

THE STATUS OF CAPTIVE SNOW LEOPARDS IN CHINA

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Despite the fact that China was a major habitat for the wild snow leopard (before the Liberation in 1949), there were only snow leopard pells to be seen in fur stores and no living animals exhibited at any Chinese zoo. This was chiefly due to the fact that the species' far off and precipitous habitats presented many difficulties in the matters of catching, transporting and feeding. Hence the first living specimen did not come to the Beijing Zoo until 1956. This was followed by a few more specimens exhibited in other zoos, but even now the snow leopard remains a rare exhibit. According to statistics compiled in mid-1986, there are fifteen zoological gardens keeping a total of thirty-five snow leopards in China. Judging from the range and resources of the snow leopard in China, these figures are too small.

There are quite a few problems in the keeping of snow leopards in China. Beginning with the collection and transportation, there is a high rate of loss. Mortality remains high at the early stage of keeping; average longevity is consequently low. Technically, there is much to be done to improve the management and exhibition. The problem of breeding seems to be particularly difficult. Since 1956, when the first snow leopard arrived at the Beijing Zoo, thirty years have passed with only one zoo successful in reproducing the animal. And the success came very late in 1984.

The authors wish to point out an obvious difference in the composition of captive snow leopards between the Chinese and the foreign zoos. Among the Chinese captive animals only a small fraction of them are zoo born, the greater majority being wild-caught (Table I). However, most of the foreign captive snow leopards are zoo-born. According to the International Pedigree Book of Snow Leopards of 1984, among the 292 registered, only 39 (including six from China) were wild-born. In this respect, the wild-born snow leopards kept by Chinese zoos have important value both for the improvement of zoo stock and for the preservation of species. Therefore, to study the condition of captive Chinese snow leopards is not only good for raising the level of Chinese zoo management and technology, but also of benefit to foreign zoos that have snow leopards in captivity.

The contents of this paper include a review of the history of snow leopard management by Chinese zoos and a description of the present conditions. The main purpose is not only to approach and analyze all the existing problems for a solution and future improvement, but also to serve as reference material on which our foreign colleagues can gain understanding and give comments.

ON SNOW LEOPARD COLLECTION

Among the Chinese zoos which have snow leopards in captivity, two have been serving as the chief collectors and suppliers, namely, the Beijing Zoo and the Xining Park Zoo of Qinghai Province. The former did most of the collection in the 1950's and 1960's, and the latter has continued the work from the end of the 1960's until very recently. Besides the two, the Urumqi Zoo of Xinjiang and the Jiuquan Park Zoo and Lanzhou Park Zoo of Gansu have also collected snow leopards from their own provinces. Almost all of the remaining zoos received their snow leopards from the Beijing or Xining Zoos.

In the mid-1950's, the Beijing Zoo established a collecting station at Baoxing (better known as Moupin) in western Sichuan. The main objective of collection was giant pandas and a total of seventy-three giant pandas were collected there in twenty-one years. The collection of snow leopard was merely a side job. A snow leopard cub collected on December 26, 1955, and sent back to Beijing in January 1956, was the first snow leopard to be exhibited by any Chinese zoo. Following this young animal, the collecting station at Baoxing received four more: one on October 6, 1957, one on June 2, 1958, and two on August 30. At Baoxing, subtropical animals living at the lower elevation are easier to collect, but snow leopards and other alpine animals living at elevations above 4,000-5,000m are comparatively fewer and more difficult to catch. Thus, not many had been collected. The station was evacuated in 1976 for the sake of conservation.

At approximately the same time another collecting station was established by the Beijing Zoo at Yushu, on the southern border of Qinghai. Statistics compiled by He Lihua of the Beijing Zoo gives the number and dates of the twenty-one snow leopards collected: one in November 1957, one in April 1958, one in May, 1959, one in December, 1959, two in 1960, two in March 1962, one in January 1965, one in November 1965, two in April 1966, one in June 1966, four in October, 1966, three in October 1972, and one in September 1973. He added that there could be a few omissions. Also, the list does not include those which died before being transported to Beijing.

All collecting stations set up in different provinces by the Beijing Zoo were evacuated after the mid-1970's. The job of snow leopard collection in Qinghai was taken over by the People's Park at Xining.

