

From Unformed to Unmanageable: Hand raising a Malayan Sun Bear

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HISTORY

On February 16, 1997, an adult female Malayan Sun Bear named Moon gave birth to her first cub in Sun Bear Forest at the San Diego Zoo. This was the first bear cub ever born at Sun Bear forest, and it was quite a surprise to animal care staff. Keepers quickly prepared the special cubbing den so that Moon and her cub could be sequestered together. Moon was attentive, but no nursing was actually observed. The animal care staff was reluctant to interfere with the fragile mother-infant bond between a first time mother and her cub, even for a brief medical assessment. However, on day three, Moon left the cubbing den and did not return. This event provided veterinarians with an ideal opportunity to examine and evaluate the infant. Upon examination, it was discovered that the 3 day old cub had sustained moderate to severe abrasions on all four foot pads. This trauma was presumably caused by the neonate's relentless search for the dam's nipple. Additionally, the blood glucose was low and only very small amounts of milk were aspirated from the stomach, a further indication that the cub's early attempts to nurse from the dam were infrequent or unsuccessful. Veterinarians treated her abrasions, and administered subcutaneous fluids and prophylactic antibiotics. The bandaged cub, a female later named "Niah", was transferred to the Children's Zoo Primate nursery for hand rearing.

VETERINARY CONCERNS

The first few weeks in the nursery were critical for Niah, as they are for most animals being hand reared. Nursery personnel were especially observant for subtle changes in activity, vitality and appetite which would indicate secondary infection. Niah's body temperature and weight were closely monitored. A mild tincture of iodine was applied to the umbilical stump three times daily until the stump had sloughed off and was dry. The erosions and abrasions on the feet pads healed fairly quickly, as our veterinarians made frequent visits to the nursery to change the bandaging materials. Administration of antibiotics continued throughout the healing process and no secondary infection occurred. Niah's claws were trimmed regularly to prevent the sharp digits from becoming entangled in the bedding or incubator grates.

INITIAL HOUSING

Niah was housed in an isolette (human infant) incubator set at 90°F with 70% humidity. Absorbent cotton flannel receiving blankets arranged in a "donut" shape provided a comfortable nest for the cub to cuddle in, and also served to elevate the head. A hot water bottle covered in a flannel receiving blanket was supplied to simulate the maternal body. A stuffed animal surrogate equipped with a recorded heartbeat-sound device was also added to the incubator environment. This auditory enrichment was used to settle the fussy cub between and after feedings. Terry cloth towels were avoided as they can be a hazard. Strings from the towels can be ingested by the eager cub and tiny sharp claws can become snagged or entangled in the terry cloth loops.

FORMULAS

Historically, at the San Diego Zoo as well as at other zoos, bears that have been hand-reared from the first week of life have developed digestive problems. These problems were directly related to the artificial milk formula that they were fed. Artificial milk substrates used in the past resulted in the formulation of lactobezoars and other digestive problems in many individuals. If left untreated, these lactobezoars, the hard, rubbery, indigestible milk curds that form in the cub's stomach, lead to partial or complete obstruction of the digestive tract. The reformulation of a satisfactory artificial milk substrate for Niah was the responsibility of Society nutritionist, Dr. Mark Edwards. The new bear diet that Dr. Edwards prescribed had never been used before. It was the responsibility of the nursery staff to watch closely for the clinical signs that a lactobezoar was forming. In order to definitively monitor the digestive function of this bear cub, belly measurements were taken and recorded several times daily for the first several weeks. We palpated the abdomen for signs of a mass, as well as measuring stool output and character.

