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Captive Management of Snow Leopard Cubs: An Overview

By Helen Freeman and Michael Hutchins, Seattle

With 5 Figures

The Snow leopard (*Uncia uncia*) is considered highly endangered (Simon 1966). In 1947, there were approximately 125 snow leopards housed in 47 zoos worldwide (Duplaix-Hall 1975). Acurate appraisals of the number of free-living animals are not available; however, the International Union for the Conservation of Nature and Natural Resources (IUCN) has listed 400 ± 200 as a rough estimate of the surviving population (Simon 1966).

Although the snow leopard is now protected throughout most of its range, a recent survey (Schallev 1975) suggests that their numbers continue to decline at an alarming rate. The probable reasons for this decline include poaching, a low fecundity and the scarcity of natural prey due to human overkill. The poor status of free-living snow leopards, combined with the possibility of captive propagation and reintroduction into the wild, favors the development of successful breeding programs. Indeed, if numbers continue to decline, the future survival of this species may depend solely upon the ability of zoos to maintain a viable breeding population.

Little information exists on the behaviour, physiology and captive management of snow leopards. One major problem is lack of a detailed field study; however, even if the density of wild snow leopards were higher, they would still be extremely difficult to observe due to rugged and often impassable terrain in which they live. Therefore, by necessity, much of our knowledge concerning snow leopard biology will have to originate from captive research programs.

The following paper is divided into two sections. The first contains some notes on the birth, development and captive management of 3 snow leopard litters at the Woodland Park Zoo in Seattle, WA, USA. The second section summarizes the results of a management-related questionnaire sent by the authors to zoos having snow leopard births prior to and during 1973.

I. Woodland Park: Notes on Birth, Development and Captive Management

The Woodland Park Zoological Gardens has maintained an adult pair of snow leopards since 1972. These animals were wild-caught in USSR during 1971 and have produced 3 consecutive litters since 1973. Information regarding their behavior, maintenance and cage utilization patterns has been published elsewhere (Freeman 1975).

The first Snow leopard raised at Woodland Park ("*Pushkin*", ♂) was born on 23 June, 1973. The exact hour of birth is unknown, but at 8 hours the cub was heard vocalizing from an area in back of the 9×12×4 m openair enclosure (Fig. 2, A). At this time, the ♀ was seen peering out from an area approximately 2 m from the cub and did not seem to be responding to its calls of distress. The ♂ was at the front of the enclosure, pacing and reacted aggressively when observers approached. Since both adults remained inattentive, it was decided to remove the cub and attempt to rear it by hand. At the

time of removal, distention of the bladder was observed and upon being massaged, the cub urinated immediately. A small amount of blood was present in the urine. The cub was clean and dry, indicating the possibility of some maternal care and its weight shortly after removal was 623 g.

