Como Zoo Orangutan
Birth Management Plan
(Final Draft with Addendum)
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Medical sections edited by Dr. Micky Trent, Como Zoo Veterinarian

Overview

0.1 Sumatran Orangutan, Markisa (#1998) is currently housed in a group of 2.3 orangutans. She is pregnant and estimated to deliver her infant between 22 November 2007 and 16 December 2007, based on copulation dates and her last observed menstruation. Markisa has had one previous pregnancy that resulted in a stillbirth.

Objectives

✓ Promote the maternal care of Markisa’s infant
✓ Prevent medical complications through careful observation and emergency preparedness
✓ Formulate protocols for both anticipated outcomes and “plan B” scenarios
✓ Establish staff roles and a chain of command

General Species Information

Gestation

Female orangutans become sexually mature around 7 to 10 years of age, which is indicated in the individual animal by the beginning of a monthly menstrual cycle. In the wild, females do not generally give birth until 12 to 15 years old, although in captivity they may reproduce as young as 7 years old. The duration of an average menstrual cycle is approximately 23 to 33 days in length, with menses lasting from 1 to 4 days.

The most obvious sign of pregnancy is the swelling of the labia majora; this occurs abruptly over several days around 2 to 4 weeks after conception. The swelling will remain until after parturition, and may continue to enlarge throughout the duration of the pregnancy. Though there is some variety in appearance and size between individuals, this is the most easily observed indicator of pregnancy, and the best method for confirmation according to the Orangutan Species Survival Plan (SSP)©. In addition, human test kits that detect the presence of human chorionic gonadotropin (HCG) in urine and ultrasound may also be used to confirm a suspected pregnancy.

Gestation lasts an average of 8.16 months (245 days, +/- 12 days), and is frequently accompanied by both behavioral and physiological changes. Loss of appetite, lethargy and personality changes are all reported by the SSP© Orangutan Husbandry Manual as having been observed in pregnant orangutans. It is also noted that “during the later stages of pregnancy, females may appear agitated, restless, [...] avoiding interactions with conspecifics” (Sodaro et al, 2006). Around one month into gestation, the mammary glands begin to enlarge and the nipples swell. Some females have been observed to self nurse. Constipation has also been observed during the later stages of pregnancy.
Parturition

Reports on the duration of labor vary from 25 minutes to 4 hours, depending on the health and reproductive status of the female, as well as the number of offspring she is carrying (although twinning is rare). The labor process is generally comprised of three stages. During the first stage, the female shows signs of discomfort, her activity level increases, and a clear vaginal discharge may be observed. The second phase constitutes the actual birthing process: the frequency of the contractions increases, the female may lie down (dorsally or ventrally), and the infant is expelled in a head-first orientation. The umbilicus is usually severed by the female with her teeth. Finally, during stage three, the placenta is passed. This may occur immediately, or as late as several hours after parturition. It is not unusual for the female or other members of the orangutan group to eat the placenta. Minor vaginal bleeding or continued contractions may be observed for up to several days after the birth (Sodaro et al, 2006).

Mothers generally clean the mucus from the infant’s face immediately following parturition, usually with either their fingers or by sucking. Sexual behavior may also be exhibited by the female towards her neonate, such as “dorsal-dorso mounting, oral-genital inspection and manipulation and insertion of fingers into ano-genital areas” (Sodaro et al, 2006). Infants should begin to nurse within 4 to 6 hours after birth, but in some cases it has been observed to take up to 2 days. The female should keep the infant clinging to her body at all times, usually either to her upper back and head or to her side. She may also spend more time resting than usual during the first few days after parturition, and changes in appetite (either increases or decreases) have been reported (Sodaro et al, 2006).

Infant birth weights vary considerably, ranging from 1420 – 2040 grams with an average of 1720 grams. They have minimal body fat at parturition, so “the rib cage is prominent and the abdomen may appear sunken” (Sodaro et al, 2006). Passage through the birth canal may cause the infant’s head to initially appear slightly misshapen (Sodaro et al, 2006). The first bowel movement is usually composed of meconium, a thick, dark stool produced in utero. Once the infant begins nursing, the stool becomes softer and pale yellow.
History of the Expectant Female

Relevant Social History

Markisa (#1998) was parent-reared at the Oregon Zoo (formerly, Washington Park Zoo), which makes her a likely candidate for being a successful mother. It is noted in her records that overall her relationship with her parents was positive. She did, however, experience some minor trauma as an infant. Her records indicate that an older male sibling (who did not wish to share maternal attention) expressed aggression towards Markisa and her mother, such as throwing boxes at them or trying to pull Markisa off her mother. These displays subsided over time and her brother eventually underwent a scheduled transfer to another zoo. Unfortunately, Markisa never had the opportunity to interact with a younger sibling, as her mother had only one unsuccessful pregnancy while the two were housed together. After her transfer to Como Zoo in 1995, Markisa did have the opportunity to witness another female orangutan at Como Zoo (Joy #1335) deliver and rear an infant (Willie #2374). Markisa has been observed to play with and inspect Willie frequently. Despite the absence of younger sibling experience as a juvenile, this later encounter with birth and maternal activity again is suggestive of her potential for success as a mother.