FEEDING REGIME

Because of the novelty of the formula, and the incidence of lactobezoars in this species, we were very cautious about Niah's feeding schedule. Dr. Edwards wanted to further reduce the risk of a lactobezoar by not over-filling the stomach. Therefore, feedings continued around the clock for the first 21 days; the overall feeding routine proceeded as described below:

Age Days	Schedule	Percentage of body weight
0 - 20	Every 2 hours, 12 x day	25 - 27%
21 - 23	Every 2 hours, 10 x day, 5:00am - 2:00am	25 - 27%
24 - 28	Every 3 hours, 8 x day, 5:00am - 2:00am	25 - 27%
29 - 34	Every 3 hours, 7 x day, 5:00am - 11:00pm	25 - 27%
35 - 41	Every 3-4 hours, 6 x day	25 - 27%
42 - 56	Every 4 hours, 5 x day, 6:00am - 10:00pm	22%
57 - 83	4 x day	18%
84-90	3 x day	14%
91 - 116	2 x day	9%
117 - 125	1 x day	3%
1 2 6	Weaned	

Veterinarians and Dr. Edwards were consulted each time a bottle feeding was dropped and the remaining feedings adjusted, especially at the beginning of the hand rearing process. The appearance and quantity of the stools were continuously monitored. Throughout the bottle feeding period, milk curds could be clearly seen in the stool. Frequently, the curds appeared as

clumps or twisted ropes; these were surrounded by looser, more homogenized, uniform milk stool.

NIPPLE SELECTION

Bear cubs frequently have a very vigorous nursing response; even from the first days of life. They can easily aspirate milk formula into their lungs if the nipple is too soft, or the hole in the end of the nipple is too large. Special care must be taken to select the proper nipple, and to create a feeding hole of the appropriate size. If the hole is too large, aspiration will occur; if the hole is too small, the cub will not take in enough milk, leading to insufficient weight gains and frustration. Upon admit, Niah was started on a standard Evenflo nipple. There are several thicknesses of Evenflo nipples, and the more rigid ones were selected. The small hole was burned through the latex rubber nipple using a 26g needle, heated to red hot over a gas stove. This nipple was attached to a standard Evenflo bottle, taking care that the ring was tightened as much *as* possible to further control the flow of milk out of the nipple. This arrangement worked well until the animal was two months old. At that time we noticed that she was becoming frustrated, and that her muzzle had grown substantially. We then tried a beige lambing nipple with the smallest prestamped hole available. She used this nipple for all of her feedings except the first one in the morning, because she was so eager about this feeding. Ten days later, we switched her over to a more rigid red lambing nipple with a slightly larger hole; this offered the formula slowly enough, without collapse of the entire nipple.

HANDLING AND FEEDING

As with other hand reared carnivores, a bear should never be allowed to nurse formula while lying on its back. The position of choice is in sternal recumbency with the head elevated. Burping the cub and rubbing her belly after feeding helped to release gas and reduce bloat. Niah was overly-eager at feeding times, frantic to get the nipple into her mouth. Her formula was usually consumed very quickly and afterward she would continue to be anxious, clawing and rooting for more milk. It became necessary to provide a pacifier in order to calm the demanding cub, and the pacifier was employed both before and after each feeding. The pacifier was fashioned for Niah using a standard Evenflo nipple stuffed with tape to prevent airflow out of the nipple. The pacifier was offered both before and after feedings, resulting in a slightly calmer feeding routine. Following the formula intake, we spent time grooming, patting, scratching and holding. The cub eventually became sleepy and relaxed and only then was she returned to the isolate or crib. In addition to suckling at feeding times, Niah engaged in non-nutritive suckling bouts *as* well. The cub made a distinctive humming sound during this behavior. Her favorite spot for non-nutritive sucking was the skin of her handler's fingers or the skin of the arms, and she would root enthusiastically. We tried to discourage this behavior by offering a pacifier at these times *as* well

From the time Niah was first admitted to the nursery and continuing until she was lightly furred, she did not thermoregulate well. Therefore, we needed to keep her warm even during feedings. To accomplish this we used a small portable space heater and fed the cub directly in front of it which prevented chilling. Handlers exercised caution when holding the squirmy cub, because when she was angry or hungry, she could thrash about unpredictably, making her difficult to hold.

EXCRETION

Newborn bears, like other carnivores, must be stimulated to urinate and defecate. When Niah was very young, a warm soft cloth was used to accomplish the stimulation. As the cub became older, we used warm running water in the scrub sink basin until relief was accomplished. This reduced the chance of abrasion sores, and handled the increased stool and mine load more hygienically. Stools ranged in consistency throughout the bottle feeding period. At times the stool appeared greasy with air bubble-like beads, and other times had long strings. The color also changed often, from brown to yellow, without apparent cause. Niah began defecating on her own at one month of age, but we continued to manually stimulate her until she was consistently defecating on her own 2 weeks later.