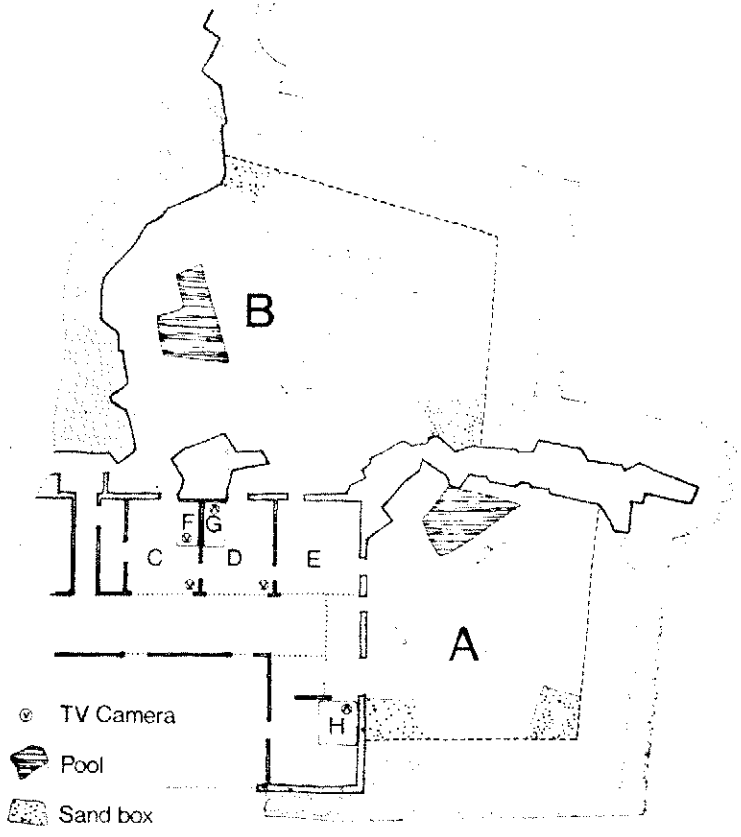

Fig. 1. Snow Leopard Breeding Facilities at Seattle's Woodland Park Zoo

The second cub ("*Rimsky*", ♂) was born 11 May, 1974. Prior to the ♀'s entry, the 2.4×1.3×1.0 m high indoor maternity den (Fig. 2, h) was equipped with a closed circuit television camera (Concord model CTC-30) so that behavior could be monitored and recorded without disturbance.

Parturition occurred at 12.27 hours. Shortly after birth, the ♀ curled into a sternal position facing the cub and wrapped her tail around him. Until 3.39 hours, she slept, waking only intermittently to groom the cub as it nursed. During this period, the ♀ frequently approached the den entrance, but spent the majority of his time in the outdoor enclosure, either pacing or in a crouched stationary position.

At 3.40 hours the ♂ entered the maternity den, licked the ♀'s inguinal area and then left. The ♀ followed him out of the den for about 30 seconds, returned and licked the cub several times. Shortly thereafter, the ♂ extended his head into the den, sniffed the ♀'s genital area, backed up to the entrance and marked it by urinating. He then treaded

with his back feet and walked out of the camera range. The ♀ proceeded to groo cubs and then exhibited Flehmen (HEMMER 1968).

During the next few minutes, there was an abrupt change in the behavior parents. This period was characterized by frequent movements in and out of th and several instances of cub transport. The decision to remove the cub was ma 3.50 hours when the ♀ graped it roughly in her mouth, shook her head, dropped i side the den and then walked away. The cub's weight at the time of removal was 7

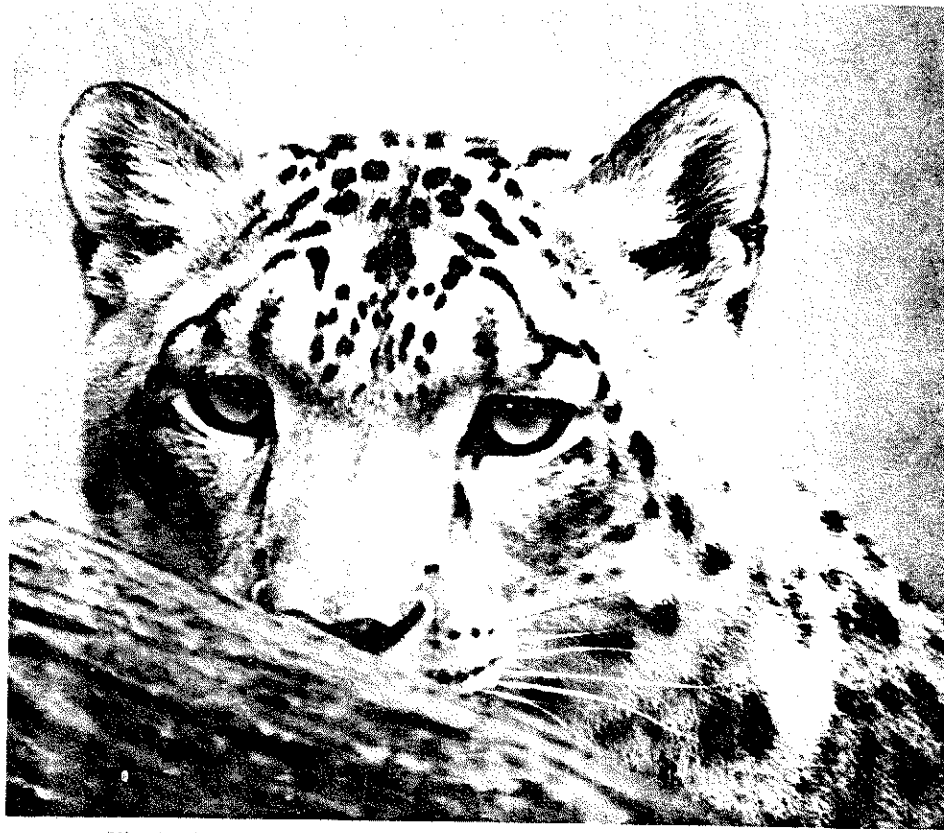

Fig. 2. An adult ♀ snow leopard peers over a log in her enclosure at Seat Woodland Park Zoo. Phot.: HENRY D. KLEIN