Reproductive History

Markisa is currently 20 years old and has been in consistent good health, but has never successfully delivered a live infant. She did, however, have one unsuccessful pregnancy, sired by Jambu Aye (#1955), in May 2005 at the age of 18. Though the pair was not recommended to breed, Markisa’s contraceptive implant had apparently migrated (or been picked out) since the implant’s transponder could not be located with the scanner after the pregnancy was confirmed. The implant had been put in two years prior and was not due to be replaced for another year. At this time, her menses was not behaviorally or visually apparent to keepers so the absence of monthly menstrual blood could not be used as an indicator. The staff first became aware of her pregnancy in February 2005 when labial swelling and abdominal growth was apparent, followed by nipple swelling and breast development. A human pregnancy test confirmed the keepers’ suspicions. There are no accounts of any unusual signs or symptoms noted in her medical record prior to indicators of labor on May 10, 2005. At this point, she was placed alone in a holding area with abundant wood wool bedding. Normal signs of labor (such as amniotic discharge, contraction of vagina and behavioral changes) were accompanied by some abnormal pink discharge for several days and then followed by a period devoid of any indicators of labor except for the contraction of genitalia. Ten days after the labors signs were first observed, a red mucus-like vaginal discharge was noticed. This progressed to an orange/brown vaginal discharge over the next 24 hours and was accompanied by a brief reduction in activity and appetite. A sample of the discharge was obtained and evaluated by the University of Minnesota College of Veterinary Medicine and a regimen of amoxicillin and Zithromax was prescribed to treat a possible infection. Analysis of the sample was consistent with a bacterial infection and also contained indicators of minor internal hemorrhaging.

On May 24th, Markisa gave birth overnight to a fully developed stillborn. Keepers discovered the infant during the morning check at 7am on May 25th. Markisa was allowed to remain with the neonate for as long as she chose. She cleaned the infant’s face and kept it with her in her nest until mid-afternoon at which time she left the infant on a bench and indicated to keepers that she wanted to leave the holding area by sitting at her shift door. During the entire process, the other orangutans in her social group were allowed full visual access to Markisa. Once the stillborn was retrieved, it was submitted to the University of Minnesota Veterinary Diagnostic Lab for further evaluation. A
full necropsy was performed. Lung lesions were suggestive of dystocia with aspiration of amniotic fluid and meconium, and the overall postmortem condition of the fetus indicated that it had died very recently. Examination of the placenta revealed necrosis and neutrophilic infiltration to deeper areas, which is indicative of infection. It was unknown to the pathologist whether placental separation from the uterine wall precipitated the death of the fetus and the subsequent infection, or if the infection itself caused the placenta to separate and resulted in the death of the infant.

In order to prevent a similar scenario from recurring, it is of critical importance to correctly identify the syndrome that caused Markisa’s stillbirth and the symptoms associated with it in order to be better prepared to act to save the infant’s life during her current pregnancy. The *Medical Management of the Orangutan* presents a case of placenta previa, which displays a series of events similar to those observed during Markisa’s first pregnancy: A fourteen year-old female was reported to have a small amount of blood lost from the vagina late in her pregnancy, and despite expectations of imminent parturition, birth did not occur. Eleven days later, another small amount of blood was observed. Approximately three weeks later, the female was found dead of a massive hemorrhage that presumably resulted when she gave birth to a full-term fetus. While the infection component of Markisa’s situation is not present in this case, the death of the female due to a greater severity of blood loss eliminated the possibility for such a development. Taking into consideration the results of the necropsy, Markisa’s symptoms, and their similarity to those displayed by an orangutan diagnosed with placenta previa, one possibility for the cause of Markisa’s stillbirth was placenta previa. However, since slight bleeding only occurred two weeks before parturition (as opposed to periodically throughout the pregnancy) and since the bleeding was not considered “excessive,” a more likely cause could be placenta abruptio, or the premature separation of the placenta from the wall of the uterus.

