HUMAN INTERVENTION IN THE REARING OF AN INFANT BORNEAN ORANGUTAN (Pongo Pygmaeus Pygmaeus): A FAILED ATTEMPT AT MATERNAL TRAINING OF A BIRTH MOTHER, THE SUBSEQUENT HUMAN HAND-REARING AND A SUCCESSFUL INTRODUCTION OF AN INFANT TO A SURROGATE ORANGUTAN MOTHER

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ABSTRACT

In 2008, the Kansas City Zoo received a Species Survival Plan (SSP) recommendation to breed two Bornean orangutans housed at the zoo's orangutan facility. The breeding was successful and fetal development was monitored regularly through ultrasound. The next year, a female Bornean orangutan named Kalijon was born. Even after months of preparation and a maternal training program, the birth mother refused to let the baby nurse. Although the standard recommendation is to wait seventy-two hours before permanently pulling an orangutan infant for hand-rearing, it was believed that Kalijon's well being was at stake and consequently, she was removed after thirty hours. For the following five months, Kalijon was hand reared by human caregivers twenty-four hours a day. As she developed and her needs changed, a program was put in place to encourage her physical and mental development, ensure her health, and maintain her orangutan identity. During this five month time period, another female Bornean orangutan housed at the Kansas City Zoo was selected as an excellent candidate for surrogacy and was trained to cooperate with staff in Kalijon's continued care once the infant was turned over to her. The introduction was a complete success and considered one of the earliest of its kind.

PREPARATION AND CARE DURING PREGNANCY

In 2008 the Kansas City Zoo received an SSP recommendation to breed TK, a twenty-three year old female Bornean orangutan with Berani, a ten year old male Bornean orangutan. TK had previously given birth to two other offspring at a different institution, both of which had to be hand-reared. Therefore Kansas City Zoo staff knew they were faced with a challenge. TK and Berani were introduced in July of 2008 and instantly took to one another and bonded as a pair.

With her past infants, one born in 2003 and the second in 2006, TK was reported to be a loving and nurturing mother, however, she would not hold either of the infants in a position that allowed him or her to nurse. Despite being dam-reared herself, she preferred to hold the baby on her head or shoulders. Shortly after the 2006 birth, attempts were made to correct the position of the infant by anesthetizing TK and repositioning the baby near the nipple, but each time she moved him back to her head soon after she awoke. After multiple attempts the decision was made to hand-rear the infant as had been done with the infant in 2003.

Keeping TK's history in mind, TK's trainer started her on a rigorous maternal training program within

one month of introducing her to Berani in hopes of teaching her to care for her own baby or to allow keepers to assist her in caring for the infant. Other challenges keepers faced included TK's indifference to training, her short attention span, and a disconnection from keepers. She had also demonstrated a limited ability and/or inclination to offer new or creative ideas necessary to develop new behaviors. Unlike other orangutans, she rarely seemed to experience the "ah-ha" moment where what is being asked of her suddenly clicks and the new behavior is formed. However, she was food motivated. By consistently doing short sessions at least once daily for the duration of about eight months, TK did learn eight of the nine behaviors asked of her.

In addition to preparing for the infant's care after birth, staff also wanted to monitor the progress of the fetus during pregnancy. Therefore, at the same time that TK was learning maternal behaviors, she was also being trained for ultrasound procedures. Keepers and animal health staff had great success meeting this goal and were able to perform an ultrasound on TK with her complete cooperation approximately once per week during the last fifteen weeks of the pregnancy. A simple approach guided by her natural inclinations was used.

Ultrasound Training

The basic behavior for ultrasounds was *present* (the abdomen to the mesh), but some desensitization also had to be done with the gel, the probe, and the animal health staff. Due to the large size of TK's belly, her lower abdomen could not be accessed even with her belly pressed to the mesh. Using an already established behavior, *toes*, in which she sticks her toes through the mesh, her trainer began asking her to present the toes gradually higher and higher, presenting a clearer view of the lower abdomen. The next step was to ask her to present her belly while holding the toes through the mesh about a foot or so off the ground. With one foot elevated, the only part of her belly she was able to press to the mesh was the lower abdomen. Next trainers worked on holding this position for increased amounts of time up to ten minutes or so. Five to ten minute holds seemed to be plenty of time for the vet staff to monitor fetal activity and capture still images used to measure growth. In all, fourteen ultrasound sessions were completed. The preparation and training allowed staff to acquire excellent images with minimal stress to TK throughout the pregnancy.