WEANING PROCEDURES

At 71 days of age, Niah was introduced to solid food. The first item offered, twice daily, was Omnivore biscuits soaked with a little warm formula. Gradually some fruits were added to the gruel mixture such as grape, banana, apple, and steamed yam and carrot. We soon saw that Niah did not appear as eager to eat when her diet items were stirred up together to form a slurry. Instead, she preferred to have only the biscuits and formula offered together, mixed to an "oatmeal" consistency. The fruit and vegetable items were readily consumed when presented in a flat pan, in similar fashion as the adult bears'. Niah's biscuit-and-formula gruel eventually had to be mixed to a offered in a heavy cement-like consistency, or the whole thing would be dumped on to the floor by the anxious cub.

SANITATION AND QUARANTINE PROCEDURES

We considered our newborn cub at risk for infection due to immuno suppression. Niah was deprived of her mother's milk and its protective colostrum content. This made general cleanliness and quarantine considerations very important. Keepers handling the new bear cub wore gloves and long sleeved gowns until fecal cultures and blood exams were completed at one month. The bedding was laundered separately in a mild detergent, and the isolette was kept in a room separated from the rest of our nursery population. The cage furniture, isolate and enrichment items were cleaned on each shift, particularly because the cub was prone to wiping her nose on the isolette and smearing milk particles on her bedding. Once on each shift daily, we wiped the walls of the incubator with a surface disinfectant and broke down the isolette completely twice daily. Once Niah graduated from the isolette, her enclosure was cleaned at least once daily.

CLIMATIZATION AND INTERIM HOUSING

The process of climatization outside of the incubator environment was a gradual one. The first step was to remove the hot water bottle from the incubator at 7 days of age. Next we began a series of steps to reduce the temperature of the incubator. The temperature was reduced from 90°F to 86 at 8 days of age, and down to 82 at 29 days. At 30 days it was further reduced to 80°F. The incubator heat was turned off at 42 days. At this time Niah began spending short periods of time outside the incubator in a warm room (75°-80°F free of drafts). During this time she was placed in a human infant crib lined with Plexiglas, and her flannel receiving blankets and cage furniture were arranged as previously described. She was also provided with a familiar surrogate and a hot water bottle covered in a flannel receiving blanket so that she could choose which temperature felt comfortable to her. Additionally, she was given a large plastic box to simulate the den environment. At first Niah was very frightened by this change and signaled her displeasure with enthusiastic barks and grunts. By day 49 however, she was more comfortable in

the cal and rectal temperatures confirmed that she was successfully maintaining her body temperature. At this time the incubator was completely discontinued.

Niah soon outgrew the crib, and she was moved to a larger box enclosure. This enclosure measured 40" x 72" x 30" tall and was constructed of wood with Plexiglas sides. This afforded Niah more room to move about, however she still was allowed her "comfort" items (IE: hot water bottle, surrogate and the "den") to which she could retreat when startled or tired. When this enclosure began getting too small, Niah was allowed free run of the isolation room in the nursery and only placed back into the wood box enclosure for cleaning, and we then discontinued the hot water bottle. At this point Niah's behavior began to change, and she became more outgoing and assertive. She was active and interested in her environment. She quickly began to tear everything up and it was a challenge to house and properly stimulate this curious but destructive cub.

Niah's ultimate housing arrangements in the nursery were made when she was four months old. This arrangement included two large display windows and an adjoining bedroom area, with guillotine door connecting the two areas. We thought that the exposure to the guillotine door was another important step in alienating her to life in the main zoo. The two large pen areas as well as the sleeping quarters were amended with plenty of perches for climbing, and furnished with large carnivore toys (balls, plastic barrels etc.), as well as a few towels for the sleeping area. Before Niah left the nursery, she succeeded in tearing the plaster from the ceiling in the bedroom area, chewing the wood frames around the windows, removing most of the first layer of laminated wood on the doors, and shredding much of her perching material.

