

observations on the breeding, management and physiology of Snow leopards

Panthera u. uncia

at Kaunas Zoo from 1962 to 1967

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For five years the Irbis leopard or Snow leopard *Panthera u. uncia* has been breeding at Kaunas Zoo. The whole question of reproduction of Snow leopards in captivity needs urgent consideration since the breeding record of the species in captivity is very poor. According to the *Yearbook* records in 1967 33 zoos exhibited 64 Snow leopards, of which only 15 had been born in captivity (see p. 364). Moreover, since the *Yearbook* records were started in 1960, only 11 zoos have succeeded in breeding the species.

As both practical experience and a series of statistical data show, Snow leopards do not adjust easily to captivity. They frequently suffer from endo-parasites and are very susceptible to pneumonia, tuberculosis (Petsch, 1966) and feline enteritis. They also become easily disturbed by the shock of transport to a zoo. We have had cases of Snow leopards that have refused to eat or drink for eight days, following their arrival at the zoo, and that can only be persuaded to eat if they are provided with live food. If they are obtained as the result of being trapped, they usually have suffered a severe injury (severed paws or toes) and the trauma of this makes it difficult for them to adjust to captivity. A further hazard is that Snow leopards do not do well in low altitude zoos. The longevity record is generally very poor and they seldom live for more than 1½ or 2 years in captivity. It has also been noted (Marma, 1962) that Snow leopards often suffer from ascites. This is apparently related to the difficulty a mountain animal has in adjusting to changes in altitude, humidity, diurnal temperature, atmospheric pressure and solar radiation.

Undoubtedly these external factors are also reflected in the functioning of the circulation of the blood. Carnivorous species are distinguished by an unusual degree of adaptation to carrying out very diverse and intensive muscular activity, such as the ability to make very long leaps (the leap of a Snow leopard is from 10 to 15 m). According to Slonim (1962) the Snow leopard has a very highly developed mechanism for distributing the blood, regulating the breathing, changing the respiratory function of the blood, and guaranteeing a very intensive and differential transfer of oxygen. It is usual for felid

INDEX	SPECIES OF CARNIVORE		
	<i>Panthera leo</i> (b. Kaliningrad)	<i>Panthera uncia</i> <i>uncia</i> (b. Kaunas)	<i>Panthera tigris</i> <i>sumatrae</i>
Age in Years	6	3	16
Quantity of Leucocytes 1000 per 1 mm ³ blood	14.2	18.4	5.2
Granulocytes			
Eosinophiles %	3	3	1
Basophiles %	1	—	—
Myelocytes %	—	—	—
Neutrophiles			
Young %	1	—	—
Rod-shaped %	13	12	8
Segmented %	61	69	80
Lymphocytes %	18	12	8
Monocytes %	3	4	3
Hb %	72.1	94.5	90.2
Quantity of Haemoglobin per Erythrocyte (micro micro g)	19.1	10.2	16.3
Concentration % of Haemoglobin in Erythrocytes	22.6	34.0	30.7
Volume of one Erythrocyte μ^3	69.4-103.0	30.0	53.0

Table 1. Certain mean comparative haematological indices for large carnivores in Kaunas Zoo.

species to be very sensitive to changes in oxygen supply, and the Snow leopard is particularly remarkable in this respect.

The picture of the Snow leopard's blood agrees, according to the data of Marma (1965), with the blood indices of African lions *Panthera leo*, tigers *Panthera tigris* and Caracal lynxes *Felis caracal*, having the characteristics of mountain mammals (i.e. small diameter red corpuscles (4.73–6.15 μ), averaging 5.5 microns, and a high concentration of haemoglobin (16.4 g per cent)). No less important is the haematocrit index (i.e. the relative volume of red corpuscles (47 per cent)), corresponding to the large number of red corpuscles (14.1–16.8 million/mm³) in the blood (Marma, 1965).

The leucocyte formula of the Snow leopards in Kaunas Zoo accords with the mean data for African lions (see Table 1) and does not go outside the fluctuations shown by Christoph (1960).