Later evaluation of the 2005 stillbirth, by Como’s consulting OB/GYN for the current 2007 pregnancy, suggests that signs instead point to a full term or over term pregnancy rather than premature placental separation. Labor was initiated but the process was not coordinated and the fetus aspirated. Therefore, the current explanation for the stillbirth was due to mechanical dystocia.

**Current Status of Expectant Female**

**Present Social Group Considerations**

Currently Markisa is held with an adult male: Jambu Aye #1955 (the sire of her pregnancy); two other adult females: Joy #1335 and Amanda #1442; and a juvenile male: Willie #2374. Markisa is a subordinate group member and is particularly fearful of Joy, the former dominant female recently “overthrown” by Amanda. Markisa’s relationship with Jambu is generally empowering for her – she feels confident and secure enough to steal his food and push him around. She is generally more relaxed when Jambu is present. Willie is very high energy and Markisa’s preferred playmate. Willie and Markisa frequently wrestle.

In terms of evaluating potential risks, both during parturition and for the new infant after it’s born, the adult female Joy most likely represents the greatest concern. This is due primarily to the violent and aggressive behavior she has displayed towards Markisa in the past. In addition, Joy has reared an infant of her own (an activity in which she appeared to take great satisfaction) and therefore she may attempt to take the newborn. Presumably she would not have reason to injure it, but there is no way to predict exactly how she may react. In other circumstances, these potential risks could warrant
Joy’s transfer to another institution—particularly since she is not involved in any breeding recommendations due to her hybrid status (following the birth of Willie, her third offspring conceived while implanted, a tubal ligation was performed to prevent future pregnancies in 1999 so she is no longer able to bear infants of her own). However, since Joy has already demonstrated success in raising her own offspring, she has been recommended to join the SSP©’s list of surrogate mothers. By becoming a surrogate, Joy may be able to fulfill the biological need she may have to bear more infants. Around the time that Willie turned 8 years old, Joy began visibly menstruating and pursuing Jambu for breeding—behaviors that are worrisome to the keepers surrounding Markisa’s pregnancy (i.e. will she steal the baby?). However, she may prove to be a valuable surrogate at her current residence in case Markisa does not demonstrate competent maternal skills. Therefore, Joy will remain in the group to be readily available in case she is needed to fulfill this role.

As previously stated, Joy was the dominant female within the Como group. However, one year ago Amanda dethroned Joy and has since occupied the position of dominant female. This change in the social hierarchy is fortunate for Markisa and her infant and it is hoped that Amanda will protect Markisa and prevent Joy from stealing/harming her infant. Increased grooming (by Amanda towards Markisa) has been observed during both of Markisa’s pregnancies. Markisa has also been observed staying within close proximity (1-3 ft) of Amanda during most of the day.

Any of the other individuals in the group also have the potential to cause harm to Markisa and her infant. Willie has never had experience with an infant and he is accustomed to having long periods of interaction with Markisa. The greatest risk that Willie poses is inappropriate behavior due to his inexperience or displays of frustration due to Markisa’s limited available attention once her infant is born. Amanda (a permanently contracepted hybrid) has never been a mother but was present for the birth and rearing of Willie so she poses little concern except for any actions she deems necessary to maintain her dominant status in the group. Jambu presents the least threat as he has demonstrated appropriate and positive parenting skills during the birth and rearing of his offspring, Willie. Also, Markisa appears confident around Jambu, and so she would likely be able to express to him her distress if any behavior he exhibited represented a threat to her or her infant.

In light of these concerns, appropriate preventative measures must be taken in order to ensure the safety of Markisa and her infant. The simplest method to protect them during the delivery is to house Markisa alone in holding at the first signs of labor (see General Species Gestation Information for the specific indicators). This will also be beneficial since it allows for better access to Markisa in case complications arise during or after the birth. A mesh window between the holding and the exhibit, as well as the adjacent holdings, will allow the group to maintain some degree of visual, auditory, and optional tactile interaction during this time. This should ease the reintroduction process. The actions and time scale implemented following the birth will be highly dependent upon the health of the mother and infant, as well as the perceived success of Markisa’s maternal skills.