According to Liao Yanfa (1985), his Park Zoo had collected a total of 73 (40 males and 33 females) from 11 counties between 1968 and 1984. The list included 18 adults, 11 immatures (*T* to 3 years old), and 44 young animals under six months of age. Fifteen of the young animals were cubs between 15 and 50 days after birth, and 13 were newborn cubs whose eyes had not opened. Of the total number received by the zoo, some died shortly after the arrival, some were retained by the zoo, and more than two dozen were transferred to the thirteen zoos at Beijing, Tianjin, Nanjing, Shanghai, Taiyuan, Xian, Chongqing, Chengdu, Yantai (Chefoo), Jinan, Shenyang, Dalian (Daien) and Guangzhou (Canton). In fact, most of the snow leopards kept by Chinese zoological gardens were received from the Xining Zoo. One of these is now on exhibition at the San Francisco Zoo.



FIGURE 1. Liao Yanfa, director of the Xining Zoo, holding a young snow leopard approximately six months of age (Photo by Tan Bangjie).

TABLE I. Register of Snow Leopards In Chinese Zones as of 30 June 1986.

Zoo	No.	Sex	Capture or Birth Place ¹	Capt/b. Date	Present Age (yr)	Present Since	Physical Condition
Xining	1	F	Tianzun, Qinghai	3/84	8	3/84	healthy
	2	r	Tianzun	4/84	3	4/84	crippled
	3	K	Tianzun	3/83	4	4/83	healthy
	4	M	Tianzun	5/83	9	5/83	healthy
	5	M	Qilian	5/79	8	7/79	crippled
	6*	F	b. Xining	7/13/84	2	birth	healthy
	7-	M	b. Xining	6/5/85	1	birth	healthy
	8	F	Ülan, Qinghai	1/86	1	1/86	crippled

Urumqi		M	Hami. Xinjiang	1981	7	1981	crippled
	2	M	Harni, Xinjiang	1981	8	1981	crippled
	3	M	Beitashan, Xinjiang	1979	10	1979	crippled
Yinchuanj	11	M	Yushu. Qinghai	1978	8	4/80	healthy
	2	F	Qilian. Qinghai	4/79	10	10/84	healthy
Beijing	;	F	Qilian	7/78	8	11/78	healthy
	2	M	Dulan, Qinghai	1979	7	12/85	healthy
Shanghai	1	M	Qilian	1979	8	9/79	blind
	2	M	Sunan, Gansu	1983	adult	11/83	healthy
	3	K	Sunan, Gansu	1983	adult	11/83	healthy
	-1	M	Sule. Qinghai	1983	4.5	10/85	crippled
	5	F	Qilian	1979		10/85	crippled
Tianjin	1	M	Qilian	1/81	7	1/83	poor
Jinan	1	M	Tianzun	6/83	6	7/84	healthy
	2*	F	b. Xining	6/5/85	1	11/85	healthy
Shenyang	1	M	Sule, Qinghai	4/83	4	12/83	crippled
Changdu	1	M	Dulan i	6/83	3	10/83	healthy
Chongqing	1	M	Dulan	6/83	3	10/83	healthy
Guangzhou	1	F	Qilian	1/75	14	9/76	crippled
Dalian	1	M	Tianzun	2/84	-1	5/84	poor
	a	F	Qilian	1971	15.5	10/72	crippled
Lanzhou	1	M	Yumen, Gansu	1985	3	1985	healthy
Jiuchuan	1	M	Sunan. Gansu	1984	2	1984	healthy
	2	M	Sunan, Gansu	1985	adult	1985	healthy
	3	K	Sunan, Gansu	1985	adult	1985	healthy

Kashgar 1 M no further information
7. F

¹ All individuals were wild caught except those indicated with • and b.

Regretfully, the data of snow leopards collected by the zoos of Urumqi, Lanzhou and Jiuquan are largely incomplete. It is understood that the Urumqi Zoo had a large number of snow leopards in previous time. There is no record left. All we know is that five leopards (two males and three females) had been kept between 1972 and 1980. Three are still living from 1980. The known sources of its collection include the following localities: five from the Altai mountains, two from the Tacheng district near the Soviet border, and three from Hami and the Beitashan Mountain in northeastern Xinjiang.

A collector's group dispatched by the Beijing Zoo to look for the Przewalski horse in the early 1950's had also brought home two snow leopards from the Beitashan area.

