The first snow leopard (*Panthera uncia*) arrived in the United States at the Bronx Zoo in 1903. It was considered a zoological rarity then -- it is still considered that today.

From the beginning a behavioral difference was noticed between the spotted leopard and the snow leopard. That difference was in temperament. The director of the Bronx Zoo at that time wrote: The snow leopard is as good-tempered as a house-cat and as playful as a kitten. It is peace-loving.

If we were to write that today we would instead say: The snow leopard exhibits a high degree of social behavior with a low incidence of aggression. This is just a fancier way of saying the same thing.

From 1903 until approximately 1970, not too much was added to our basic understanding of the snow leopard. We did fill in a few facts through an occasional sighting by a hunter, but the animal was scarce, even in its natural habitat, and was not encountered often. Usually what was collected was the location of the sighting, such as which Asian mountain range, the altitude, and whether or not the snow leopard had beat the hunter to the game.

If the snow leopard was killed, the size of the cat and the condition of the pelt were noted. Usually nothing was added about behavior because it is difficult to learn about behavior in an animal that is dead.

Due mainly to the efforts of two men, Hari Dang, a hunter who wrote down his observations of the snow leopard and its prey,
and George Schaller, the first individual to collect any systematic data on the snow leopard in the wild, we can now fill in a few more gaps.

Although its range is large, extending from the southern Himalayas westward through Pakistan and north to the Russian mountain ranges, its density or population is low in all of these areas. This probably has not varied over the years. The number of carnivores has to be low compared to the number of prey animals. Add to this fact that the snow leopard lives in an extremely harsh environment and there will be few ungulates able to make a living and even fewer snow leopards.

In the wild snow leopards prey on a number of species, including blue sheep, deer, ibex, markhor, marmots and pheasants. With the local villagers going higher and higher trying to find grazing land for their sheep and goats, domestic stock is now a principal food source. This is a major concern because the snow leopard is a very slow eater and is easily shot when lingering over a livestock kill.

With regard to its social behavior, there are repeated references in the literature to "resident pairs". This is usually in regard to the snow leopards' hunting behavior and concerns two animals working cooperatively to bring down prey. One animal will chase a goat or sheep into an area where the other animal is waiting in ambush. This technique is especially valuable in barren rocky habitat where the prey could keep moving away into escape zones. Here is where the fantastic leaping ability of the snow leopard is put to its best use. There is one reference to a snow leopard seen jumping 15 meters (49.2 feet) uphill. Even if this is exaggerated, it somewhat discourages zoo officials from building an open-air grotto for their snow leopards.

With regard to the social system of the snow leopard, George Schaller writes: "Virtually nothing is known about interactions between adults in the wild."
Keeping this and what else we've learned from the natural habitat in mind, we'll now review some of the data collected in captivity.

The majority of cub births in captivity occur in May. Based on surveys I've done, totalling 46 litters consisting of 96 individuals, 62% of the births were in May. The next highest month was June with a total of 21%, thus having 83% of all births occurring in two months of the year.

Running a multiple regression program on a computer, using a smaller sample size by throwing out the two most extreme cases, we found that snow leopards in zoos located in more northern latitudes tend to have litters slightly earlier in the spring. This suggests photoperiod as a possible cue for the onset of oestrus, but it did not show a strong relationship. Altitude of the Zoo and temperature, using the first day of frost, were also tested against the birth date and with these, no relationship was shown. In other words, using the previous three factors as the test, zoo location had little effect on the timing of parturition. We know that oestrous in the snow leopard is set into a very limited time frame, but what we don't know is what outside mechanism, if any, triggers it.

Although hardly anything is known about interactions between adults in the wild, we can look at the reason for monogamy and see if the snow leopard fits into any of these.

Basically, in order for a social system to have evolved, it has to have provided a higher degree of fitness for the individuals involved. For monogamy to have evolved (for it is not the most common social system among mammals; polygyny and promiscuity are) individuals who formed a pair bond have had to produce more offspring than those who stayed with the other social systems. The genetic blueprint for this behavior would spread as more and more successful reproduction accrued to pair-bonded individuals. The species would come to consist of individuals who behaved monogomously.
Because of the harsh environment of the snow leopard, it could be that the cooperation of two parents may well enhance the ultimate survival and success of the offspring. The cooperation of two committed adults may be needed to get the young to where they are able to hunt for themselves.