**Present Medical Considerations**

Starting in June 2005, Markisa began taking daily oral contraceptive pills (Nortrel norethindrone and ethinyl estradiol tablets), as her potential breeding recommendation with Jambu had been terminated due to a mean kinship value disparity and a pending breeding recommendation with a male at a different institution. An oral contraceptive was chosen due to its ease in reversal and non-surgical implementation and removal (again, there was a pending transfer) and because Markisa is very food-motivated. She eagerly accepted her pill crushed and delivered in a spoonful of applesauce each morning. Markisa had reliably taken her pill consistently for two years with no issue.
On March 28, 2007, she was prescribed Ampicillin (1250mg) for a severe finger injury. After her pregnancy was discovered, and the records consulted for a possible cause for contraceptive failure, it was noted that Ampicillin reduces the effectiveness of oral contraceptives when keepers referred to the manufacturer’s insert when looking for a possible drug interaction. Assuming that the antibiotic was the cause of the failure, the time around which it was being administered suggests a likely window for conception. Breeding behavior was noted on April 3, which would estimate her due date to be December 4 (+/- 12 days). In late June, the appearance of labial swelling and two months with no observed menstrual bleeding warranted a pregnancy test. Two Clear Blue Easy urine pregnancy tests were conducted, one that evening and one again the next morning: both results were positive.

Once the pregnancy was confirmed, the oral contraceptives were discontinued, as well as a daily dose of aspirin that she had been receiving as part of a cardiovascular health maintenance regime. Also, her daily multivitamin was changed to a pre-natal multivitamin. While it should not have any effect on the health of the baby, it may also be noted that she was administered Metronidazole for 10 days during June to address a fecal sample that was positive for Giardia.

Markisa’s training staff also began focusing on voluntary transabdominal ultrasound conditioning. This would allow for the veterinary staff to monitor changes in the growth of the fetus, heart rate fluctuations (indicative of fetal distress), and amniotic fluid volume.

The most imperative factor during her pregnancy will be to maintain careful observation for any signs that would indicate 1) the fetus is at risk; 2) Markisa is at risk; and 3) parturition is imminent. Also, due to the complication that arose during her last pregnancy, signs of dystocia and infection must also be specifically watched for (see table 1 for key signs of potential pregnancy and delivery complications that have been observed in orangutans that would warrant contacting the supervising veterinary staff).

### Signs of Potential Pregnancy Complications Previously Observed in Orangutans

<table>
<thead>
<tr>
<th>Observation</th>
<th>Possible Problem</th>
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<tbody>
<tr>
<td>bloody vaginal discharge (especially large quantities observed late in pregnancy)</td>
<td>placenta previa or placenta abruptio</td>
</tr>
<tr>
<td>signs of labor that last more than 6 hours</td>
<td>dystocia or placenta abruptio</td>
</tr>
<tr>
<td>thick, creamy, odiferous, or discolored vaginal discharge</td>
<td>uterine infection</td>
</tr>
<tr>
<td>lethargy or anorexia that lasts for more than 6 hours, missing a meal</td>
<td>pregnancy toxemia</td>
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*Table 1 (Wells et al, 1990)*
Another important piece of information relevant to Markisa’s reproductive history involves her mother, Inji. According to the Oregon Zoo, Inji has had a history of multiple stillborns. This info was brought to the attention of Como staff after presenting Markisa’s birth management plan at the 2007 Orangutan SSP Husbandry Workshop in case there is a genetic link.
Overview of Preparations

There are four stages/phases that we must successfully progress through and consider:

1. Pregnancy {pre-partum preparations}
2. Birth {parturition-related protocols}
3. Rearing {parturition-related protocols & post-partum management plan}
4. Reintroduction {post-partum management plan}
Pre-Partum Preparations

Veterinary Consulting

Como Zoo’s chief veterinary staff, Dr. Micky Trent & Dr. Ralph Farnsworth, will be overseeing all aspects of medical care for Markisa and her infant. Dr. Mary Boyce will serve as an emergency back-up and will participate in voluntary ultrasound training sessions with Markisa.

Dr. Trent will compose a supporting team of medical professionals and an OB/GYN to consult with during the pregnancy and parturition. Important aspects of the 2005 pregnancy which must be reviewed include:

- the observation notes from the 2005 pregnancy;
- a review of the video depicting what appeared to signs of labor, possible discharge of amniotic fluid and subsequent vaginal discharge;
- and, a closer examination of the stillborn’s necropsy reports.

Additionally, the vet staff will consult with the SSP Veterinary Advisors (see Professional Resources / Contacts) regarding Markisa’s history and potential issues.

Based on the dystocia experienced during Markisa’s previous pregnancy and her mother’s reproductive history, it was determined that surgical intervention will occur if Markisa is in labor for more than four hours (the average maximum length of labor for an orangutan) or demonstrates signs of labor for a substantial amount of time and then ceases labor behavior. Refer to “Parturition-Related Protocols” for emergency intervention plan.