A total of ten snow leopards (seven survived) was collected by Jiuquan Zoo from the Qilian Mountain on the Gansu-Qinghai border in the years 1976-1984. Two of these were transferred to the Dalian Zoo in 1977, which gave one female to the Shanghai Zoo for exportation to San Francisco in 1983. Another pair was transferred to Shanghai in 1983, where they are still living. A female given to the Urumqi Zoo died several years ago.

The Lanzhou Park Zoo had also collected a number of snow leopards from the Qilian Mountain as well as from the Gan-nan (South Gansu) district in the 1970's. At least five (four males and one female) were kept by the zoo from 1970 to 1980. A pair transferred to the Shijianzhuang Zoo in 1978 died shortly after transfer.

Both the Chengdu Zoo and the Chongqing Zoo received young snow leopards from mountain districts of western Sichuan. But no details are available to date.

PROBLEMS ASSOCIATED WITH COLLECTING

There are serious problems connected with the collection of snow leopards. In China there have been many people going to the mountains or forests to collect wild animals, but none of them has had scientific study or special training in the capture of snow leopards. All the snow leopards captured thus far have been either by chance or for retaliation. There has been no selectivity. Both old and young, or even newly born, were taken, as reflected in the case of the Xining Zoo. Such collection without choice naturally results in high mortality which in turn becomes one of the main reasons for the high death rate in snow leopard captivity in China.

Let us further probe into the case of the Xining collection. Four of the newborn cubs died before the keepers had time to pack them up for transportation. Two others died on the third and fifth day following their capture. Another two died on the eighth day. Only two of the thirteen newborn ultimately survived, a survival rate of only 15.38%. As for the cubs captured when less than two months of age, at least half of them died within the first or second month following

the purchase. Experience has shown that the rate of survival for the cubs is far below that for the adults; they have much weaker power of resistance and a much higher incidence of disease. It was entirely wrong to capture such cubs. However, since they were already caught by chance, if no one purchased them in time, the loss would be even greater. This is a practical problem worthy of consideration.

Another problem is deformity. A number of snow leopards exhibited by Chinese zoos are handicapped with one broken foot or leg. Only a few of them are uninjured, usually those captured very young or bred by the zoo. For example, of the eight animals presently on exhibition at the Xining Zoo, excluding the two zoo-born, three of the remaining six have permanent foot and leg injuries. The same is true of the five Shanghai animals: one is blind, two have permanent injuries. The Urumqi Zoo has three snow leopards, all crippled; so are the snow leopards kept by the zoos of Dalian, Shenyang and Guangzhou.

Statistics compiled by the Xining Zoo indicate that of the seventy-three snow leopards collected by the zoo, eleven adults and subadults were injured. A few others died shortly after the capture, but the nature of the wounds was not recorded. However, according to hunters' experiences, snow leopards caught by steel traps often broke their limbs during the frantic struggle to free themselves from the trap. The death rate as a result of the worsening of the wound was comparatively high.

Very young animals captured by means other than traps were not injured, but their death rate is also high for other reasons which will be discussed later in this paper.

According to Sun Yanxing (1983), it was possible to catch adult snow leopards by means of lassoing. He personally knew a cowboy of Aksa county, Gansu Province, who had lassoed a snow leopard in late April, 1983. The cat had just finished eating domestic sheep and was unable to run away swiftly. Another means to capture live snow leopards was adapted by hunters at the Jiuquan District and uses a loop made by steel cable placed on the path of snow leopards. This method usually caused high mortality because the animal was easily strangled as it struggled to free itself.

Difficulties are also present during transportation. To bring a wounded or a very young animal a long way from the high mountains to the zoo naturally involves problems. The Xining Zoo has had a great deal of experience in transportation. In December 1982, two adults were collected from Sule village, Tianzun county. One of these died in a basket carried by manpower during a 45 km hike descending from the mountain; the second died of acute pneumonia before reaching the zoo. In February 1979, another adult snow leopard collected from Dulan county died of liver rupture because the truck carrying it overturned on the mountain road. Another captured snow leopard ran away after it snapped the rope at night.

