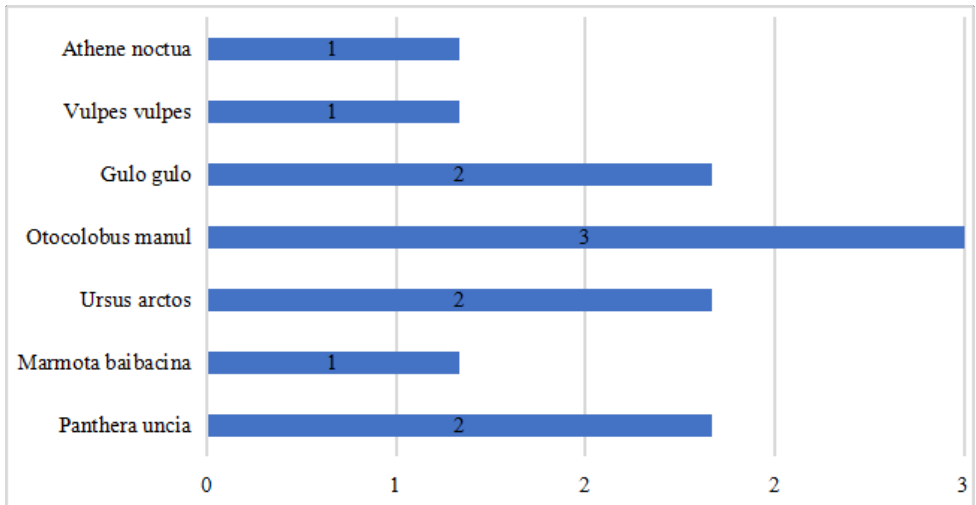


Figure 3. Composition of vertebrates on the Chikhachev Ridge recorded during June–July 2021. The abscissa axis is the number of photo/video recordings of this species.

After processing the photo and video material, only 30% of the data was analyzed, because 70% of the data were taken under strong wind gusts and direct sunlight (Table 1).

Table 1. Patterns of animal behavior (camera trap data from June–August 2021)

Species	Date	Time	Air temperature, °C	Fixation	Behavior pattern/camera-trap evidence	Camera
Snow leopard	17.06	5:53:31	3	Photo	Sniffs scrape/tail and left side of body visible	Reconyx
Snow leopard	17.06	5:53:32	3	Photo	Approaches a scent marking stone/tail and back visible	Reconyx
Snow leopard	17.06	5:53:33	3	Photo	Approaches a scent marking stone/tail and back visible	Reconyx
Snow leopard	17.06	5:53:34	3	Photo	Marks cheek gland/tail and back visible	Reconyx
Snow leopard	17.06	5:53:36	3	Photo	Sprays urine/tail and right side of body visible	Reconyx
Snow leopard	17.06	5:53:37	3	Photo	Moves away from scent marking stone/tail and right side of body visible	Reconyx
Snow leopard	17.06	5:50:17–5:50:32	3	Video	Approaches a scent-marking stone, sniffs it, protrudes with cheek gland, and sprays urine, then moves away	Reconyx
Altai marmot	01.07	12:06:14–12:06:45	16	Video	Lies on the grass, stretching his legs forward and throwing his head back, then moves away/the left side of his body is visible	Reconyx
Snow leopard	13.08	5:55:02–5:55:46	3–4	Video	Approaches the marking stone, sniffs it, registers the other animal marks and stirs them up, with cheek gland secretion and spray urination, then walks away	Reconyx
Snow leopard	13.08	4:55:49	2	Photo	Sniffs scrape/tail and left side of body visible	Seelock

According to the camera trap material the snow leopard was most active in the morning from 4 to 6 am at 2–4 °C. A total of three tags were taken: 17.06.2021 – 5:53; 13.08.2021 at 4:55 and 5:55. No snow leopard images were recorded in July, probably due to high temperatures in camera trap locality: on 1.07.2021 at 12:06 pm it was 16 °C and on 5.07.2021 at 3:55 pm it was 7 °C, that is, from 4 to 6 am the average July temperature was 7–12 °C.