Maternal Behaviors

These maternal behaviors were developed to deal with an array of possible foreseeable situations and were taught using basic positive reinforcement training.

1. ***Feed the Baby*:** Mom is required to press her nipple through the mesh or larger portal while the trainer uses his or her fingers and warm water to simulate suckling. A small orangutan stuffed animal (the "baby") is held up to the nipple to mock the feeding of an infant through the mesh.
2. ***Take*:** The trainer offers the "baby" to Mom through a six inch round portal in the mesh. Mom is required to take the "baby" from the portal and hold it until given further instruction.
3. ***Get the Baby*:** Mom is asked to retrieve the "baby" from anywhere in her stall and bring it back to the front to her station.
4. ***Give*:** The "baby" is handed back to the keeper through the portal in the mesh.
5. ***Show*:** Mom holds the "baby" up against the mesh and allows the keeper to touch and examine it.

6. ***Bottle*****:** Mom executes the *show* behavior with a hold, allowing the keeper to feed the "baby" a bottle of formula.
7. ***Other*****:** Mom adjusts the "baby" by turning it around or over when holding it in the *show* behavior, allowing the mouth to be accessed for feeding or any other part of the body to be examined if necessary.
8. ***Pump*****:** Mom presses either breast to the six inch portal in the mesh and allows a breast pump to be used to extract her milk.
9. ***Nurse*****:** Mom picks up the baby and holds it near her breast to allow baby to find the nipple.

The *nurse* behavior is the only skill trainers were unable to teach TK despite taking several different training approaches. Although TK performed the *pump* behavior quite well, milk was never extracted due the fact that the portal was not big enough to easily accommodate the pump and achieve the proper seal required for the pump to work.

Other Husbandry Considerations

After consulting the SSP, animal managers decided to separate TK and Berani about ten to twelve weeks before the birth of the baby. Knowing that their separation would be stressful to both orangutans, it was hoped that an early separation would keep them from associating the experience with the infant. In addition, keepers wanted to minimize this type of stress in the latter stages of TK's pregnancy. The separation was also beneficial to TK's training. She was able to focus better without the distraction of a cage mate during the sessions.

In the final weeks of pregnancy, TK was housed in a heavily straw bedded stall (one to two feet deep covering entire stall) and only moved for cleaning. Two cameras with different views of the stall were set up in order to record the birth. With daily enrichment added, she did not seem to mind the single stall and the consistency seemed to provide increased cooperation and comprehension of maternal behaviors and ultrasound training.

Consistent weights were taken and recorded throughout the pregnancy. (See Figure 1) When her weight dipped slightly in the second month, a diet increase of ten percent was deemed necessary. At the veterinarian's recommendation, onions, garlic, and hot peppers were eliminated from her diet and enrichment in later stages of pregnancy. TK was not given any additional vitamins or supplements.

HAND REARING

Separation from Birth Mother

Kalijon was born on April 24, 2009. It was observed that TK was nurturing to Kalijon, however would not let her nurse. TK had possession of Kalijon for at least thirty hours during which maternal training was attempted, but was ultimately unsuccessful. TK cooperated somewhat by leaning toward the mesh with her head where Kalijon was clinging tightly, but she refused to remove or reposition the baby. There were a few instances when Kalijon was close enough to the mesh to drink from the bottle; however, she was not able to take a significant amount. Based on veterinarian assessments of the infant's health, animal management made the decision to anesthetize TK on the afternoon of April 25, 2009 and pull Kalijon. During the anesthetization, Kalijon was able to nurse and receive colostrum. Rather than returning the infant and giving TK

another chance to properly care for her, the decision was made to temporarily hand rear Kalijon based on TK's behavior and her past failures to feed the infant even after anesthetizing.