Physical Facility Review

The birth of Markisa’s infant should occur during the winter months. This means that Como’s orangutans will not have access to the outdoor exhibit and the flexibility of that option. Instead, they will only have access to the indoor exhibit and three holdings. All orangutans are typically secured in holding overnight and are housed in these typical social groups:

- Holding #4: Amanda
- Holding #5: Jambu and Markisa
- Holding #6: Joy and Willie

However, there is flexibility within the group as Jambu does shift in at times with just Amanda or Joy and Willie- depending on his preferences and the cycling of those females. Unless signs of labor occur early, staff will begin housing Markisa alone in holding #5 with ample amounts of bedding, by 12/1. Cameras will be mounted outside of Markisa’s holding to document the birth and resulting behavior. Markisa’s cargo net will be lowered to allow for better visual access. Holding #6 will also be utilized (cargo net removed) in the event that we need to immobilize. This holding is safest in that there are no high benches from which she could fall once under sedation.

Based on Markisa’s last pregnancy, a point should come when Markisa chooses to remain in holding and not shift out. Keeping Markisa in holding at that time will be ideal for close observation during the imminent birth and post partum care (should intervention be necessary). During this time, Markisa and the other orangutans will retain visual, auditory and some tactile access through the mesh windows of the exhibit and adjacent holding shift doors.
Hand-rearing Equipment Review / Needs

All equipment required in the case of intervention and hand-rearing should be available prior to parturition (including oxygen set-up, incubator, thermometer, blankets, heating pad, sterile cotton, scale, bottles, nipples, Pedialyte, formula, and nursing record sheets). All items are to be secured by 11/1. The veterinary staff is currently researching the suitability of plasma as opposed to colostrum. Primate keepers, zoo managers and veterinary staff must review the Orangutan SSP Husbandry Manual’s “Hand Rearing” chapter prior to parturition. To be completed by 11/15.

Maternal Training

Although Markisa’s history is suggestive of the potential for good maternal skills, maternal training still offers a proactive approach for furthering her chances of success. Markisa has already achieved mastery of a number of important behaviors and is currently working on several others that will improve her maternal skills and prepare her to respond correctly and efficiently should staff need to intervene for any reason. Overall, the maternal training plan is designed to meet three main goals: 1) encourage Markisa to perform maternal behaviors; 2) enable Markisa to shift herself or an object upon request; 3) allow keepers to visually inspect the infant by having Markisa present the baby to the mesh; and 4) prepare behaviors to lessen the stress on Markisa during medical procedures. Table 2 summarizes a list of all the behaviors that will be useful, both during and after pregnancy.

<table>
<thead>
<tr>
<th>Maternal Training Behaviors, Benefits &amp; Level of Mastery</th>
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<tbody>
<tr>
<td>Behavior</td>
</tr>
<tr>
<td>Present nipple and allow it to be manipulated</td>
</tr>
<tr>
<td>Present abdomen and allow it to be touched with probe or hands</td>
</tr>
<tr>
<td>Shift into holding</td>
</tr>
<tr>
<td>Present arm for hand injection</td>
</tr>
<tr>
<td>Stand on scale</td>
</tr>
<tr>
<td>Present vagina</td>
</tr>
<tr>
<td>Urinate into pvc collection apparatus</td>
</tr>
<tr>
<td>Present the baby</td>
</tr>
<tr>
<td>Supplemental feeding</td>
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Key: Polished = any trainer can successfully request behavior; Trained = only specified trainers can successfully request behavior; In progress = behavior is still in process of being shaped; Not trained = shaping for behavior has not yet begun

Table 2
Animal Management Plan for Onset of Labor

Prior to her previous (stillbirth) delivery, Markisa displayed specific behaviors that indicated to keepers she was nearing labor:

- Refusing to go on exhibit and remaining in holding
- Spending more time in a lateral position, both in her hammock and on the floor of holding
- Clenching her hands and feet in response to contractions

Presumably Markisa will behave similarly when nearing parturition for this pregnancy; therefore, preparations for delivery should be taken if any of these behaviors are observed. If none of them are observed prior to December 1st, preparations should begin at that time.

Preparations for delivery include the following:

- Housing Markisa in holding alone at night
- Setting up observation cameras linked to the computer’s hard drive
- Lowering her cargo net for better visual access
- Heavily bedding Markisa’s cage with wood wool
- Allowing Markisa to remain in holding during the day if she doesn’t express an interest in going out on exhibit
- Continuing maternal training sessions
- Intensive observation of Markisa and notification of veterinary staff at first indications of labor

Day/Night of Birth:

1. If Markisa goes into labor during the day, keepers will immediately separate her from the group.

2. All individuals on the notification tree (see next section) will be notified and equipment for an emergency intervention will be gathered and set-up. The vet cart, ape crate, and a transport vehicle (van) will be secured. Park Security and the Engineers must also be notified of keeper activity on-site after hours, between 4pm and 8am.