The Xining Zoo has had experience on the transportation of feline cubs. According to Liao Yanfa (1978), the Xining Zoo had lost a

number of cubs before 1974. They thought that alpine cats such as the snow leopard and lynx were cold resistant animals, so no attention was paid to the problem of heat preservation during the arduous journey, even if it was made at times of bitter cold and hard wind. Soon after their arrival at the zoo, cubs fell sick and died. In January 1975, it was discovered by chance that a lynx cub was sound and well after a 800 km journey by truck, and did not get sick afterwards. Thus, they adopted this means of protection

each time they transported young animals. During a five-year period, they carried home twenty-three cubs of snow leopard, lynx and other cats and none of them fell sick right after their arrival. The lesson taught them that young animals, including cold-resistant species, would lose most of their power of resistance during the long journey due to weariness and high tension, and hence would be unable to resist the wind and cold.

ON SNOW LEOPARD HUSBANDRY

Chinese zoological gardens have been keeping snow leopards since 1956. In thirty years, twenty zoos (Beijing, Tianjin, Taiyuan, Shijiazhuang, Jinan, Yantai, Shenyang, Dalian, Shanghai, Nanjing, Guangzhou, Xian, Xining, Lanzhou, Jiuquan, Yinchuan, Urumqi, Kashgar, Chongqing, Chengdu) have kept more than 150 snow leopards.

Despite the long time and the large number of animals already kept, husbandry techniques have still not advanced, as judged by the low rate of survival and reproduction and the high incidence of disease and death. We have dealt with the matter of collection and transportation in our previous pages, and we will discuss the problem of reproduction in another section. This section will discuss the question of scientific management.

As an alpine animal, the snow leopard lives in mountains between 3,000 and 5,000m above sea level, in an environment with plenty of sunshine and ultraviolet light, low atmospheric pressure, pure and fresh air and very little bacteria. When the snow leopard are transferred to an entirely different environment in cities of a warm country, where summer is long and hot, the weather comparatively wet, and where there is a lack of ultraviolet rays, but many new bacteria, the unfavorable conditions become quite obvious. However, experience gained by zoos in western Europe and North America has proved that snow leopards living under such unfavorable conditions are able to live a long life, as indicated by records of keeping and breeding. The more important fact is the level of technical expertise.

The Chinese zoo that is the most successful in keeping snow leopards is the zoo at Xining. Besides being favored by better natural conditions, the continued efforts that they have made to improve their technical standards have also been productive. Accordingly, zoos in other Chinese cities like Lanzhou, Urumqi, Xian, Beijing and Harbin

have good reason to keep snow leopard well, if only they can improve the standard of their facilities, management and technology.

Another point to consider is that most of the snow leopards living and breeding well in European and American zoos are zoo-born animals, whereas wild-caught animals are more difficult to breed. It is also noteworthy that their breeding rate was comparatively lower twenty or even ten years ago, when there were more wild-born animals represented in the total percentage. This is worthy of consideration because almost all of our captive snow leopards are wild-born. Thus, we are hopeful to have more breeding successes when the ratio of our zoo-born and wild-born animals gradually becomes balanced.

Undeniably, geographical merits have something to do with Xining Zoo's success in keeping snow leopards. Xining is located at an elevation of 2,275m. It has a mean annual temperature of 5.5°C, a rather cool summer with a mean temperature of 17.2°C for July, and a long winter with the lowest temperature at -26.6°C. There are 2,600 to 2,800 hours of annual sunshine, which is 700 hours more than other cities on the same latitude. It has strong solar radiation with an

annual radiation of 139-177 kilocalories per square centimeter. The range of temperature varies between 12°C and 20°C daily. All these climatic conditions are comparatively close to the living conditions of wild snow leopards.

In addition to these natural favors, the Xining Zoo has adopted the following measures to improve the animal's captive conditions:

(1) To increase daily illumination, there is a program to irradiate with infrared lamp and ultraviolet lamp at fixed hours. It begins with three minutes per day for the first three days, and then increases one minute per day for every three days until it reaches a total of fifteen minutes per day on the forty-fifth day. There is a five-day intermission, and then the process is repeated on a continuing cycle.

(2) Cages are firmly built, wind-proof and facing the south, with an indoor dimension of 3 x 2.7 x 3.2m, and an outdoor yard of 3.3 x 3.8 x 2.85m surrounded with net. Besides the daily clean up, both the Inner and outer cages are disinfected with ultraviolet lamps for fifteen minutes daily and washed with 1-3% cresol and soap solution once a week. A raised platform, two meters high, is erected in both cages for rest and exercise.