Plan for Twenty-four Hour Care

A plan for twenty-four hour care was then implemented. No specific deadlines were created in order to maintain flexibility throughout the process. Human caretakers in this plan included ten main animal keepers, a handful of other animal keepers that covered a shift here or there, nine supervisors/managers, and eleven docents. The first couple of days were divided up between the same four caregivers to help with consistency and then all the rest of the caregivers were worked into the schedule to help avoid any imprinting. The day was split up into several different shifts. The docents had her during the work day period, which were usually divided into two different slots from 8:00 am to noon and noon to 5:00 pm. During this time an animal keeper was always in the building to supervise, assist, and answer any questions if needed. From there a supervisor or manager would take her from 5:00 pm to midnight, followed by a keeper coming in from midnight to 8:00 am. Brown, fuzzy vests were worn by all caregivers to encourage Kalijon to naturally grab and hang on as she would with her real orangutan mom. Trying to keep the experience as natural as possible, diapers were never used. Kalijon was kept in the orangutan building at all times and had constant body contact. She was never placed in an incubator. One of the orangutan stalls in the building was set up as a nursery for the caregivers. It was decided that staying in the building was the most beneficial to Kalijon because she could always see, smell, and hear the other six orangutans the zoo housed. It is believed this exposure was essential to helping her identify herself as an orangutan and initiating a bond with the other orangutans. The exposure was gradually increased and eventually even gentle touches with the other orangutans through the mesh were encouraged. Kalijon was also introduced to a lot of the same environmental objects like fire hoses, ropes, and enrichment items that she would have had exposure to if she were not hand reared.

Exercise Program

At three weeks old, an exercise program for Kalijon was initiated, which involved staff holding her up by her hands and having her do mini pull ups to strengthen her muscles. Sessions of about five minutes at least four times a day were done. Also for muscle development, caregivers encouraged her to hold onto the fuzzy vests while they decreased their support provided for her. Over time, caregivers reduced support from a hand under her bottom, to a hand on the small of her back, and then eventually to no support at all once she was holding on completely. After Kalijon was more active, a mini jungle gym was constructed out of rope and PVC tubing to help her develop climbing skills. The structure also encouraged her independence and cognitive development through play.

Obtaining Daily Weights

Daily weights of Kalijon were obtained at 3:00 pm during the hand rearing time period. (See Figure 2) In order to obtain these weights, caregivers would have Kalijon grab onto a toy stuffed-animal orangutan, wrap her in another vest or blanket, and then place her in a basket on a scale.

Feedings

As is common when orangutan infants are put on human baby formula, Kalijon had digestion and constipation problems early on. Therefore, only Similac brand formula was used, but different proportions and dilutions of low iron and full iron formula were utilized throughout the first two

months to help Kalijon adapt. (See Table 1) Until she was seven weeks old, Kalijon was given a bottle whenever she acted hungry. At seven weeks, a feeding schedule was put into action. From then on, a bottle was only offered at specific times throughout the day. If the bottle was refused, a fifteen minute time out occurred and then only one more offering was given. If neither opportunity was taken, she would have to wait until the next scheduled feeding. Over time, the feeding schedules were manipulated to decrease the daily amounts of bottle offerings and increase the amount of formula offered per feeding. (See Table 2) Although the number of feedings and formula amounts changed, the average total intake of formula every day only slightly increased (See Figure 3). A small bell was rung before every bottle feeding for association purposes to aide staff in possible future challenges within feedings after she was introduced to another orangutan. For example, if whatever orangutan Kalijon was housed with would not turn her face to the mesh for a bottle feeding, the keeper would ring the bell in hopes that Kalijon would hear it and start to look for the bottle herself. Kalijon was always good about recognizing feeding times and there was never a problem getting her up to the mesh correctly, so the bell was never relied upon later. A smaller, portable three foot by three foot mesh station was also constructed to desensitize Kalijon to taking a bottle through the mesh since formula would still be necessary for many months after putting her in with another orangutan. The design was very useful because the feedings could be done in any desired location. Kalijon was also given chunks of carrots for teething purposes and was started on soft, mushy solid fruits like bananas and grapes when she was three months old. Her first two bottom teeth broke through at about four and a half months old.