A litter of lion cubs (*Panthera leo*) was born on the same night and on 16. V 5 days of age, a ♂ was taken from this litter and placed with the snow leopard i incubator. This action was taken in an attempt to minimize some of the negative ef often associated with hand-rearing (e.g. imprinting on humans). At the time of t introduction, the snow leopard weighed 992 gr and the lion 2013 gr. A heating covered with a soft furry fabric, was placed in the incubator and upon its insertion immediately crawled up to it and slept in close contact.

At 4 weeks, observers noticed that the lion was sucking on the snow leopard's area and ears. The snow leopard attempted to escape from the lion by walking around the container, making a high frequency "chirping" vocalization

it was thought that the heavier and more active lion was not allowing the snow leopard enough time for passive sleep. For this reason, the cubs were separated for 8 hours every night over a 2 week period. During the separation both cubs slept soundly through the night. After 2 weeks, the snow leopard's weight had increased from 1616 to 2622 gr. This gain in weight, combined with further locomotor development, gave the snow leopard greater success in avoiding the lion and made the nightly separations unnecessary.

Fig. 3. While being weighed, this 5 months old cub displays a facial expression typical of threat. Note the flattened ears, bared teeth and dilated pupils. Phot.: HENRY D. KLEIN

Both the lion and snow leopard were given Esbilac formulas (see Table 5) from birth. After drinking the formula from a bottle, each was given a pacifier. From one to approximately three weeks of age, the snow leopard spent an average of 13 minutes bottle-feeding and another 15–16 minutes on the pacifier. The first snow leopard cub ("*Pushkin*") was introduced to semisolid food at 17 days and the second ("*Rimsky*") at 19 days. The mixture was composed of Esbilac and a small amount of canned feline Zu Preem. This formula was fed with an eyedropper. The earliest recorded instance of self-grooming occurred at 4 weeks when one of the cubs licked the webbing of his forepaw to remove some spilled formula. Table 1 pairs some other important behavioral and morphological features with the time they were first observed for "*Pushkin*" (♂).

Fig. 4. One of the 3 cubs born in 1975 pauses after a play session with its mates. Phot.: HENRY D. KLEIN

Table 1. Morphological and Behavioral Development of a Hand-reared ♂ Leopard

Behavorial or morphological feature	Age in days
Eyes open (complete)	11
Ears open	15
Claws retract	26
Umbilicus off	11
First teeth (top middle incisors)	18
Defecates without stimulation	25
Stands and walks	17
Washes face with paws	49
Holds tail up	47
Eats solids voluntarily	48
Laps liquid from pan	43
Sits up, plays with towel	36
Play stalk and chase	52

In 1975, steps were taken in an effort to provide the ♀ with optimal conditions. Both adults were moved to a larger 13.4×11.0×4.1 m high enclosure (Fig. 1, b) adjoining three 3×3 m high indoor cages (Fig. 1, c, d, e). Two of these cages (c and d) contained a 2×1×1 m high nestbox each with a 55×36 cm entrance (Fig. 1, f and g). The floor of each box was covered with straw. False ceilings allowed for the installation of closed circuit television cameras and illumination was provided by a 40 watt shielded red light. Two other cameras, mounted on the walls of the cages, provided a view of the floor areas.

Since their arrival, the ♂ and ♀ displayed what appeared to be a strong bonding tendency (Freeman 1975). However, due to the ♀'s reluctance to care for previous offspring, it was decided to separate the pair shortly before the birth of the third litter. In order to minimize some of the stress which might be associated with this procedure, the ♂ and ♀ were separated for one day a week beginning in January. Although separated physically, they still had visual access to each other through a wire mesh screen.

