



**Kolmården Djurpark
Snow Leopard Trust Final Report
May 2018**

In November 2017, Kolmården Djurpark generously provided \$5,000 to the population-monitoring component of the Snow Leopard Trust’s project, *Long-Term Ecological Study of the Endangered Snow Leopard* in Mongolia’s South Gobi Province. We are sincerely grateful to Kolmården Djurpark for being a dedicated supporter of our ground-breaking study, and we are pleased to provide you with a final report of our project’s accomplishments over the past year.

Summary

The snow leopard (*Panthera uncia*) is a magnificent flagship species for the spectacular mountain ranges of Central Asia. The best estimate of global snow leopard population is 3,920-6,390 individuals (Snow Leopard Survival Strategy 2014). Snow leopards are likely declining across most of their range and the threats continue to increase. Their cryptic nature, remote habitat, and low densities make snow leopards very difficult to monitor and survey.

Threats to snow leopards include persecution by herders due to livestock depredation, habitat degradation and fragmentation, poaching for trade in pelts and bones, and loss of wild prey. In addition, unsustainable and poorly planned development—primarily mining—is a critical threat to snow leopards in delicate regions of the cat’s range.



*Mother and two grown cubs, with a third cub out of view.
Tost Nature Reserve, South Gobi, Mongolia. October 2017.*

In 2008, the Trust launched a long-term study of snow leopards in the Tost Mountains of South Gobi, the objective of which is to address critical gaps in knowledge of snow leopard ecology ranging from spatial and tropic ecology to basic population parameters. Through the study we also strive to better understand relationships between wildlife, livestock and humans. In 2013, to engender greater understanding of wildlife ecology among children, we added an educational component by providing summer “eco-camps” for local children at our permanent study site in the heart of the Tost Mountains.

The long-term study, now in its 10th year, is the longest-ever study of wild snow leopards. While the study is centered in a 1,700 km² area of the Tost Mountains, thanks to the Kolmården Djurpark, it has been able to expand outwards and last year surveys covered a total of 8,000 km², including neighboring mountains.

Through this long-term study, Kolmården Djurpark has helped the scientific world gain a prolific amount of ground-breaking data on the lives of snow leopards, including male and female home range sizes, snow leopard diets, and juvenile dispersal. These data have been invaluable for informing and improving efforts to conserve the majestic snow leopard and its habitat.

Information from the study supported grassroots advocacy by Tost herder communities, Snow Leopard Trust, and its partners to make the Tost Mountains into a federally-protected Nature Reserve in 2016. The reserve, which is 7,400 km² in size, is the first reserve in Mongolia specifically designated to protect snow leopards. Named the “Tost Nature Reserve” (that includes Tost and neighboring Tosonbumba Mountains), it serves as a connective corridor between two adjacent protected areas: Gobi-Gurvansaikhan National Park and Great Gobi Strictly Protected Area (please see related map on page 5). With Nature Reserve status for Tost, mining, hunting and construction are prohibited, while local communities can continue their traditional herding practices in a sustainable manner. This incredible success story would not have been possible without Kolmården Djurpark, and we give you our most heartfelt thanks.

The study data you are helping to collect is also supporting the Global Snow Leopard and Ecosystem Protection Program (GSLEP, <http://www.globalsnowleopard.org>). Under GSLEP, the Mongolian government has endorsed 82,000 km² of South Gobi (including the Tost Nature Reserve) as one of three priority landscapes to focus conservation efforts.

2017 highlights of our long-term study:

- In April, three snow leopards were successfully GPS-collared in the Tost Nature Reserve: two males and one female. The female was pregnant and gave birth to two cubs in July; a rare den visit enabled us to collect vital data on the young cubs.
- In October, Trust scientists were able to recollar a female snow leopard called *Dagina*. We have followed her via camera trapping since she was a cub in 2009, and first collared her in 2012—making her the longest-studied cat in the program.
- Six camera trap surveys were completed covering 8,000 km², including a new area called Small Gobi A Strictly Protected Area. From preliminary analysis of the first four surveys, we have identified six individual females with a total of 13 cubs.
- Two wild prey abundance surveys were conducted over areas totaling 2,400 km.²
- We began an ibex study pilot in Tost with the goal to collar ibex, and to track movements of both snow leopards and their primary natural prey.
- Eco-camps were held in June 2017 at our base camp in Tost for 40 children and their teachers.
- Orjan Johansson, who GPS-collared all snow leopards in our study, successfully defended his doctoral thesis entitled “Unveiling the Ghost of the Mountain; Snow Leopard Ecology and Behavior”.