3. Keepers or interns will begin videotaping the birth.

4. Once the infant is born, we will start a 24 hour watch on Markisa and her baby. Traffic through the service area at Primates will have extra restrictions during this time as to not distract or disturb Markisa, her infant, and the rest of the orangutan group.

5. The Primate staff will monitor and notify zoo management and the veterinary staff once Markisa and her infant’s conditions are assessed.
Notifications of Impending Birth

Once signs of labor occur and the birth is imminent, the following notification tree will be used to alert all relevant staff to the situation:

Primate Keepers:

- Megan Elder- (cell) 612-419-4478
- Tami Murphy- (cell) 701-261-3302
- Geoff Jungheim- (cell) 651-324-3042 / (home) 651-917-9310
- Adam Nigon- (cell) 651-357-7931 / (wife) 651-357-7943

Zoo Managers:

- John Dee- (nextel) 651-248-7793 / (cell) 651-278-5155 / (home) 651-227-1272
- Joanne Kelly- (nextel) 651-783-6986 / (home) 651-778-1464
- Allison Jungheim- (cell) 612-845-5556 / (home) 651-917-9310

~ Zoo managers will alert Mike Hahm, Zoo Director/Campus Manager

Veterinary Staff:

- Dr. Trent- (cell) 651-755-4818 / (office) 612-624-7477 / (home) 651-639-0483
- Dr. Farnsworth- (cell) 651-402-2245 / (office) 612-625-3130 / (home) 651-484-8822
- Dr. Boyce- (cell) 651-231-1060 / (office) 612-625-6700

Dr. Trent will notify the emergency intervention team of veterinary professionals at the University of Minnesota to be on stand-by. In her absence, Dr. Farnsworth and/or Dr. Boyce will contact this team.

Jane Quandt serves as the anesthesia/critical care resource at the University of Minnesota-

** If unable to contact any vet staff, call the hospital number at 612-625-6700

Primate Interns:

- Sarah Johnson- (cell) 608-698-0731
- Kevin Loula- (cell) 651-214-2539
Parturition-Related Protocols

*Overall, intervention will be based on physical condition and behavior of mom and baby!*

However, based on Markisa’s previous experience and history, an emergency intervention plan has been established in the event that Markisa’s labor exceeds the average duration of labor for an orangutan listed in the **General Species Information** section. We have decided to give Markisa four hours to deliver her infant after the on-set of observed labor behavior. If Markisa fails to deliver the baby unassisted, or shows signs of giving up, we will begin preparations for a caesarian section.

At the first signs of labor, the phone tree will be activated. Dr. Micky Trent will ensure that all of the emergency vet staff at the University of Minnesota is contacted regarding the imminent birth. Como Zoo staff will ensure that the vet cart (with the immobilization equipment) is brought to the Primate Facility and that an ape crate and transport vehicle is secured. After two hours of labor has passed, the emergency team will begin prepping at the University and will wait on stand-by to receive Markisa for surgery. After four hours of labor has passed, the decision to immobilize and transport Markisa to the hospital for a c-section will be made.

Post-Partum Management Plan

**Assessing the Condition of the Infant (should all go well and no surgical intervention is required)**

1. If the infant is strong and alert, a continuous watch will be done through the night.

2. If Markisa is not nursing the infant and the condition of the infant remains stable (and Markisa is not harming the infant) it can remain in holding until morning.

3. If nursing has not occurred by morning, then we will use training techniques to encourage Markisa to nurse the infant.

4. If the infant’s condition appears to deteriorate through the night, we will notify the vets and remove the infant for an examination. We will encourage the infant to nurse from Markisa’s breast (while she is under sedation), if possible. If not, we will attempt to bottle feed and ensure that the infant receives colostrum or plasma.

5. If the infant’s condition seems to improve after feeding, we will put the infant back in holding with Markisa and continue to observe and document.