On 2. V. 1975, a litter of three cubs was born ("*Piotr*" ♂, "*Pavel*" ♂ and "*Marya*" ♀). The ♀ and cubs were left totally undisturbed for 2 weeks; however, extensive behavioral observations were conducted through the video monitor. During this period, the cubs oriented themselves towards their mother, spending the majority of their time in nursing or sleeping. Two weeks after birth, the ♀ was allowed to rejoin the ♂. On their meeting, affiliative behavior predominated and no indications of aggression were observed. While the ♀ was absent, the cubs were weighed, sexed and marked for individual recognition

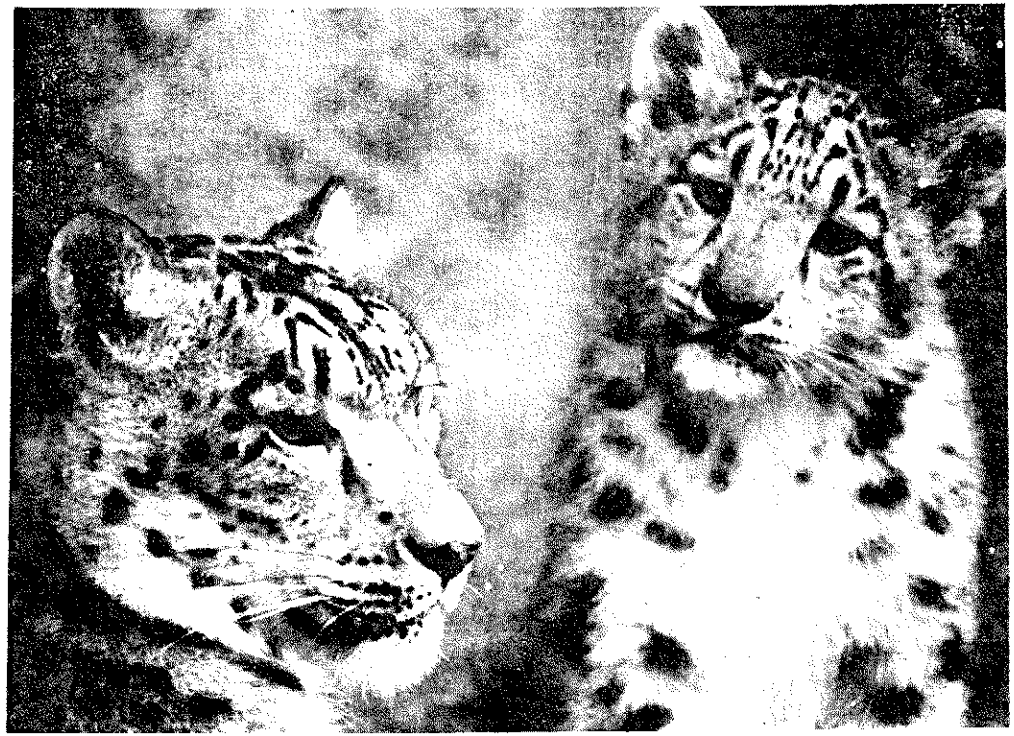

Fig. 5. While in the outdoor enclosure, the mother and cubs were usually in close

by shaving different areas of the body. At 2 weeks of age, the young ♀ ("*Marya*" the smallest at 1.35 kg, while the ♂♂ ("*Piotr*" and "*Pavel*") were at 1.41 and 1. respectively. After weighing, the cubs were replaced and the ♀ was allowed to re- the denning area.

The cubs were first observed engaging in social play at 16 days of age and groo themselves at 4 weeks. They did not begin to leave the nestbox regularly until were 5 weeks of age and were not allowed into the open-air enclosure until 9 The adult ♂ was visible to the cubs through a wire mesh screen and a number of actions involving nose contact and Prusten (Schaller 1967) vocalizations were obse In November, when the cubs were 5 months old, the ♂ was allowed to join the f group. He has since been seen soliciting play behavior and grooms the cubs frequ A more detailed article describing the birth and development of this litter is curr in preparation (Freeman and Hutchins; in prep.).

II. Survey Results

When the first snow leopard was born at Woodland Park, it became immed apparent that little information existed on the captive management of this sp In an effort to solve this problem, a questionnaire regarding the care of snow le cubs was sent to 20 zoos having births prior to and during 1973; 10 replies were rec A total of 33 litters, representing 59 individual cubs were reported in the survey figure includes the 1974–1975 litters at Woodland Park and the 1975 litters at the homa City and San Antonio Zoos. Previously published information from the St. Zoo (Freuh 1968), Lincoln Park Zoo[1] (Kitchiner, Merrit and Rosenthal 1977 Kaunas Zoo in USSR (Marma and Yunchis 1968) was combined with survey d order to obtain a more comprehensive picture. Unless otherwise indicated, data on breeding programs were obtained from the above references. Inclusion of this inf tion raised the total number of litters under consideration to 47 and number of indiv cubs to 96. Table 2 lists to zoo location, zoo identification code, sex ratio, date of and source of information for each litter.