Hernia Surgeries

During the course of the hand rearing period, Kalijon had to undergo two different hernia surgeries. The first surgery took place at three months old when two different hernias, one umbilical and one inguinal, were repaired. The umbilical hernia was noticed early on but was not going to be repaired unless Kalijon had to be anesthetized for another cause. When the second, more serious inguinal hernia was noticed, the decision was made by management to repair both hernias. The second surgery occurred at four and a half months old when the cranial portion of the first inguinal hernia site was repaired. After each surgery, there was a time frame of about a week and a half where Kalijon was not exposed to any form of her exercises and her mobility was kept as limited as possible.

Separation Training from Caregivers

Near the end of hand rearing, a separation training plan was implemented working toward getting Kalijon tolerant of being completely off human caregivers and comfortable with being left alone to eventually get her into a stall with another orangutan. Initially, caretakers attempted to place Kalijon on her play area and then remove themselves of any visual contact. Kalijon became extremely stressed and this resulted into her clinging on harder than ever, not even wanting to play on her jungle gym with a caretaker right next to her. Therefore another more gradual separation approach was taken. Keepers started by having her play on her jungle gym or a play area while sitting next to her and then gradually moving away in small amounts. When Kalijon would throw a fit after realizing the caregiver was not present anymore, the caregiver would scoot closer or re-enter the area until she calmed down and then start with the separation process again. The hope was that when she was left in the introduction stall alone, she would not be screaming and distraught when the other orangutan entered the stall, and ultimately would not upset or appall that orangutan.

SURROGATE MOM

The initial plan was to hand-rear Kalijon for a minimal amount of time then return her to TK and implement maternal training. Immediately after she was pulled for hand-rearing, TK was housed in the stall next to the stall set up as a nursery. She could see Kalijon from a high mesh transfer door and a low mesh transfer door twenty-four hours a day. TK was encouraged to watch feedings, touch, and interact with the infant. Unfortunately, her interest was very minimal. Eventually she only came to see Kalijon if a food reward was present, and then progressed to grabbing at her somewhat aggressively.

The decision was made not to return Kalijon to TK, and TK was immediately started on birth control. About a month later, she was reintroduced to Berani, the baby's father. She seemed very content to be back with him after a five month separation and no longer showed any interest in the infant. Staff anticipated the possibility of anxiety or depression once she realized the separation from the baby was permanent. However, no signs were ever observed that she was upset in any way.

Fortunately, another female, Jill, age thirty-three, took a strong interest in Kalijon. Jill has successfully mothered three infants of her own. In addition, she is an exceptionally bright and cooperative individual. So the decision was made to start preparing Jill as a surrogate mother.

In order to prepare Jill to care for Kalijon, she was first separated from the adult male and juvenile female with whom she was housed. Jill had been exposed to maternal behaviors years ago in preparation for the birth of her own baby, but it was not known what behaviors she knew, the specific criteria, or cues. Therefore, it was decided that her training would be done in the same manner as TK's training but with emphasis only on the behaviors *get the baby*, *show*, *bottle*, and *other.* Jill was also housed next to or near the nursery at all times. Eventually, all bottle feedings were done in front of Jill's stall using the homemade mesh structure designed for this purpose. Jill was also allowed to interact with Kalijon through the cage mesh and was encouraged and rewarded for positive interactions. She was always extremely gentle and curious.

INTRODUCTION OF KALIJON TO JILL

When she was five months old, Kalijon was introduced to her surrogate mother, Jill. The nursery stall was cleared out and converted into the introduction stall since Kalijon was most familiar with that area and the stall was equipped with a window to the kitchen area for convenient viewing. The stall was bedded down with a very thick layer of straw approximately two feet deep. Several of the furry vests were tied to some low-hanging ropes on which Kalijon was accustomed to playing. Once she was busily playing, the keeper was able to back away a few feet at a time and eventually close and lock the cage door. Jill, who was in the stall next door, was then given access into Kalijon's stall. Immediately Jill approached her and began investigating. Each orangutan took a few moments to assess the situation, and Kalijon did not appear frightened, but perhaps a little confused. Kalijon had a few off and on crying fits, but each time Jill was encouraged to *get the baby.* Jill was fairly attentive and would pick the infant up from the straw, but hesitated to remove her when she was clinging to mesh or ropes unless Kalijon reached out to her.