(3) Feeding: In the wild, snow leopards mainly hunt bharal [blue sheep] for food. This has a lower percentage of fat (13.7%) compared to beef (20.7%) and mutton (34.6%). Captive snow leopards fed with beef or mutton could easily grow fat in a few months time which is undesirable for breeding. For this reason, the daily ration for an adult animal is limited to two kilograms of meat, one-half pound of milk, two raw eggs and five drops of cod-liver oil. There is one fast day per week. Since only frozen meat with low nutritive value was available, live food has been supplied since October 1983. Three times per week, a live goat or sheep is driven into the cage and killed by the

snow leopards (Figure 2). Supplements of live **chicken or rabbit** and fresh, animal livers are also given **irregularly**.

According to Xu Shuren et al (1981), a live bharal weighing 15 kg was given to a snow leopard in January 1981. The cat killed it with a single bite on the neck and dragged the carcass up to the platform for consumption. All that remained on the next day were the head, the leg bones, the ribs and part of the viscera.

The Xining Zoo reared eight young snow leopards captured from the wild between 1976 and 1981. These undernourished weaklings needed fortified nutritions and an indoor warmth above 15°C. Each was given a wooden box of 50 x 40 x 40 cm lined with straw for bedding. Each had its own feeding tray and drinking vessel and was fed separately. The feeding schedule was three times a day up to four months of age and then gradually reduced to two times and one time a day (Table II). When seven months old, meat with bone was given, and living chicken, or rabbit, was used as replacement once every two weeks. At one year, one fast day per week was instigated. Proper exercise and sunning were enforced daily.

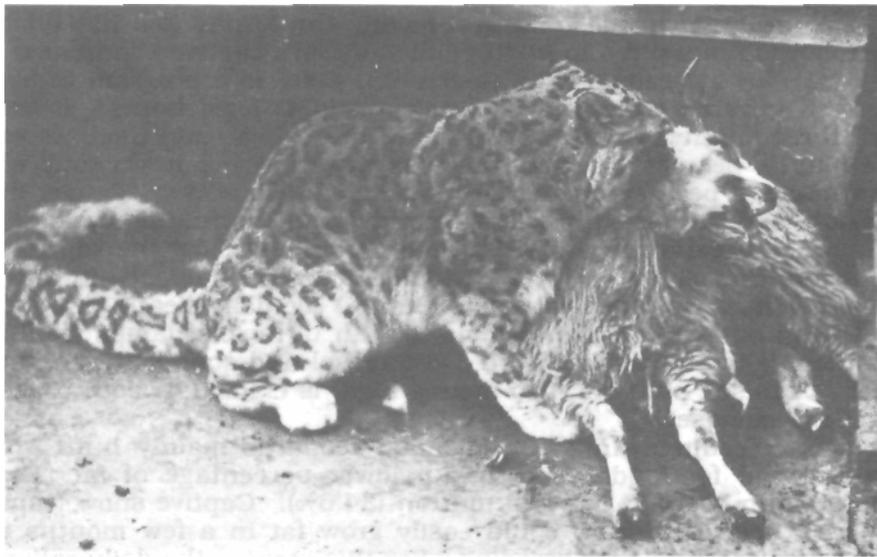


FIGURE 2. Live food is supplied three times a week to snow leopards at Xining Zoo. An adult female, No. 3, is shown here killing a sheep [Photo by Liao Yanfa].

TABLE II. Feeding Table for Snow Leopard Cubs between 2 and 7 Months Old.

Age (mo)	Times I (day)	Milk (g)	Water (ml)	Salt (g)	Meat Calcium (g)	CLO (drop)	Vit. B (g)
!	1	100	50	0.2	100	1	2
	i	120	50	0.2	120		2
!	'	150	.1	0.4	200)	2
..	2	250	i,	0.4	350	1	3
»	2	250	>0	0.5	400	1	3
		200	50	0.5	1000	2	4

CLO = cod liver oil; Vit. B = vitamin B complex

Common diseases for the captive snow leopard in China include: (1) acute pneumonia, which is usually fatal if not given proper treatment within three days; (2) hemorrhagic enteritis, a seasonal disease most often occurring in the summer (three cubs showed symptoms of this disease three days after their arrival at a zoo: all were treated and two were healed after two weeks but the third died on the fourth day with rectal bleeding); (3) alimentary toxicosis: three snow leopards at the Xining Zoo died of *Clostridium botulinum* in January 1980; and (4) skin disease; a male snow leopard died at Xining Zoo and was found to have 60% of its skin bored by maggots.