Table 2. Zoo Location, Zoo Identification Code, Sex Ratio, Date of Birt Source of Information

Location	Code	Number and Sex in litter	Date of birth	Source
Alberta Game Farm (Canada)	AG	1,1	24. 5. 1973	Surve
Brookfield Zoo (Chicago, USA)	BR	1,1/1 1,1 0,2 1,1 1,1 1,0	17. 5. 1968 24. 5. 1969 23. 5. 1970 24. 5. 1971 6. 6. 1972 14. 5. 1973	Surve
Cincinnati Zoo (USA)	CN	1,0 1,0 3,0	6. 5. 1969 12. 5. 1972 27. 6. 1973	Surve

Table 2 (Continued)

Location	Code	Number and Sex in litter	Date of birth	Source
Kaunas Zoo (USSR)	KN	1,1 1,1 1,2 1,1 2,2 1,0	21. 6. 1962 4. 6. 1963 15. 4. 1964 24. 4. 1965 22. 4. 1967 1. 5. 1967	Marma and Yunchis 1968
Krefeld Zoo (Federal Republic of Germany)	KR	2,0 1,0	13. 6. 1966 26. 5. 1968 6. 6. 1970	Survey
Lincoln Park Zoo (Chicago, USA)	LP	1,2 1,0 0,2 2,1 0,2	30. 5. 1962 28. 5. 1967 20. 5. 1973 24. 5. 1973 28. 5. 1973	Kitchner, Merrit & Rosenthal 1975
Oklahoma City Zoo (USA)	OC	0,2 1,1 1,1 0,2 1,1 1,1	27. 5. 1966 27. 7. 1967 21. 7. 1968 27. 5. 1972 15. 5. 1973 23. 5. 1974	Survey
San Antonio Zoo (USA)	SA	1,0/1 2,0 0,3	11. 6. 1972 25. 5. 1973 14. 6. 1973	Survey
San Diego Zoo (USA)	SD	0,0/1 0,0/1 0,0/1 0,0/1 0,0/1	19. 5. 1963 20. 5. 1963 12. 5. 1964 21. 7. 1967 1. 8. 1969 (Found dead)	Survey
San Francisco Zoo (USA)	SF	0,2 2,1 2,0/1	1. 6. 1967 19. 5. 1969 30. 4. 1971	Survey
St. Louis Zoo (USA)	SL	4,0 1,2 1,2/1	9., 10., 12. 5. 1965 (Staggered births) 9. 5. 1966 6. 5. 1967	Freuh 1968
Woodland Park Zoo (Seattle, USA)	WP	1,0 1,0 2,1	23. 5. 1973 11. 5. 1974 2. 5. 1975	Survey

The earliest birth uncovered in the survey was 30. IV. (SF) and the lates 27. VII. (OC). San Diego reported finding the carcass of a cub on 1. VIII. 1969, b actual date of birth remains unknown. Taking the previously published inform into account, the earliest birth would be 15. IV. (KN). The majority of births oc in May (62%), concurring with the results of a previous study (Freeman, in All others occurred in April (9%), June (21%), July (6%) and August (2%). The n of cubs per litter was most frequently 2 (43%), followed by a litter of one (30 (21%), and 4 (6%). Up to 5 cubs per litter have been reported (Hemmer 197 none of this size were detected in the available data. The overall distribution o according to sex was 49 ♂♂, 41 ♀♀ and 8 unknown. Of the 47 total litters, 12 co exclusively of ♂♂, 8 exclusively of ♀♀, 20 were of mixed sex and 7 were unkno questionable.

Incidence and Reasons for Hand-rearing

Hand rearing has been, and evidently still is, a relatively common procedu raising captive-born felids. In many cases Zoo personnel have no choice but to r a cub that is being mistreated or neglected by the parents. However, recent de mental studies on mammals have shown that inadequate socialization and/or impr can result in modifications of social behavior which may even affect later sexua ference (Fox 1968). Due to the problems often associated with this procedur authors' survey included questions concerning both the frequency of occurren reasons behind the hand-rearing of snow leopards.