The following is detailed reporting on our project goals for 2017.

Goal 1) Employ satellite GPS collars on up to five snow leopards to advance knowledge about home-range size, movement and activity patterns, travel corridors, hunting behavior, and dispersal.

We are very pleased to report that Orjan Johansson—with support from other snow leopard researchers and veterinarians—was able to GPS collar **four** snow leopards in the Tost Nature Reserve. Three of the four cats are new to our study (two males and a female), and are the 21st, 22nd and 23rd cats to be fitted with GPS collars. They were temporarily called M12, M13 and F10. The fourth snow leopard is *Dagina*, named by Kolmården Djurpark. She was previously collared in 2012, and is known from camera traps since 2009.



Orjan and Swedish veterinarian, Frida Ohrn, monitor Dagina's vital signs during GPS collaring. November 2017.

The GPS collars on the four snow leopards are programmed to drop off approximately 18 months after collaring. The collars relay the cats' positions via satellite every five hours. We use these data to monitor movement patterns and space use, possible migration to other regions, track kill sites (when snow leopards usually stay in one location for several days), and locate den sites of females with newborn cubs.

We were particularly pleased to collar female F10 in April 2017 as we suspected she might be pregnant. Later, in July 2017, from F10's GPS locations and lack of movements, we were confident that she had given birth. Two snow leopard researchers quickly flew to Tost from Sweden and were successful in locating F10's den. They were able to weigh, measure and chip-mark two cubs (one male and female) while F10 was away hunting. With the discovery of an active den in 2017, we have now located a total of four dens with six cubs since our study began. Prior to our long-term study, snow leopard birth rates, den use, sex ratios, and litter sizes were never documented in the wild.

Snow Leopard Trust researchers will compare photographs taken of the three newly-collared snow leopards with our existing database of research camera photographs to examine if we have encountered them before. For example, we may have photographs of the young snow leopard called M13 from when he was still travelling with his mother. This will help us understand if he is a local cat or if he has moved into the Tost area from a different region.

We look forward to following the four collared snow leopards in 2018, and thus far can share some brief information about their lives and movements.

M12. The first male collared in 2017 is about 3-4 years old. From his movements, we observe that he has an established range in the Tost Mountains, occupying an area that is almost identical to the first cat collared as part of our long-term study, called *Aztai*. We were excited to observe that M12 visited the active den of F10 and her two cubs several times, and since he did not harm the cubs, we think he could be the father.

M13. This male cat is a younger than M12 and is about two years old. We assume he has recently dispersed from his mother. He is exploring large areas of the eastern part of the Tost Mountains to—perhaps—establish his own home range.

F10. This female snow leopard is about five years old. F10 gave birth to two cubs two months after she was collared. Later in the year, we set up camera traps where F10 was ranging in the hope of seeing her and her cubs again. Happily, we found images of F10 and her two cubs (November 2017), providing evidence that the cubs had survived the first few months of their lives. We hope to see them again in 2018.

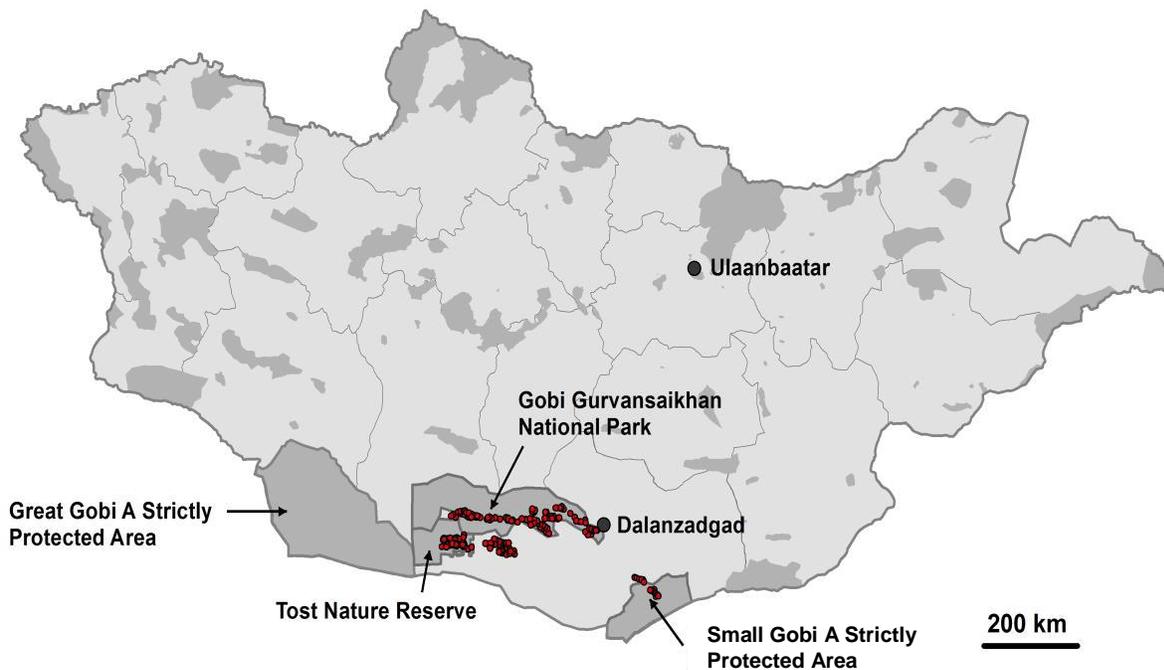
Dagina. The first time we saw Dagina was in 2009 in a camera trap image. She was a small cub that was following her mother, Agnes. In 2012, we were able to put a GPS collar on Dagina for the first time. While we were able to follow her movements, Dagina gave birth to a cub. Now we'll get another glimpse into her life—this time as an eight-year-old cat. **Dagina has the honor of being the longest-studied wild snow leopard ever.** We know she's capable of breeding, and by tracking her movements in 2018, we will be able to observe if she gives birth to cubs again.