6. If at anytime, Markisa becomes aggressive to the infant and begins to injure it, we will remove the infant.

**Additional Considerations**

There is the possibility that the infant may be compromised medically. If this is the case, we will wait for the veterinary evaluation of the infant’s condition. If it becomes necessary to treat the infant, we will proceed with a reintroduction of Markisa to her infant as soon as possible. We will continue to train Markisa focusing on breast manipulation and milk collection (if possible) during the time the infant is being treated. This will allow us to feed the infant Markisa’s breast milk. If the infant’s condition is stable, we may be able to let the infant nurse from Markisa’s nipples through the mesh. The infant will be housed in a holding area as near as possible to Markisa’s (to encourage maternal bonding and interest) unless there is a medical concern. Keepers will temporarily serve as surrogates and will model orangutan-specific parenting behaviors for Markisa to observe during this critical time. We will follow our hand-rearing procedures at this stage.
Hand-Rearing

Hand-Rearing will only be performed as a temporary solution in the event that Markisa does not initially display appropriate maternal skills and the condition of the infant is (or will soon be) compromised. The infant will then be reintroduced to either Markisa, or an appropriate surrogate, depending on the situation (see Reintroductions for the details of the introduction process). The infant should be removed if any of the following conditions arise:

- Markisa is aggressive towards the infant
- Markisa does not clear the infant’s face (nose & mouth) of mucus- this should occur immediately after parturition
- The infant is unable to nurse for whatever reason for more than 36 hours
- The infant is left on the floor and there is concern of hypothermia
- The infant appears critically ill: if it is limp, unable to cling, or blue/grey in color
- Markisa develops medical complications

The veterinary staff will need to evaluate the medical state of the infant in order to determine the immediate course of action. If incubation is required, the temperature should be set to 30°C. Human formula may be bottle fed if it appears the infant is receiving insufficient nutrition from nursing. Special care should be kept to limit infant to exposure to disease so the number of humans it has contact with should be kept as small as possible. Protective equipment (gloves, face masks and surgical gowns) will be worn by staff when in close proximity to the infant to prevent the transmission of germs/illnesses to the infant, especially if handling.

Como staff will follow the protocols set forth by the Orangutan SSP Husbandry Manual’s “Hand Rearing” chapter.

Dietary Changes

According to the nutrition chapter of the Orangutan SSP Husbandry Manual, no dietary changes are required for females during the first trimester of pregnancy other than the implementation of a prenatal vitamin regimen. Caloric increases can be made during the second and third trimesters (by 300 – 350 kcal/day) but isn’t necessarily required due to the relatively small size of the developing fetus. It is more important to ensure that the pregnant female maintains a healthy weight and does not develop risk complications due to obesity.

Post-parturition, Markisa’s diet will need to be raised due to the increased energy demands of nursing. The SSP manual suggests following the recommendation for human females by increasing the new mother’s diet by 500 kcal/day during the first six months of lactation- if the female is healthy and has not put on an excess amount of weight during her pregnancy. The Zootrition software will be used to determine her current diet’s kcals and how best to meet these increasing needs. It is imperative that Markisa receives adequate concentrations of vitamin D, calcium, and phosphorus for milk production and other biological needs. Fortunately, these requirements are typically met through commercially produced primate biscuits which are a normal part of her current diet.
The scale will serve as a good indicator of whether or not Markisa’s dietary needs are being met. Therefore, it will be important to routinely monitor her weight. Her pre-pregnancy weight is in the 120 – 125 lb range. Her late pregnancy weight is approximately 135 lbs.

Post Partum Training Plan (As adapted by Brookfield example in SSP Husbandry Manual)

Assuming the infant’s condition is stable and no nursing is observed, the following may occur:

- **Infant born at night**: keepers’ monitor; training session attempted early to mid morning
- **Infant born in early morning**: keepers’ monitor; training session attempted in early to mid afternoon
- **Infant born in afternoon**: keepers monitor; training session may be attempted later in early evening or may wait until early AM dependent on infant’s condition

Behaviors Needed to Accomplish:

**Scenario: Markisa holding infant but not nursing infant; Infant strong/alert**

- Hold hands so arms are away from infant
- Scratch and touch abdomen
- Target nipple to cage mesh
- Work with two trainers at once so one trainer can do hand hold and other trainer can position infant to her breast
- Working with surrogate stuffed animal through cage mesh getting her accustomed to being touched by surrogate, allowing her to touch surrogate in a gentle manner and training her to release her hold on surrogate on cue

Other problems associated with above scenario:

- Infant carrying position may be improper
- Markisa could be jealous of the attention given to her infant. This *could* be overcome by feeding and talking to her.

**Scenario: Markisa ignoring infant or Markisa interested in infant but not carrying it**

- Retrieve infant
- Hold infant (object)

Once Markisa retrieves the infant and holds infant at cage mesh, the trainers will try to position it to her breast.