Once it was clear that Jill was not going to be rough and that Kalijon could be consoled by an

orangutan mom, all people left the animal area in order to allow time for the two to bond. Staff was able to watch through the kitchen window without drawing the attention of either orangutan. Every attempt was made by staff to remain out of Kalijon's sight for the remainder of the day so that she would look to Jill for comfort rather than reaching out to her human caretakers. She continued to have minor crying fits and bouts of confusion, but they became more and more infrequent throughout the day. Jill did require some encouragement several times when she would let the fits go on without retrieving the baby.

At one point, Kalijon climbed to the top of the thirty foot mesh and seemed unable to climb down. Though Jill climbed up near her when told to *get the baby,* she would not pick up Kalijon and climb back down. When it was feared that Kalijon may become exhausted and fall from the high mesh, Jill was briefly shifted out of the stall and Kalijon was retrieved by one of her human caregivers. She was then placed in an outdoor stall that had a much lower maximum height and Jill was reintroduced. Since they could not stay locked outside overnight, plywood was immediately installed to cover the mesh front of the inside stall so that Kalijon could only climb about eight feet high before reaching a smooth expanse of plywood that did not allow her to get a finger-hold and climb any higher. This seemed to be an excellent solution and would definitely be recommended as a preparation for other institutions doing similar introductions.

Within twenty-four hours of the introduction, Jill and Kalijon bonded and Jill began carrying her full-time. Within forty-eight hours, Kalijon no longer showed any desire for her human caregivers by reaching out or crying out. At this point, overnight observations were stopped. Jill was very cooperative and accommodating from the beginning, and there have been no problems feeding a bottle to Kalijon even at very early morning and very late night feedings.

CONTINUED CARE

Kalijon and Jill adapted well to the bottle feeding training. Jill quickly realized Kalijon was the substitute for her training doll and when Kalijon ate, Jill was rewarded. Over time, scheduled feedings decreased, increasing the amount of formula eaten per feeding. Weaning was encouraged by offering solid foods at the end of formula feedings. Kalijon also started foraging with Jill during scattered exhibit feedings. Produce portions of the daily diet were cut very small for Kalijon and so that Jill could not horde the food. A mixture of Mazuri Leaf Eater "mini" and Marion Leaf Eater "lemur size" primate biscuits were also given and initially offered soaked in juice. A quarter tablet of a children's multivitamin was also added into her diet every other day at nine months old.

It was decided by animal management to introduce Josie, a seven year old daughter of Jill, to Jill and Kalijon so she could witness mothering behaviors (as Josie has a valuable lineage and will breed in the future). When Kalijon was five and a half months old, Josie was introduced to the two. By early afternoon, Josie had taken Kalijon from Jill and was engaging in rough play that could be harmful to Kalijon. Even though Kalijon would cry out, Jill showed no interest in nurturing her or taking Kalijon back. It was concluded that the bond between Jill and Kalijon was not strong enough, and Josie was separated that same day. Another introduction is planned for the future when Kalijon is larger and better able to fend for herself.