Goal 2) Complete at least five camera trap surveys in Tost and neighboring mountains to gather data related to snow leopard population dynamics such as survival, mortality, and migration.

Camera trapping is important to establish population baselines, monitor health and abundance of snow leopard populations over time, and understand snow leopard migration and population connectivity.

We have been conducting annual camera trap surveys in 1,700 km² of Tost since 2009. The first five years of camera data show that the area has a stable adult population of 12-14 snow leopards, and that fewer than 50% of young individuals remain in the study area for more than one to two years before migrating to neighboring mountain ranges, or even further (Sharma et al., 2014). Beginning in 2013, we expanded our camera survey to the mountains surrounding Tost.

In 2017, we completed six camera trap surveys totaling 8,000 km². These include one in the Tost Nature Reserve, three surveys in the neighboring mountains of Gobi-Gurvansaikhan National Park (Nemegt, Gurvansaikhan and Zoloon), one in Noyon, an unprotected area east of Tost, and a new area called the Khorkh Mountains—located in Small Gobi A Strictly Protected Area. Three of the protected areas where we are conducting camera surveys are labelled on the map below (as well as Great Gobi A Strictly Protected Area.)



We have been able to expand our camera trap surveys beyond Tost, thanks to the invaluable help of community rangers, and park rangers and personnel from Gobi-Gurvansaikhan National Park, who have been trained to conduct the surveys.

Thus far, we have begun to analyze 2017 camera images from the three Gobi-Gurvansaikhan regions and Tost. Images from Noyon and Small Gobi A Strictly Protected Area will be available later in 2018. Our Mongolia team is currently going through the very time-consuming work of identifying the individual snow leopards from the 2017 camera trap images, where all images will be compared against each other, and against cats from previous years. This research is also the focus of Mongolian student Tengis Baatbaatar, who recently began his Masters degree on abundance and movements of snow leopards in the Tost, Noyon and Nemegt Mountains. His work will be important for learning about factors that affect the abundance of snow leopards in these mountains and how cats move between mountain ranges. We will share Tengis's findings with you as they become available.

At this time, we can report that from preliminary analysis of the available 2017 camera images, we have identified six individual snow leopard females with a total of 13 cubs, including F10 and two females with three cubs each. We are delighted to see that seven of the 13 cubs were photographed in the newly-protected Tost Nature Reserve. A mom with cubs are featured in a rare sequence of photographs available as a short video on Snow Leopard Trust blog: <https://www.snowleopard.org/rare-footage-snow-leopard-family-four/>.

Goal 3) Continue to engage and train rangers to help increase capacity for camera trapping and wild prey surveys.

Camera trapping: As noted above, rangers made it possible for us to survey 8,000 km² of important snow leopard habitat in South Gobi last year. We wanted rangers to be able to conduct camera trap surveys on their own in 2017, and thanks to partners like you, they did!

In fall 2016, our field researchers held a review workshop for rangers in preparation for 2017 camera trapping. They were confident that the rangers had acquired the necessary skills to complete camera surveys independently. A camera trapping schedule was worked out and funds were provided to support rangers' fieldwork. The cameras were rotated through the regions and remained in each surveyed area for about two months. Much of the camera trapping in 2017 was, indeed, carried out independently by the rangers, making it possible for us to survey even more snow leopard habitat, and begin surveying Small Gobi A Strictly Protected area, which is of high value for snow leopard research.