Horgai is a dominant male and has lived on the Chikhachev Ridge for a long time, so there is no need for frequent marking of the territory. Additionally, other snow leopards were not observed in the area during the study period. Other mammals were active at higher temperatures (7–18 °C). There was one photo taken after sunset, a snow leopard, which means that it was active both during the day and night, unlike the Altai marmot, which was active only during the day.

This territory is transboundary and snow leopards live in Russia only in winter when there are herds of argali, while in summer they return here to mark their territory, whereas marmots, gophers and snowcocks are active and numerous. In spring and fall periods, snow leopards move to Mongolia and probably breed there. According to our data, that was the year 2021, which was the most unproductive for 10 years (we registered only one individual on the Chikhachev Ridge). However, the number was reduced to five individuals in 2016, while in 2020 it was eight individuals (Spitsyn 2021).

The Chikhachev Range is home to one of the key transboundary snow leopard populations in the Russian Federation. The Chikhachev Ridge is home to one of the key transboundary snow leopard populations in the Russian Federation. Since 2011, this area has been monitored using the camera trap method synchronously by several participants from different locations. Since 2011, this area has been monitored using the camera trap method synchronously by several participants on different sides of the ridge and the state border. The Altai Reserve (Altai Republic) – on the western macro-slope, the Altai Reserve (Altai Republic) – on the western macro-slope, the Altai Reserve (Altai Republic) – on the western macro-slope, the Ubsunur Basin Reserve (Republic of Tyva) and the Sailugem National Park (Silkhem cluster "B", Mongolia) – on the eastern macro-slope of the ridge (Spitsyn 2021, 2023)

The snow leopard actively used methods of territory marking the territory, such as olfactory and visual, as in its area there are some concurrent predator species, such as the Pallas cat, the wolverine, and the red fox. During the summer period, we recorded one prey species, the Altai marmot. The snow leopard is active in the transboundary area in summer at temperatures up to 3 °C.

There is a definite irregular fluctuation in snow leopard numbers: in 2016 – 5 individuals, in 2020 – 8 individuals, and in 2021 - 1 individual.

References

- Davis BW, Li G, Murphy WJ (2010) Supermatrix and species tree methods resolve phylogenetic relationships within the big cats, *Panthera* (Carnivora: Felidae). *Molecular Phylogenetics and Evolution* 56 (1): 64–76. <https://doi.org/10.1016/j.ympev.2010.01.036>
- Chelyshev AN (2014) New record of snow leopard in Katon-Karagay National Park. Selevinia. *Zoological yearbook of Kazakhstan and Central Asia* 22: 198. [In Russian]
- Chelyshev AN, Gabdullina AU (2018) History of the study of snow leopard (*Panthera uncia*) in Katon-Karagai National Park (Kazakhstan Altai). In: Specially protected natural areas of Belarus: collection of scientific articles 13. Belarusian Press House, Minsk, 108–114 p. [In Russian]
- Gabdullina A, Amanbaev Z (2019) Occurrence of snow leopard *Panthera uncia* (Schreber, 1775) in the territory of the Katon-Karagai National Park (South-West Altai, East Kazakhstan). *Acta Biologica Sibirica* 5 (2): 33–34. <http://dx.doi.org/10.14258/abs.v5.i2.5929>
- Gabdullina A, Amanbaev ZhB, Kasymov ET (2021) New data on the location of the snow leopard *Panthera uncia* (Schreber, 1775) and the stone marten *Martes foina* (Erxleben, 1777) in the Katon-Karagai State National Natural Park (Kazakhstan Altai). *Acta Biologica Sibirica* 7: 142–148. <https://doi.org/10.3897/abs.7.e69228>
- Janecka JE, Zhang Y, Li D, Munkhtsog B, Bayaraa M, Galsandorj N, Wangchuk TR, Karmacharya D, Li J, Lu Zh, Zhumabai Uulu K, Gaur A, Kumar S, Kumar K, Hussain Sh, Muhammad G, Jevit M, Hacker Ch, Burger P, Wultsch C, Janecka MJ, Helgen K, Murphy WJ, Jackson R (2017) Range-Wide Snow Leopard Phylogeography Supports Three Subspecies. *Journal of Heredity* 108 (6): 597–607. <https://doi.org/10.1093/jhered/esx044>
- Janecka JE, Janecka MJ, Helgen KM, Murphy WJ (2018) The validity of three snow leopard subspecies: response to Senn et al. *Heredity* 120 (6): 586–590. <https://doi.org/10.1038/s41437-018-0052-7>
- Janecka JE, Hacker C, Broderick J, Pulugulla S, Auron P, Ringling M, Nelson B, Munkhtsog B, Hussain S, Davis B, Jackson R (2020) Noninvasive genetics and genomics shed light on the status, phylogeography, and evolution of the elusive Snow Leopard. In: Ortega J, Maldonado JE (Eds) *Conservation Genetics in Mammals. Integrative Research Using Novel Approaches*. Springer International Publishing, Basel, 83–120. https://doi.org/10.1007/978-3-030-33334-8_5
- Johnson WE, Eizirik E, Pecon-Slattery J, Murphy WJ, Antunes A, Teeling E, O'Brien SJ (2006) The late Miocene radiation of modern Felidae: a genetic assessment. *Science* 311 (5757): 73–77. <https://doi.org/10.1126/science.1122277>
- Kitchener AC, Driscoll CA, Yamaguchi N (2016) What is a Snow Leopard? Taxonomy, Morphology, and Phylogeny. In: McCarthy T, Mallon D (Eds) *Snow Leopards*. Academic Press, Amsterdam, Boston, Heidelberg, London, New York, 3–11.
- Kitchener AC, Breitenmoser-Würsten C, Eizirik E, Gentry A, Werdelin L, Wilting A, Yamaguchi N, Abramov AV, Christiansen P, Driscoll CA, Duckworth W, Johnson W, Luo SJ, Meijaard E, O'Donoghue P, Sanderson J, Seymour K, Bruford MW, Groves C, Hoffmann M, Nowell K, Timmons Z, Tobe SS (2017) A revised taxonomy of the Felidae: The final