Out of the 12 zoos under consideration, 4 hand-reared all of their cubs (SA LP, SL), four allowed the ♀ to raise her litters (KR, SF, KN, CN), 2 hand-reared litters and let the ♀ raise others (WP, OC), one successfully introduced the adult ♂ the cubs were 5 months of age (WP) and one allowed both ♂ and ♀ to remain in t closure throughout the cub's development (AG). For those zoos which respon the questionnaire, the reasons and/or justifications for the removal and hand-r of cubs were highly variable. One zoo reported having limited facilities and a l confidence in their primiparous ♀ (OC), and 4 cited suspected neglect or mistrea by the parents (SA, WP, BR, LP).

Cub Mortality

Few authors have commented on the reasons for mortality in captive snow le and most data currently available probably concentrate on adult individuals. (1973), for instance, cites feline enteritis and pneumonia as the most frequent ca death. Marma and Yunchis (1968) characterize the snow leopard as being highl ceptible to enteritis, pneumonia and endo-parasites. One author (Petzsch, ci Marma and Yunchis 1968) has also mentioned tuberculosis as a factor. Data o mortality collected from the authors' survey and the previously published lite were combined in Table 3. Although the reasons varied considerably, it is inter to note that the most frequent causes of death were abortions and stillbirths (1 and mistreatment by the parents (16%). These factors were closely followed by monia (11%) and enteritis (8%) as the major killers of young snow leopards.

Temperature and Humidity Range of Incubator

Incubators were used by several zoos for newborn snow leopards. A range of

Table 3. Cause of Death, Number of Deaths, Percent of Total and Location of Zoo

Cause of Death	Number	Percent of Total	Location
Aborted or Stillborn	6	16	KN (2—)*, SD (1) BR (2), SA (1)
Killed by Parent	6	16	KN (1), SD (4), SL (1)
Pneumonia	4	11	SL (1), LP (2), SF (1)
Enteritis	3	8	BR (1), SL (1)
Internal Deformities of the Digestive Tract	3	8	KN (3)
Interstitial Nephritis	2	5	BR (2)
Suffocation	2	5	SF (2)
Severe Anemia	1	3	BR (1)
Ruptured Bladder	1	3	CN (1)
Possible Nutritional Deficiency	1	3	BR (1)
Heart Defect	1	3	SL (1)
Empyema	1	3	SL (1)
Respiratory and Cardiac Arrest During Anesthesia	1	3	SL (1)
Unknown	6	16	SL (1), LP (3), OC (2)

* Marma and Yunchis (1968) report that a nervous ♀ aborted and ate an unknown number of cubs during the night.

its cubs at the lowest temperature, with the incubator turned off and the room heated to around 20—22°C; the relative humidity was 50%. Interestingly, the highest temperature was kept at another Chicago Zoo, Brookfield, where newborn (up to 2 weeks of age) were placed in an incubator set at 32.2°C and 50% humidity. During the warmer summer months, the Oklahoma City Zoo used an incubator which was not in operation. The cubs were placed inside the container on top of a heating pad (set on "low") and wrapped in cotton blankets. The temperature was usually between 26.7 and 29.4°C. During the winter, the cubs were kept in an operable incubator and the temperature again maintained between 26.7 and 29.4°C. Humidity was not maintained at a specific level in either summer or winter. The San Antonio Zoo kept its incubator set at 28.9°C for newborn, but humidity was not measured. When the cubs were 3—4 weeks old, humidity was recorded at 65%. Woodland Park lowered its temperature setting over a 2 year period. In 1973, the incubator was maintained between 25.6 and 26.7°C at 66% humidity, while in 1974, the range was dropped to 22.2—24.4°C at 64% humidity. Freuh (1968) has stated that cubs more than 2—3 weeks old should be protected from becoming too hot. He stresses holding the environmental temperature below 29.4°C.

Hair Loss Problem

One of the questions included in the survey concerned the incidence of hair loss in snow leopard cubs. 5 of 7 respondents (OC, WP, BR, LP, SA) reported the onset of excessive hair loss a few days after birth. The time of onset was variable, with one zoo reporting initial loss of hair at 7 days (WP), one at 12 and 22 days (SA) and one at 10 days (LP). The 2 zoos which did not experience this problem were also those in which the mother raised the young (AG, CN), suggesting that this condition may be caused by a nutritional deficiency in artificial formulas. However, since no study has ac evaluated he cause of hair loss, other possibilities might be high environmental tem ture in the incubator or a lack of maternal grooming. One zoo (WP) observed ha in its hand-reared litters, but not in its mother-reared. Officials at the Oklahom Zoo found no indications of infection in skin cultures prepared from afflicted nu reared cats and did not consider hair loss a serious problem. Lincoln Park rep having observed this condition in other species of cold climate felids. A spokesm the San Antonio Zoo noted that, when their cubs were 4 weeks of age, hair grew rapidly when the humidity was maintained at 65%. Woodland Park, however, ob the same results by increasing the amount of fat in the diet. This was accomp through the addition of butter and Liquid Glo-Coat.