CONCLUSION

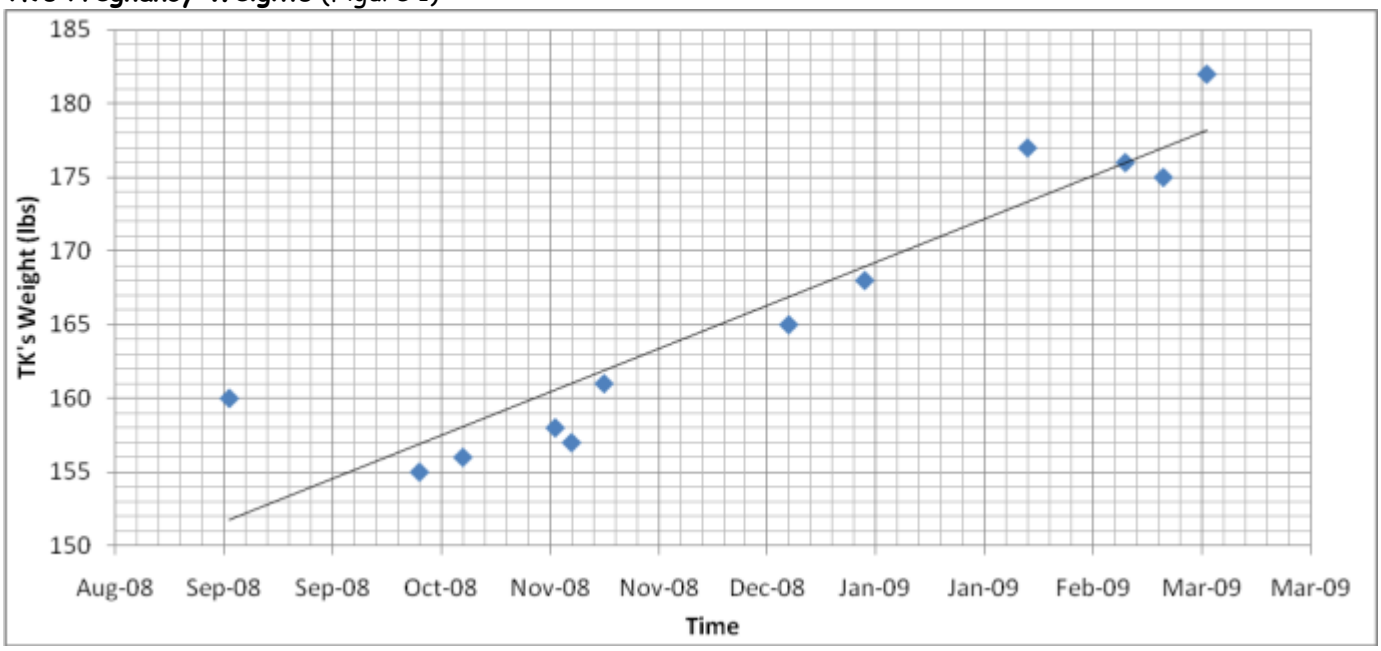
Many factors contributed to the successful care of Kalijon. Having a birthing plan in place as soon as there was a confirmed pregnancy gave staff time to prepare, and utilizing a staff that understood the importance of raising Kalijon like an orangutan and not like a human also helped Kalijon to associate herself as an orangutan. The chance of her imprinting on any one person was lessened by using multiple people to care for Kalijon. By keeping Kalijon in the building with multiple orangutans, she learned the sights, sounds and smells of her species. Jill's previous maternal experience, training, and intelligence eased the role of keeper involvement once introduced. By never setting deadlines for milestones such as weaning and independence, Kalijon developed at her own pace. Even though Jill and Kalijon were both ready to be introduced when she was four months old, the introduction was postponed due to the second hernia surgery. Still, this introduction is considered to be the earliest of its kind at five months.