PHYSICAL DEVELOPMENT

Bear cubs are unformed at birth and scarcely resemble the adult. When raising a bear cub from the first week of life, one can observe the many interesting changes that the body undergoes during the neonatal period. These changes occur very rapidly, almost daily at times, and observations were noted by Niah's handlers with a great deal of interest. At 39 days of age Niah's right eye began to open, by 45 days both eyes were open. At 3 1/2 weeks both ears were open and at 6 weeks she began to utter a variety of new vocalizations, each seeming to signal a different emotion. At 4 days old she was creeping belly-down, at 56 days she was crawling belly-raised. At 101 weeks she was making an effort to run and by 12 weeks she was good at it. Her behavior changed at 2 1/2 months when she began following her keepers around the room and clearly recognized them. Niah's eagerness to follow her keepers instead of passively waiting for them to reappear, marked the time when a mother reared cub would be following its mother outside of the den to explore. After this time she became the unmanageable bear and was constantly hungry for exploration, novelty, and social play.

REINTRODUCTION

The teams at Sun Bear Forest and the Children's Zoo began a series of meetings to discuss and plan the eventual transfer of Niah to the Sun Bear Forest area. Animal care staff including veterinary services, Sun Bear Forest keepers and leads, and Children Zoo keepers and managers were all involved in Niah's reintroduction. It was decided that Niah would eventually leave the collection at the San Diego Zoo and be sent to another facility. However, we considered it important to adequately socialize her before leaving.

Niah's reintroduction started very early. When she was just 3 weeks old, we took the first step by playing audio tapes recorded at the bear enclosures at Sun Bear Forest. These tapes included sounds of the keepers and the bear vocalizations. We also provided her with a few tufts of Sun Bear hair and a small log from the exhibit that the adults had used. These items allowed her an early opportunity to hear and smell other Sun Bears. Niah's vocalizations and scents were also presented to the adult bears.

Niah was wary and nervous when she was introduced to an unfamiliar person. When she was 3 months old, we began short introductions to her new keepers at Sun Bear Forest. At first the daily visits were a short 15 minutes in length, but as her tolerance grew we lengthened the visits to one hour.

When Niah was 4 months old we began to acclimate her to the facilities at Sun Bear Forest. We transferred her daily in a crate from the nursery to the off-exhibit Sun Bear bedrooms and sat with her as she surveyed and inspected the area. After she was more comfortable with her surroundings, she spent most of her day there and returned to the nursery only for overnight.

Finally at 165 days, Niah graduated from the nursery and was living at Sun Bear Forest. Niah was consuming an adult Sun Bear diet and was eating well. We continued to carefully monitor her body weight and increase the amount of solids she was offered as her body grew. When Niah was 6.5 months old, she was given the opportunity to enter and explore the large exhibit at Sun Bear Forest with its added interest and many hazards. Niah took these changes in stride well, but continued to prefer the company of humans over the company of other bears.

Next, we attempted to pair Niah with another Sun Bear in our collection. We hoped that another bear might possibly minimize her dependence on humans, and teach her some of the lessons she had missed out on during the hand rearing period. The keepers at Sun Bear Forest selected a mature and gentle female named Dressina. Dressina, a 16 year old who had experience as a mother, was also calm and reasonable. The reintroduction took place in the bedroom area because it afforded keepers the chance to separate the two animals in the event of aggression. At the time of this writing, the two animals are housed together, except during feeding times. There have been occasional spats between the two animals, most notably an incident when Dressina pushed Niah off of a high climbing structure. Generally though, the reintroduction is going well and Niah is adjusting to life as a bear. We are now awaiting shipment permits and the plans are for Niah to join another hand reared male Sun Bear. We hope that the experience she has had with Dressina has helped to prepare her for her future.

CONCLUSION

The San Diego Zoo has had inconsistent success hand rearing orphaned bear cubs from their first week of life. These animals are born very helpless and premature, making the hand rearing process long and complicated. We were successful with this individual, thanks to the hard work of all the animal services personnel who worked with her. The special reformulation of the hand-rearing diet by Dr. Mark Edwards was an integral part of the process and we thank him as we look forward to more success in the future using this diet. We have witnessed a wide variety of stages and developmental changes hand rearing Niah. We have learned much about working with baby bears, a beautiful and unique group of animals every step of the way: from unformed to unmanageable.