The blood data presented by us were collected from clinically healthy Snow leopards. The haematological indices confirm the impression that the Snow leopards living in Kaunas Zoo are clinically healthy. Moreover, they have good longevity records and have lived in captivity for an average of seven to eight years (see Table 2).

NO.	NAME	SEX	YEAR OF BIRTH	DATE OF ARRIVAL IN ZOO	WHERE OBTAINED	LONGEVITY IN ZOO (IN YEARS)
1.	Printse	♀	1953	24.6.1955	Pamir-Tianshan	11
2.	Ruta	♀	1957	23.5.1959	Pamir-Tianshan	8
3.	Ramuna	♀	1959	24.9.1960	Pamir-Tianshan	7
4.	Amuras	♂	1957	17.12.1961	Pamir-Tianshan	6
5.	Snaige	♀	1962	21.6.1962	b. Kaunas Zoo	5

Table 2. Basic breeding stock of Snow leopards *Panthera u. uncia* at Kaunas Zoo.

The Snow leopards are kept in small enclosures and both indoors and outdoors are provided with a number of wooden shelves on which they can lie. The enclosures are provided with aspen logs on which the leopards can sharpen their claws. Although the leopards are only given prophylactic worm treatment in the spring and autumn, they rarely become infested with ascarids.

The Snow leopards are fed on fresh horse meat, alternating with beef. They are each given 3 kg daily. In addition they are each given 20 g of oat shoots, 10 g of fish oil (or 3 drops

of vitamin A concentrate daily for four days of each week), and 10 g of yeast. Three times a week they are given a live rabbit, duck or chicken. The cages and the leopards are regularly irradiated with a quartz lamp, starting with one minute, and increasing by a minute daily. After a 20 minute session a two-day pause is made. We have never found it necessary to give the Snow leopards such food as goat, goat's milk, or diluted sheep's milk, as recommended by Krumbiegel (1965).

We started breeding Snow leopards in 1962, having obtained a male for the three females in December 1961. We placed the male and females in adjoining cages. After seven days the male was let into the females' cage. After four days he chose the female 'Ramuna' and on 16 March 1962 they mated. He paid no attention to the other females. At first we believed that the male Snow leopard would mate with only one female in a mating season. The mating season for all the females was generally in accordance with the data in the literature (Bobrinskii *et al.* 1965) i.e. at the end of the winter. However, in 1967 the male leopard surprised us by mating with two females in the course of one week: with 'Ramuna' on 13 January 1967 and with 'Ruta' on 18 January 1967. As the result 'Ramuna' gave birth on 22 April 1967 to four cubs, and 'Ruta' gave birth on 1 May 1967 to one cub. According to Agiropulov *et al.* (1953) Snow leopards give birth to two to five cubs in the wild.

Oestrus in the females is marked by lack of appetite, increased restlessness and more vocalisation. They usually leave about one third of the food they eat normally. Oestrus lasts about seven days and during this time the male mates about 10 to 20 times a day. The copulatory position is the same as in leopards and tigers. During mating the male makes a characteristic cry.

At the end of oestrus the mated female is separated and put in a neighbouring cage containing a special breeding den. The den measures 130 by 58 by 78 cm, with an entrance measuring 38 by 38 cm. It is made of wood 2 cm thick. The cage itself measures 192 by 186 by 175 cm. There is also an outer enclosure measuring 165 by 200 by 275 cm.

The secluded breeding den provides the pregnant Snow leopard with quiet and a feeling of security. Although during the first month of pregnancy the female usually rests on the shelves fixed to the walls, by the second month she rests only in the breeding den. We consider this den is a very important factor in breeding Snow leopards successfully.