Also, because of the low density of the snow leopard in the wild, and the extremely limited oestrous cycle of the female, it may well be to the advantage of each individual to have the other sex in close proximity during this period.

In captivity males have been observed taking an active part in the raising of their young. At Woodland Park Zoo the father was seen soliciting play and grooming the cubs. Also, when playing with the cubs, he performed the same behavior patterns the female used. In other carnivores when the male is involved in raising the young, his energy expenditure is far above that used in the more commonly seen male mammalian strategy of only producing the semen necessary to fertilize the egg.

Because of this high energy expenditure, he will try to ensure that he has the best possible female for a mate. This is of course the usual strategy for the mammalian female because her investment in producing and caring for the young is always high. What happens with pair-bonded animals is that they then need to take a longer time to get to know each other. This process is called courtship, and courtship is most prolonged in species that have extensive cooperation between the male and female.

In fifty hours of observations spread over a twelve month period that I made on one adult pair, the frequency of social grooming was higher than the frequency of solitary grooming by either animal. There were 104 instances of social grooming, as compared to 68 and 84 observed instances of solitary grooming sessions for the male and female respectively. During that same study period only one instance of aggression was seen. That occurred when a novel object was introduced. While the female was investigating it, the male approached her from behind and
started to also investigate. She snarled and lunged at him and he retreated for a short while.

In Russia in 1962 a male was placed into a cage with three females. He chose one for a mate and paid no attention to the other two females. He kept a bond with this one female exclusively for five years although the other females stayed in the same cage and went through oestrous cycles.

At Woodland Park Zoo we introduced an adult male who was already successfully paired to one female to two different females. Each of the new females was introduced separately to the male; each was in oestrus at the time of introduction and fully receptive. The male rebuffed both of them and, in fact, on one occasion banged on the door which led to an area housing his original partner. We decided to leave well enough alone and let him back with his preferred mate. They've produced eight cubs.

As far as captive management techniques are concerned, this is what we've been doing as a result of our research studies.

Because there is a possibility of long-term par-bonding in the snow leopard, we have decided not to use the management practice common with other felids of alternating a male with different females. Once a pair bond appears to be established, I would recommend that it not be broken by introducing new females.

When introducing a new pair to each other, it is advisable to take your time. As mentioned earlier, courtship is prolonged in a pair that intends to stay together. Before actual introduction, we give them opportunity for visual, olfactory and auditory communication through a mesh door. This usually extends over a period of several weeks.

After the pair is in the same enclosure, they are still watched carefully for an extended period during the day and separated at night. Although aggression is low between bonded pairs, conversely it can be very high between a male and female who found they were not compatible.
Also, because courtship is long, the pair should be put together well in advance of oestrous. There is a common saying "Familiarity breeds contempt". In the case of snow leopards it should just say "Familiarity breeds".

In the enclosure it is recommended that they be given areas where they can lie down next to each other. We've found that ours prefer lying passively in high areas that have a long view, especially if they can see possible prey species in the distance. But for playing and rolling together, they prefer open, low areas.

We have seen no stereotypic behavior in our snow leopards. This could possibly be due to a feeling of security that they have in their environment, and the options they're given. If you only observe snow leopards during the day, you may find them staying in very limited areas. But the 24-hour studies we have done indicate that every area of the enclosure is used at some time during that period.

Starting in December we separate the male from the female for one night a week. The reason for this is to get them used to being separated so that stress is reduced if and when they have to be separated for a longer period. But even when they are in different enclosures, they can see, hear and smell each other through a mesh door. This one-night-week separation continues until shortly before the female gives birth. At that time the female is given a secluded section which includes a choice of two alternate den sites. She is still, however, able to communicate with the male through the same mesh door. The removal at parturition of the female is to reduce stress on her. In the wild situation she would probably expand her social distance at the time of parturition. She can't do this in captivity.

To further emphasize this point, in correspondence I've had with most of the zoos who had snow leopard cubs this year the one item that stands out is that the zoos which did not provide separate, secluded denning areas for their females had high mortality rates in the cubs.
The female starts spending more time outside of the maternity den when the cubs are two-to three weeks old. At this time she is given the opportunity to go outside with the male for about an hour each day. The cubs are introduced to the male between three and five months of age. We've been making this introduction at a progressively earlier time each year.

In summary, there is evidence that the snow leopard has the capacity for strong social bonding between individuals. This is a need that should be recognized by zoo personnel in their captive management program.