- report of the Cat Classification Task Force of the IUCN Cat Specialist Group. *Cat News* (Special Issue 11): 69.
- Korablev M, Poyarkov AD, Karnaukhov AS, Zvychnaynaya EY, Kuksin AN, Malykh SV, Istomov SV, Spitsyn SV, Aleksandrov DYu, Hernandez-Blanco JA, Munkhtsog B, Munkhtogtokh O, Putintsev NI, Vereshchagin AS, Becmurody A, Afzunov Sh, Rozhnov VV (2021) Large-scale and fine-grain population structure and genetic diversity of snow leopards (*Panthera uncia* Schreber, 1776) from the northern and western parts of the range with an emphasis on the Russian population. *Conservation Genetics* 22 (3): 397–410. <https://doi.org/10.1007/s10592-021-01347-0>
- McCarthy T, Mallon D, Jackson R, Zahler P, McCarthy K (2017) *Panthera uncia*. IUCN Red List of Threatened Species: e.T22732A50664030. <https://doi.org/10.2305/IUCN.UK.2017-2.RLTS.T22732A50664030.en>
- Red Data Book of Russia. Snow leopard *Uncia uncia*. Available from: <https://redbookrf.ru/snezhnyy-bars-uncia-uncia/> (accessed on 01.08.2023)
- Senn H, Murray-Dickson G, Kitchener AC, Riordan P, Mallon D (2018) Response to Janecka et al. 2017. *Heredity* 120 (6): 581–585. <https://doi.org/10.1038/s41437-017-0015-4>
- Spitsyn SV (2021) Results of the monitoring of the cross-border grouping snow leopard population on the Altai side of the Chikhachev Ridge by the method of photo traps in 2020. *Field studies in the Altaisky Biosphere Reserve* 3: 197–216. https://doi.org/10.52245/26867109_2021_12_3_197
- Spitsyn SV (2023) Results of the transboundary snow leopard monitoring in Altai side of the Chikhachev Ridge using camera trapping in 2021–2023. *Field studies in the Altaisky Biosphere Reserve* 5: 33–57. https://doi.org/10.52245/26867109_2023_5_33
- Wozencraft WC (2005) Species *Uncia uncia*. In: Wilson DE, Reeder DM (Eds) *Mammal Species of the World: A Taxonomic and Geographic Reference* (3rd ed.). Johns Hopkins University Press, 548 p.