Rectal Temperature Range

Due to the lack of published information, a question concerning the rectal t rature range of snow leopard cubs was included in the survey. A contradictory difference between the lowest and highest temperatures was found. Table 4 summ the results.

Table 4. Rectal Temperature Range of Snow Leopard Cubs in Degrees Cent

Location	Temperature Range in Degrees Centigrade	Notes
BR	36.1—38.1	Normal Range
LP	32.2—33.0	At Birth
OC	37.1—37.5	
SA	37.0	3 Weeks, With Cold
WP	37.3—38.0	First 3 weeks

Discussion

One of the purposes of breeding endangered species in captivity is to provi option of reintroducing them back into the wild (Martin 1975). In the case of th leopard, certain goals must be established if the species is to survive. Some obje such as the modification of existing zoo facilities, may be relatively easy to accom while others, such as facilitating normal social behavior and the ability to c and kill prey (Bogue and Ferrari 1976), may be much more difficult.

Based on data presented in this paper, several preliminary suggestions can b mulated. The first and most obvious recommendations involve methods for re the incidence of mortality in captive-born snow leopards. Until zoos are able te these animals readily, few will be willing to risk any attempt at reintroduction presented in Table 3 would suggest that the major causes of death in young leopards are directly related to behavioral stress (i.e. abortions, stillbirths and abuse). An animals' resistance to certain viral, bacterial and parasitic d be lowered if it is continually subjected to overly stressful cond

Table 5. Formulas and Supplements for Hand-reared Snow Leopard Cubs (Birth — 8 weeks)

Location	Formula at birth	Formula at 4 weeks	Formula at 8 weeks	Supplements
BR	Esbilac (Powder Mix)	Esbilac (Powder Mix) with Carnation milk and water (1:1)	Liquid Esbilac; Solids Started	Visyneral Vitamin Drops; Calcium Gluconate
LP	KMR diluted with destilled water	KMR: Full strength	KMR: Full strength Feline Zu/Preem Diet	Additional calcium provided with solid foods
OC	KMR: 22 ml every 3 hours from 6.30 to 0.30 h	KMR with addition of 2 eggs per can; fed 6 times daily	Zu/Preem Feline Diet after 9 weeks	Birth to 2 weeks: 0.3 cc Pedavite per day, 2–5 weeks: 0.6 cc Pedavite per day
SA	KMR diluted 1:1 with distilled water		KMR undiluted, 177 ml 3 times daily. Zu/Preem Feline Diet	abdec
WP	Esbilac and boiled water (1:1)	Esbilac (from bottle); Zu/Preem Feline Diet gruel mix (from syringe)	Esbilac (from bottle); Zu/Preem Feline Diet (from pan)	0.3 cc abdec per day beginning at 12 days of age, 0.25 cc liver blood beginning at 13 days of age, 0.1 cc Vitamino in each bottle of Esbilac beginning at 2 weeks of age. 3 cc Liquid Glo-Coat and 4 grams of butter per day increased at the rate of 1 cc per pound per cub.

In a recent survey of small felid breeding, EATON (in press) found parental to be the most frequent reason for cub mortality and suggests that environm characteristics provide the key to successful mother-rearing. Indeed, success in pagating captive felids probably rests largely upon providing the ♀ with secure roundings before, during and after parturition (KLEIMAN 1975, SADLIER 1975). R developments in the field of sociobiology (WILSON 1975) would suggest that feta sorption infanticide and cannibalism may not be "pathological" but instead repr behavioral or physiological strategies evolved to deal with environmental situatio which the young have little chance for survival (e.g. at times of low food availa or when the den has been disturbed). Thus, by providing inadequate facilities a care programs, zoos may be simulating environmental conditions responsible for gering what are normally adaptive phenomena in the wild.