During pregnancy a close watch is kept on the female's behaviour, particularly during the last week. At the end of pregnancy it is important that only one keeper should be in attendance and that the Snow leopard should be accustomed to his behaviour and voice. It is also very important that the Snow leopard should not be disturbed by outside noises or cries. These can have an unfavourable effect, particularly on the day of birth. We had one case of a Snow leopard giving birth when a strange keeper was present. In her nervous state she dragged the new-born young away and killed it. On another occasion a female Snow leopard was disturbed by the cries of sheepdog puppies which happened to be nearby. She aborted during the night and ate the offspring.

The gestation period of Snow leopards born at Kaunas Zoo is between 98 and 103 days (Marma, 1963; Junčys, 1964), which agrees with Andreevskaya's (1964) findings, but diverges from the figure of 90 days given by Bobrinskii *et al.* (1965). As can be seen from Table 3, the time of year of oestrus is not always the same. This is probably an effect of captivity. Alteration of the seasonal sexual cycle in captivity has also been observed in other captive wild animals (e.g. *Capreolus capreolus*, *Cervus nippon*) (Marma, 1962a).

Birth usually lasts two or three hours and in most cases takes place in the morning. The new-born Snow leopards weigh from 300 to 380 g. They are weak at birth and their eyes are closed. Their colouration resembles that of the adult animals. Their first cries sound rather like those of a piglet. The eyes open between the seventh and ninth day. During

NO.	NAMES OF MATED ANIMALS	DURATION OF OESTRUS	DATE OF BIRTH	GESTATION PERIOD IN DAYS	LITTER SIZE AND SEX RATIO	NO. SURVIVING TO MATURITY
1.	Amuras × Ramune	10-16.3.62	21.6.62	98	1,1	2
2.	Amuras × Ramune	27.3-2.4.63	4.6.63	98	1,1	—
3.	Amuras × Ruta	5-9.1.64	15.4.64	98	1,2	2
4.	Amuras × Ruta	5-12.2.65	24.4.65	88	1,1 (aborted)	—
5.	Amuras × Ruta	14-16.1.65	—	—	—	—
6.	Amuras × Ruta	1-10.8.65	—	—	—	—
7.	Amuras × Ruta	14-16.2.66	—	—	—	—
8.	Amuras × Ramune	11-16.4.66	—	—	—	—
9.	Amuras × Ramune	10-15.1.67	22.4.67	98-103	2,2	3
10.	Amuras × Ruta	18-21.1.67	1.5.67	99-103	1,0	—
11.	Amuras × Snaige	7-14.3.67	—	—	—	—
12.	Amuras × Ruta	17-20.5.67	—	—	—	—

Table 3. Oestrus and breeding records of Snow leopards *Panthera u. uncia* at Kaunas Zoo.

the first two weeks the mother protects her young very carefully and it is not until the third week that she sometimes comes out of the breeding den, leaving the young for short periods. By this stage the young try to follow her. When they are picked up by a person they are very aggressive, snarling and scratching.

Out of the 14 Snow leopards born alive at Kaunas Zoo, three had internal deformities. They survived for five to seven days and at post-mortem were discovered to have anomalies in the digestive tracts. One female, 'Snaige', born in 1962, is still alive but has abnormal eyelids which turn inwards and caused inflammation of the mucous membrane of the eye. She was operated on at three months of age, but it proved impossible to save the eyes and she has lost 90 per cent of her vision.

At the age of one month the young Snow leopards have a body weight of from 1 to 1.5 kg. At this stage we start feeding them minced meat (horse meat or poultry), pushing the food into their mouths. At first they are fed one teaspoon of this, but by 40 days of age they are eating two to four teaspoons. From the 50th day they feed themselves, eating up to 200 g of meat daily and by the 56th day three young Snow leopards eat 900 g daily. From the 54th day they start lapping cow milk, although they are still suckling from the mother (they suckle for 7-12 minutes at a time, with short pauses). At 1½ months the Snow leopards weigh from 2.3 to 2.7 kg. Their cry now sounds like 'Tsaoo-Tsaoo'. At the age of two months they frequently accompany the mother into the outdoor enclosure where they suckle from her, despite the presence of zoo visitors. By