Wild prey surveys. In fall 2017, our field researchers held a refresher training in double observer survey principles and GPS usage, in preparation for wild surveys in Tost and Noyon.

A total of 17 rangers attended the refresher trainings in Tost and Noyon in 2017. The training involved: how to walk double observer transects, how to classify wild prey by age and sex, and how to register wild prey locations with a handheld GPS device. Results of the wild prey surveys are summarized below.

Goal 4) Conduct at least one prey abundance survey in the Tost Mountains of South Gobi to continue monitoring population trends of snow leopard natural prey (ibex and argali).

Since 2012, we have conducted prey surveys in the Tost Mountains to estimate the abundance of ibex (*Capra siberica*) and argali (*Ovis ammon*), two important snow leopard prey species in Mongolia. The availability of these wild prey is a major determinant of snow leopard abundance. Ibex are significantly more abundant than argali in South Gobi.

In 2016, we also began to survey nearby mountains in Noyon region. Surveys were conducted in November during the breeding season when wild prey tend to be easier to detect than during other times of the year.

With the collaboration of Tost rangers and personnel from Gobi-Gurvansaikhan National Park (for Noyon), we successfully completed the surveys in Tost and Noyon in November 2017.

Results:

- 1) Ibex. The estimated number of ibex counted in the Tost Mountains in 2017 was 1150 ± 250 and was similar to the number of ibex counted in 2012-2014 (800-1000), but greater than the number of ibex in Tost in 2016 (650). In Noyon, the number of ibex counted was 1540 ± 265 , compared to 1240 in 2016.
- 2) Argali: The estimated numbers of argali in 2017 were 150 ± 100 , and 240 ± 150 for Tost and Noyon respectively. These numbers are similar to numbers of argali in previous years.

What these results show to date is that we appear to have a relatively stable and healthy population of wild prey to support the snow leopard populations in Tost and Noyon (estimated at 14 cats in

each area). Keeping these systems in balance is therefore imperative, as even a small variation in wild prey over prolonged periods could start to reduce snow leopard populations.

Goal 5) Launch research on ibex ecology to help ensure the survival and population recovery of this primary snow leopard prey species.

A core problem towards saving snow leopards is the urgent need to guarantee population recovery, maintenance and ongoing health of wild prey, primarily ibex. A barrier towards this problem is a lack of understanding of wild prey ecology, habitat use and distribution patterns necessary for their conservation. Our goal is to expand our long-term snow leopard study in Mongolia to include an ibex collaring study, which will be the first time ever that snow leopards and their primary prey are collared simultaneously.

In October 2016, we made a study visit to an ibex project in Gran Paradiso National Park, Italy. Researchers have captured over 1,000 ibex, and their ibex studies are probably considered the most successful in the world. Our aim was (and still is) to develop safe capture and handling techniques. The team in Gran Paradiso recommended we use box-traps and free-darting as our main capture techniques as they have found them to be safer and more efficient than other methods (e.g. catching with nets). We were also recommended to use salt as the attractant in the traps, which has attracted ibex also in the Himalayas (and other wild ungulates in the Rocky Mountains).



A box-trap that the Trust set up to capture ibex for our new ibex collaring study.

In November 2016, we deployed salt licks at multiple places in Tost to test salt as an attractant to lure ibex to our capture sites, and in May 2017 we built two large box traps baited with salt and attempted captures. Unfortunately, we did not capture any ibex as it seems that salt does not work as an attractant for ibex in the Tost Mountains, despite being a very efficient attractant for ibex in both the Himalayas and the Alps. We suspect that this depends on there being a lot of naturally occurring salts in the soils in Tost. We therefore resorted to other lures (water and carrots) but the effectiveness of these attractants is still inconclusive.

In November 2017, we planned to free-dart ibex when they congregated at waterholes. However, the early arrival of winter prevented this effort as the ibex got their water from snow, instead of visiting the waterholes.

We will return to the Tost Mountains in April 2018 and continue to develop box traps and free capture techniques. If these techniques do not work in our study site, the experts at Gran Paradiso have alternate recommendations, such as ‘up-nets’ (nets placed on the ground that can rise up to capture animals as they pass over), which we will consider and discuss when the time comes.

Ultimately, we hope to GPS collar up to 10 ibex on an annual basis.

Goal 6) Continue our snow leopard disease study to determine the extent of exposure that South Gobi snow leopards have to common feline pathogens, as well as exposure to potential spillover pathogens from sympatric and domestic carnivores, and wild prey.