Two immediate steps which could be taken to eliminate the problem of str captive ♀♀ are the use of closed circuit television and provision of alternate den Closed circuit television is extremely useful in that it allows a view of the ne interior, while at the same time eliminating the need for disturbance. Providing nate dens gives the ♀ an optional site in which to hide the young. Under stressfu ditions, ♀ felids and canids often resort to excessive cub transport, which when ca to its extremes, may result in severe injury or death (J. FOSTER, DVM, pers. co

One major goal of any zoo's breeding program should be to facilitate the develop of normal species-typical behavior in their captive-born animals. In mammals, su ful mother-rearing is a necessary pre-requisite for normal social development, as rearing may have many adverse affects. Sexual imprinting on humans, for inst is a relatively common phenomenon in the traditional zoo situation (HEDIGER 1968). Thus, when breeding endangered species, zoos must give some considerati the future reproductive capabilities of their animals or they will subsequently de their chances for 2. and 3. generation births. Another reason that mother-rearing s be encouraged is that the mother's milk contains antibodies which protect the y from infection until their own immune systems begin functioning (SCOTT, in p It is possible that the incidence of many viral or bacterial infections in young leopards could be lowered considerably if mothers were allowed to rear their offspring.

Another important consideration for zoos is whether or not to leave the ♂ leopard with the ♀ when births occur. There is a strong suggestion that snow leo unlike most felids, may sometimes form monogamous pair bonds in the wild (FRE 1975, EATON, in press). If this is the case, the ♂ may play an important role in the r of the young. Indeed, behavioral observations of ♂-offspring interactions at the W land Park Zoo and Alberta Game Farm (OEMING, pers. comm.) would seem to su this possibility. In both locations, wild-caught ♂♂ were highly tolerant of cub groomed them frequently. Further, the ♂ at Woodland Park was also observed soli play and engaging in other types of friendly interaction (e.g. head-rubbing and pru there were no indications of aggression.

If the pair-bond hypothesis is substantiated through future research, it could important implications for captive management. According to KLEIMAN (1975 tating [illegible] of species in which the ♂ plays a part in the rearing of the young shoul be isolated, as it appears to have a negative effect on their reproductive success. eve[illegible] until more information is collected on this subject, zoos should take care in

cising their option to leave the ♂ with the ♀ and cubs. Obviously, if the group is kept in a sub-optimal habitat and maintained under an improper care program, the animals may be stressed and behavior will be less predictable.

It is interesting to note that the survey turned up data which was highly variable and sometimes contradictory (see Incubator settings and Rectal Temperatures). This fact, combined with the realization that information from the natural habitat is minimal and that the already endangered wild population is diminishing rapidly, underscores the need for long-term management studies. Individual zoos can no longer afford to stand alone in their conservation efforts, but instead must join with others to insure the preservation of this magnificent and irreplacable species.

Products mentioned in the text

1. abdec Baby Vitamin Drops
Parke Davis and Company
Detroit, Michigan, USA 48232

2. Carnation Milk
Carnation Company
Grocery Products Division
225 108th Northeast
Bellevue, Washington, USA 98004

3. Concord CTC-30 Video Camera
Benjamin Electronic Sound Corp.
Farmingdale, New York, USA

4. Esbilac (Liquid and canned)
Smith-Douglas Division of Borden Chemical
Borden, Inc.
Norfolk, Virginia, USA 23501

5. KMR — (Kitten Milk Replacer)
Borden, Inc.
Norfolk, Virginia USA 23501

6. Liquid Glo-Coat and Vitamins
Hart-Delta, Inc.
5055 Choctaw Drive
Baton Rouge, Louisiana, USA 70805

7. Pedavite
Luar Pharmaceutical Company
915 S. 21st
Suite A 1
Hollywood, Florida, USA 33020
305() 920-7921

8. Visyneral
US Vitamin Pharmaceutical Company
1 Scarsdale Rd.
Manati, Puerto Rico 00701
(914) 779-6300

9. Zu/Preem Feline Diet
Riviana Foods Inc.
Hills Division
Topeka, Kansas, USA 66601

10. Calcium gluconate
Holmes serum Co.
Chicago, Illinois, USA

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Helen Freeman and Michael Hutchins, Woodland Park Zoological Gardens, Seattle, Wa. 98103 (U.S.A.), and Department of Psychology, University of Washington, Seattle, Wa. 98195 (U.S.A.)