ACKNOWLEDGMENTS

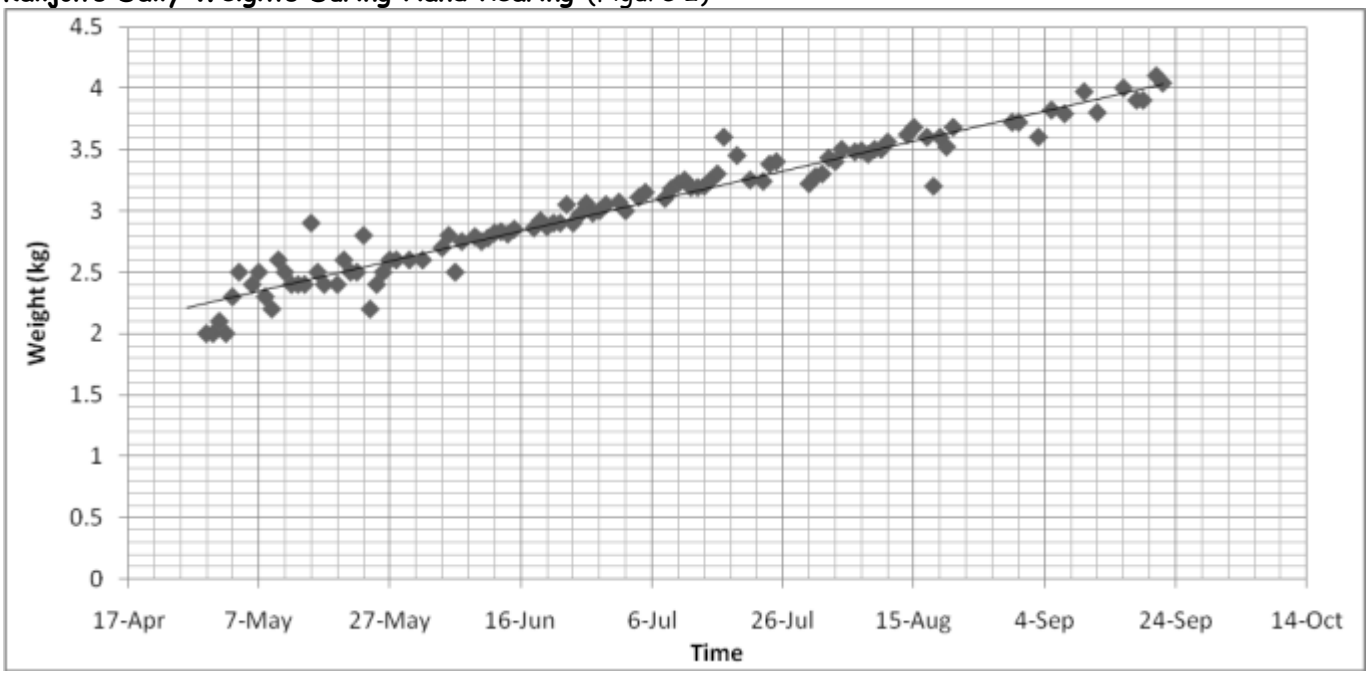
The authors would like to thank the entire Kid Zone keeper staff, the dedicated docents, Kansas City Zoo staff with special thanks to management and supervisors, the Animal Health staff, and the Orangutan SSP.

FIGURES AND CHARTS

TK's Pregnancy Weights (Figure 1)



Kalijon's Daily Weights During Hand Rearing (Figure 2)



Formula Types (Table 1)

25-Apr	full strength similac with no iron
12-May	diluted every other feeding by 50%
17-May	diluted every third feeding by 50%
20-May	changed the diluted feeding to similac with iron
27-May	1 feeding full strength no iron 1 feeding full strength with iron 1 feeding diluted with iron
29-May	2 feedings full strength with low iron 1 feeding full strength with iron
16-Jun	1 feeding full strength with low iron 1 feeding full strength with iron
22-Jun	all feedings with 1 1/2 scoops of similac with iron and 1/2 scoop of similac with low iron (for a 120mL bottle)
26-Jun	all feedings made with full strength similac with iron

Feeding Schedules (Table 2)

WEEK 7 - 11	WEEK 12 - 17	WEEK 18 - 19	WEEK 19 - 21	WEEK 22	WEEK 23	WEEK 24 - 32	WEEK 33 - 36	WEEK 37 +
12:30 AM	12:30 AM	4-6 AM	6:00 AM	6:00 AM	6:00 AM	6:00 AM	8:15 AM	8:15 AM
4-6 AM	4-6 AM	8:30 AM	10:00 AM	10:00 AM	10:00 AM	10:00 AM	11:45 AM	4:45 PM
7:00 AM	8:30 AM	10:00 AM	2:00 PM	2:00 PM	2:00 PM	2:00 PM	4:45 PM	
9:30 AM	10:00 AM	1:30 PM	6:00 PM	6:00 PM	4:30 PM	6:00 PM		
12:00 PM	1:30 PM	4:00 PM	10:00 PM	9:00 PM	7:00 PM			
2:30 PM	4:00 PM	7:00 PM						
5:00 PM	7:00 PM	10:00 PM						
7:30 PM	10:00 PM							
10:00 PM								

Kali's Daily Formula Intake (Figure 3)