A disease study was initiated in 2013 as a response to the death of four snow leopards in Tost from unknown causes. Since there is no established baseline of endemic diseases in the Tost snow leopard population, there is no way to know whether this occurrence was a natural part of snow leopard ecology or due to an emergent disease, and a potential threat to the future of the population.

Our main objective is to analyze blood and scat samples from snow leopards and associated wildlife and domestic animals. We have collected samples from 21 snow leopards, as well as hundreds of samples from goats, rodents, dogs, fleas and ticks. This work forms a PhD thesis by Carol Essen (School of Public Health, Medicine and Veterinary Science, James Cook University, Australia).

Results of the disease study have been collated and numerous pathogens appear to be crossing several species. Snow leopards tested positive to previous exposure to *Coxiella burnetii*, the causative organism of Q fever, *Toxoplasma* and *Leptospira*—which are all serious zoonotic pathogens—although the cats’ health does not appear to be adversely affected at this stage. These pathogens were also present in rodents, goats and dogs.

Ms. Essen is working to complete her PhD thesis on disease ecology of the Tost ecosystem and plans to publish multiple papers based on the disease study. The first published paper (Esson, et al., 2017) from the disease study shows that one of the rodents encountered in the Tost Mountains (the Kam dwarf hamster) is a rodent that was known to occur only in an isolated area of China. We think that this is a good illustration on how genetic tools are very useful when studying rare and elusive species, and species that generally do not attain public or scientific interest. It is also a new species for Mongolia and is good evidence of the importance of the Tost Nature Reserve not only for snow leopards and their wild prey, but also for various small mammals.

Goal 7) Hold two, five-day “eco-camps” at our long-term study site for at least 40 children and their teachers from local schools.

In June 2017, we held two five-day camps for a total of 40 students (aged 12-13) and their teachers at our long-term study base camp. We were delighted to welcome two teachers and 10 students from a school in Sevrei, a small community bordering Gobi-Gurvansaikhan National Park, and a



Eco-camp participants awed by the sight of an ibex herd on the hills above them.

region new to our community-based conservation programs. We invited the children to explore the natural world around them through hands-on experiential learning, including games, role-play exercises, and quiet time when children tune into nature.

This year, activities included biodiversity and its importance in maintaining the balance of nature; the lives of snow leopards, how well they are adapted to their harsh environment, and threats to their survival; journal writing on perceptions of nature using the five senses; hiking to areas of prime snow leopard habitat; and making informative posters on what the children had learned.

At the end of the camps, children were awarded “eco-kids” certificates, an honor that empowers them to become conservation awareness messengers within their communities. The teachers from Sevrei were thrilled with the “eco-camp” experience. One said she was so excited to use the eco-camp curriculum to teach conservation to children at the Sevrei school.

Recent and cited publications

- 1) Orjan Johansson (2017). Unveiling the Ghost of the Mountain; Snow Leopard Ecology and Behaviour. Doctoral Thesis, Swedish University of Agricultural Sciences.
- 2) Esson, C., Michaux J., Johansson O., Malmsten J., Lkhagvajav P. and Samelius, G. (2017). The importance of genetic tools when studying the distribution of rare and elusive species illustrated by the Kam dwarf hamster. *Global Ecology and Conservation* 12: 166-169.
- 3) Johansson O., Rauset G.R., Samelius G., McCarthy T., Andren H., Tumursukh L., and C Mishra (2016). Land sharing is essential for snow leopard conservation. *Biological Conservation* 203, 1-7.
- 4) Johansson O., McCarthy T., Samelius G., Andrén H., Tumursukh L. and Mishra C. (2015). Snow leopard predation in a livestock dominated landscape in Mongolia. *Biological Conservation* 184: 251-258
- 5) Sharma K., Bayrakcismith R., Tumursukh L., Johansson O., Sevger P. (2014). Vigorous dynamics Underlie a Stable Population of the Endangered Snow Leopard (*Panthera uncia*) in Tost Mountains, South Gobi, Mongolia. *PLOS ONE* 9 (7): e101319.

Conclusion

The Snow Leopard Trust gives its sincere thanks to Kolmården Djurpark and we are pleased to continue this fruitful partnership. Thank you for helping us to advance the understanding of snow leopards necessary for their continued survival in the wild. If you have any questions or concerns about the project, please contact Marissa Niranjana, Director of Zoo Programs at 206-632-2421, or marissa@snowleopard.org.

Photographs for this report courtesy of Snow Leopard Trust and Snow Leopard Conservation Foundation, Mongolia.