NO.	NAME	DATE OF BIRTH	DATE OF INVESTIGATION	BODY WEIGHT IN G	BREATH-ING RATE PER MIN	PULSE RATE PER MIN	TEMPERATURE IN °C		
							BODY	GROUND	AIR
1.	Zhvaigzde ♀	22.4.67	16.6.67	3,000	92	140	37.8	16	18-26
			26.6.67	3,920	80	144	37.7	15	18-20
			31.7.67	6,690	94	140	38.5	16	19-27
2.	Spindulis ♂	22.4.67	16.6.67	2,930	100	150	37.7	16	18-26
			26.6.67	3,790	60	148	37.8	15	18-20
			31.7.67	6,560	100	124	38.3	16	19-27
3.	Uola ♀	22.4.67	16.6.67	2,620	102	180	37.8	16	18-26
			26.6.67	3,420	68	152	37.7	15	18-20
			31.7.67	6,350	88	130	38.4	16	19-27
4.	Adult Snow leopards	summer	summer	35,800	12-80-140 48	90-120	37.5-38.5	16	18-32

Table 4. Some physiological indices of Snow leopards *Panthera u. uncia* at Kaunas Zoo.

two months their weight has reached 4 kg. For further details of weight increases, see Tables 4 and 5. From the age of two months the mother no longer looks after the young so carefully, and at three months we remove them from the mother and feed them individually. Thus at three months the young Snow leopards become independent, training themselves to catch rabbits, eat independently and gnaw meat from the bone.

Details of the young Snow leopards' dental formulae are given in Tables 6 and 7.

During lactation female Snow leopards are fed on meat and the usual Snow leopard diet described above, but in addition they receive 1 litre of fresh cow milk containing two or three beaten eggs daily. Twice weekly this is varied with additional poultry, horse meat and beef, with added minerals and vitamins. After the Snow leopards have mated, the vitamin A concentrate is removed from the female's diet. Fortunately, our main breeding female, 'Ramune', has always had a good appetite, though Snow leopards in general are capricious feeders in captivity.

It is interesting to note that experiments carried out by us with valerian (Kempinskas, 1964) show that Snow leopards react weakly to this herb, whereas lions react more positively, showing a stereotypic reaction.

NO. NAME	BODY LENGTH (WITH TAIL)		CIRCUM- FERENCE OF CHEST cm	SHOUL- DER HEIGHT cm	HEAD LENGTH cm	EAR LENGTH cm	EYE WIDTH cm	LENGTH OF FORE- PAW TO ELBOW cm
	cm	TAIL LENGTH cm						
1. Zhvaigzhde ♀	73	30	33	25	16	3.5	1.2	17.0
	80	36	42	25	16	5.0		18.0
	110	48	49	27	17.5	5.5	2.0	23.0
2. Spindulis ♂	70	29	31	25	15	3.5	1.0	16.0
	79	33	41	25	15	5.0		17.5
	101	48	47	27	17.5	5.5	2.0	22.5
3. Uola ♀	71	27	30	23	15	3.5	1.0	16.0
	78	32	40	23	15	5.0		17.0
	101	48	43	25	17	5.0	2.0	21.5
4. Adult Snow leopard	193	90	—	60	24-27	5-7	2.5-3.0	—

Table 5. Body measurements of young Snow leopards *Panthera u. uncia* at 51, 64 and 100 days of age, compared with body measurements of an adult Snow leopard. The first set of figures refers to the animals at 51 days of age, the second set at 64 days of age and the third set at 100 days of age.

M	P	C	I	I	C	P	M
1	—	1	3	3	1	—	1
							= 14
1	—	1	—	—	1	—	1

Table 6. Dental formula of a month-old Snow leopard *Panthera u. uncia*.

M	P	C	I	I	C	P	M
1	1	1	3	3	1	1	1
							= 24
1	1	1	3	3	1	1	1

Table 7. Dental formula of a two-month-old Snow leopard *Panthera u. uncia*. The lower canines were 0.5 cm long at this time.

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