By the end of June, 1986, there were fifteen Chinese zoos keeping thirty-five snow leopards (22 males and 13 females). The following are supplemental explanations to Table I:

(1) No. 1 female snow leopard of Xining Zoo gave birth to three cubs on July 13, 1984. One female died of acute pneumonia in its fifth month, another died in the spring of 1986, leaving the third (No. 6 male) still living at Xining. No. 3 female gave birth to two cubs on June 5, 1985. The female cub was transferred to Jinan in November 1985, with the male retained by Xining.

(2) Two more young females (wild-born in May 1985) were collected by the Xining Zoo in January 1986. One died shortly afterwards; the other is still living (No. 8 of the Xining collection).

(3) Of the two females given to the San Francisco Zoo by the Shanghai Zoo in January 1983, Ning Ning, was captured from Yeniugou (Wildox Ravine) village, Qilian Mountain, Qinghai Province, in April 1979 as an adult. The other, Lian Lian, was captured in the Qilian Mountain in Gansu Province in 1976. She lived at the Jiuquan Park Zoo until 1977 when she was transferred to the Dalian Zoo and then to San Francisco.

(4) Beijing Zoo originally had seven snow leopards registered with the International Pedigree Book. Numbers 1 through 4 were dead and cancelled. No. 5 (a male) was transferred to Shenyang and died there on February 23, 1983. No. 7 (a male) died in Beijing in November 1984. No. 6 (a female) remains alive and she is listed as No. 1 in Table I. She is about eight years old. Beijing obtained a male from Xining in December 1985 as her mate. As of this writing, the pair had not yet been put together.

(5) The two males kept by the Chengdu and Chongqing Zoos were from the same Utter and came to the zoos in May 1983 when they were fifty days old.

(6) Of all the snow leopard in captivity in China, a female kept by the Dalian Zoo with an age of fifteen and a half years is probably the oldest. Next is a fourteen year old female kept by the Guangzhou Zoo. The original No. 1 female of the Beijing Zoo was born in 1960 and died in Baoding in February 1979, so that her longevity was more than eighteen years. Another one, the original No. 5 male of Beijing who died in Shenyang in 1983, had an estimated age of twenty. At this age, he holds the record for snow leopard longevity in China.

(7) Other Chinese zoos that have kept snow leopards are: (1) Shijiazhuang Zoo, which had obtained a pair of cubs from the Lanzhou ark Zoo in September 1978, but lost them in less than a month; (b) Xiyuan Zoo which obtained a male and a female from Beijing and Xining in 1970 and 1976, respectively, and they died in 1976 and 1981; (c) Yantai Zoo which obtained one cub from the Xining Zoo in 1977 and a second in 1978; they died in August 1983 and May 1986 respectively; and, (d) Xian Zoo and Nanjing Zoo also kept snow leopards some years ago, but no data are available on them.

SNOW LEOPARD BREEDING

A single cub born in July 1983 at the Xining Zoo was eaten by its mother shortly after birth. This was the first record of a snow leopard birth under captive condition in China. The following year (1984) a litter of three was born in July (Figure 3), and another litter of two was born in June 1985. Up to now, Chinese breeding records for snow leopard consist of only these three litters with a total of six cubs, three of which died. Two males and one female still remain.

In addition to the Xining Zoo, there are several other zoos which have kept snow leopards in pairs, but there has been no breeding. This cannot be charged to natural conditions alone. Poor technical

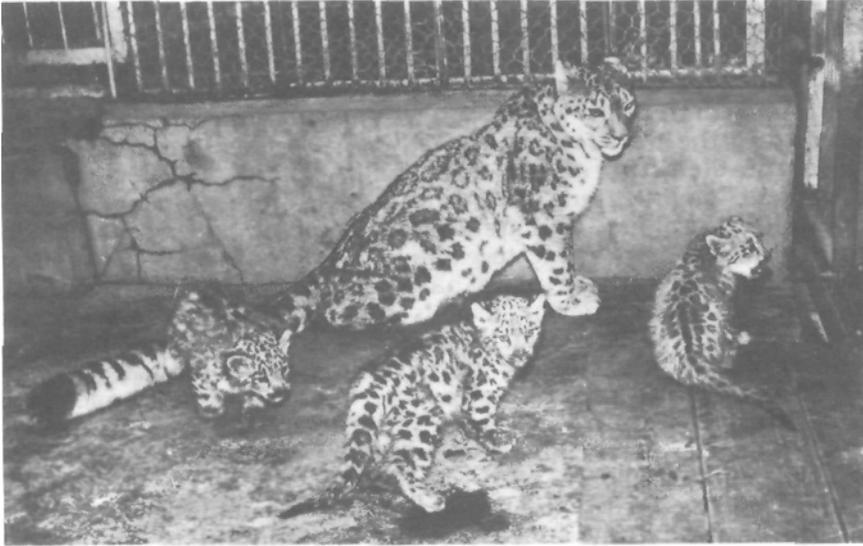


FIGURE 3. No. 1 female and her three cubs at Xining Zoo in September 1984 (Photo by Tan Bangjie).

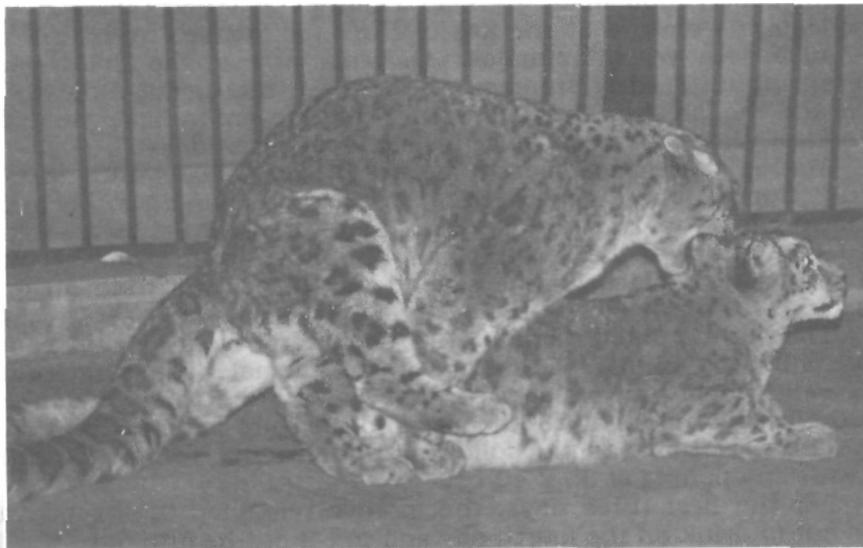


FIGURE 4. Mating behavior of No. 4 male with No. 1 female at Xining Zoo (Photo by Liao Yanfa).

management must also be a primary factor. Now there are snow leopards being kept in pairs at the zoos of Beijing, Shanghai, Jinan, Dalian, Yinchuan, Jiuquan and Kashgar. The Shanghai pair (Numbers 4 and 5) had mated in 1986, and there is hope for a successful pregnancy in the next few years. Other pairs have not mated to date. Besides the elements of age and health, there are also aspects of environment, facilities and feeding that need improvement.

Another problem is matching, as some of the zoos are without pairs. It's almost impossible to exchange different sexes between them because the zoos without pairs have mostly males, and the few that keep pairs have no extra females. It is not a good idea to collect more from the wild as this would harm the natural population. A more practical solution is to wait for more births at the Xining Zoo.

Of the eight snow leopards now kept by the Xining Zoo, five adults (two males and three females) are forming a breeding nucleus. Numbers 1 and 3 females have each bred once. No. 2 female has also mated, but unsuccessfully with No. 5 male. No. 4 male sired the two litters in 1984 and 1985 (Figure 4). All three females mated again in 1986, but without any success. One explanation is that they are growing obese due to overfeeding. However, the hope of enlarging the captive population of snow leopards in China is resting reasonably on this Xining breeding group.

The following observations were made at Xining Zoo:

An observation made by Liao Yanfa et al (1986) asserted that snow leopards mature at the age of three for females and three and one-half to four years for males. Oestrus came to the females from early spring until early summer, the earliest date being January 25, 1979, and the latest on July 3, 1984. Females were in heat one to four Limes each year; each occurrence lasted about seven days.

Mating took place mostly at night, from 1700 hours to 0700 hours. Copulations averaged 5.2 (3 to 8) times per hour, each time continuing for 3 to 15 seconds. The time of interval between two acts was 1.13 minutes at the shortest and 43 minutes at the longest. More copulations took place on the second day of oestrus than on other days.

The impregnated female was separated from her mate one month after the mating. Gestation of No. 1 female lasted ninety-nine days. The whole process of parturition lasted more than three hours, with the first cub born at 2300 hours and the third cub at 0235 hours.

The nest box had the following dimensions: 130 x 100 x 100 cm. with an opening of 35 x 40 cm.

For the first three days, the mother remained in the box and came out to drink on the fourth day and to eat on the fifth day. For the first fifteen days she came out only for eating and drinking. She began excreting outside from the sixteenth day and resting on the platform from the twentieth day, only to return to the nest box at night. The female was separated from her cubs on the ninetieth day, but they

were placed in adjacent cages so that they could see and hear each other.

When 20 days old, the cub suckled 8:8 (7 to 15) times every 24 hours, each time from 13 to 45 minutes. Sucking times were reduced to 4 to 6 instances when 40 days old, each time about 15 to 25 minutes. The three cubs were weaned on the sixty-third, sixty-seventh, and seventy-third days and began to eat meat on the fiftieth, fifty-sixth, and sixtieth days.

PROBLEMS AND PROSPECTS

(1) As a national protected animal of the first category, it is strictly forbidden in China to hunt the snow leopard, and yet almost all the snow leopards in captivity in China were wild-caught and collected from the mountains. This is not limited to the past but still happens occasionally now. Damages in the course of catching, transportation and the early stage of keeping have always been high, especially for cubs. It is believed that by strengthening the measures of conservation gradually, free hunting (or poaching) may be expected to come under control. Future collection of snow leopard must go through a process of planned supply and all details concerning the time, place, numbers, ages, sexes, etc., must be fixed beforehand by the authorities concerned. The means of catching must also be restricted. Illegal means such as using the iron trap or steel-wire loop, or the rounding up of newborn cubs from the lair, must be forbidden.

(2) It took almost thirty years for Chinese zoos to successfully

breed the first litter of snow leopards. Of the fifteen Chinese zoos that keep snow leopards, only one is breeding this animal. However, by improving the environment and installation, exchanging experiences and technical skill, elevating the standard of husbandry and management, and improving the quality and quantity of feed, it is possible for more Chinese zoos to achieve successful reproduction.

(3) It is necessary to develop the Xining Zoo's breeding group into a central breeding colony for the whole country, not only because it is the only Chinese zoo that breeds, but because it is more experienced and has a longer history in the management of the species. Other Chinese zoos may expect to obtain specimens for exhibition as well as for breeding purposes from Xining. Furthermore, the Xining Zoo may also be expected to carry on the job of international exchange. On the other hand, the cages and other installations of the Xining should be improved. In order to obtain a higher success rate, it is necessary to work out a project for the establishment of a Chinese snow leopard breeding center at Xining. To realize this project, moral and material supports from home and abroad are indispensable.

Owing to the lack of enough breeders, the problem of matching single individuals kept by some Chinese zoos is not expected to be solved within a short time. Nevertheless, there is a more reasonable solution by means of international exchange. A precedent has been set by some Soviet and Western zoos. According to Blomqvist (1984), they have reached an agreement to exchange three male Soviet snow leopards for three female Western snow leopards. Of the thirty-five Chinese snow leopards in captivity, twenty-two are males and thirteen are females, thirty-two are wild-born and three zoo-born. It is a good idea to exchange a few Chinese wild-caught males with foreign zoo-born females because it is an exchange that will be of benefit to all.

(5) Most of the Chinese zoos do not have studbooks for their animals, and some do not even have simple records, so that it is extremely difficult to trace origins. None of the captive snow leopards has a house name. Many of them do not even have a registered number; the numbers registered in Table I are mostly given provisionally by this author. In order to set up a complete studbook for all captive snow leopards in China it is necessary to improve the standard of scientific management. Furthermore, the incorporation of the Chinese studbook record into the International Pedigree Book would be beneficial to both the Chinese and foreign collections.

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