**Scenario: Markisa carries and nurses infant but is mildly aggressive to infant**

Trainers will try to calm Markisa down through stroking, positive keeper interactions and food. If this fails, we may want to consult with veterinarians about the possibility of using a sedative to relax her.
**Scenario: Markisa carries infant, does not nurse infant and is mildly aggressive towards infant**

Trainers will try to calm Markisa as above. Markisa will then be asked to bring the infant to the holding mesh and two trainers will work with her to position the infant to her nipple.

- Hold hands so arms are away from infant
- Scratch and touch abdomen
- Target nipple to cage mesh
- Nipple stimulation
- Work with two trainers touching her at once so one trainer can do hand holds while other trainer can position infant to Markisa’s breast

**Scenario: Another orangutan has infant, is harming infant, and Markisa is not interested in infant**

Remove infant from the orangutan as quickly as possible. Separate infant from group. Have veterinarians examine infant for injuries. If no serious injury to the infant, the infant will be reintroduced to Markisa and, at some point, the other orangutans.

- Markisa retrieve and pick up infant, position it to abdomen

**Scenario: Another orangutan has infant, Markisa wants infant**

We would monitor this situation closely as there could be a possibility of injury to the infant if Markisa attempts to take the infant from the other orangutan.

**Scenario: Markisa feeling poorly after giving birth, exhibiting less than optimal maternal care**

We would continually monitor this situation and a plan of action would be dependent on the infant’s physical condition and Markisa’s behavior.

*Reintroductions* (Note: the actual order of reintroductions was altered. Refer to addendum on pg24)

Regardless of the outcome of Markisa’s pregnancy, she will likely be separated from the rest of the orangutan group at some point, and a reintroduction plan will be necessary. Fortunately, all group members will retain audible, visual and some limited tactile access through the mesh windows between holding rooms and the exhibit with Markisa at all times. This will allow all members of the group to witness the birth and initial rearing of the new group member from day one.

There are three possible reintroduction scenarios that may arise: 1) Markisa’s pregnancy is not successful and she must be introduced to the rest of the group alone; 2) Markisa successfully delivers a healthy infant and displays competent maternal skills and so both she and the neonate must be reintroduced to the group together; or 3) Markisa successfully delivers a healthy infant but does not demonstrate proper maternal skills and so the infant must either be reintroduced to Markisa at a later point or introduced to the surrogate. The third circumstance would also later require another introduction similar to the protocol outlined for the second scenario. Note: A fourth scenario may exist in the event that Markisa experiences dystocia again and surgical intervention is required. This scenario will of course require the introduction of the infant back to Markisa. Timing and circumstances depend upon medical condition of Markisa and/or the infant.
Strategies for the first two situations are essentially the same. For both, the order in which other members of the group will be reintroduced is as follows: Jambu, Amanda, Willie, Joy. Based on the current group dynamics (see Present Social Group Considerations), this is the order that presents the least risk to Markisa and her infant; the hope is that the group members that are the least aggressive will become comfortable with the transition first, and then they can help mediate in the event that the more risky group members begin to display violent or dangerous behaviors. In either situation, the vet staff has approved the use of diazepam for the adults in the group (except for Markisa) in order to help reduce aggression. Also, the liberal use of popular environmental enrichment, such as browse, treat tubes, and foraging for diet will help redirect attention during all introductions. The only concern in the case of Markisa and her infant being reintroduced together would be enrichment items that have a potential to hurt a neonate (such as tubs of water or heavy branches), so these enrichments would not be used in that particular introduction scenario.

As previously stated, the first full access introduction will involve Jambu. This will take place in holding between at least two rooms. Creep access for Markisa and the infant to escape will be provided. An introduction in holding will allow for close observation and more ease in intervention, if necessary. Markisa typically shares a holding with Jambu each night so being in holding with him is normal for her. Introductions to the others will be trickier as Markisa does not share holdings with either Amanda, and especially not Joy (and therefore Willie). In the past, Markisa has been extremely uncomfortable when either Joy or Amanda have entered or crossed through her holding space. We want to ensure that holding continues to be Markisa’s “safe place” and remains positive since it is extremely important that we maintain her cooperation in shifting off exhibit for the necessary monitoring of Markisa and her baby’s health. Therefore, the intros involving the adult females will need to take place in the indoor exhibit with keepers on close standby to operate holding doors at a moment’s notice if necessary. Due to the potential for other members of the group to inflict bodily harm to mother and baby, precautions must be taken so that staff will be prepared if an intervention appears necessary. A carbon dioxide fire extinguisher is already kept in plain sight near the exhibit; this leaves open the possibility that it may be sprayed at aggressive individuals as a distraction during the introduction if it appears any other group members pose a risk to Markisa and the infant. The similar use of hoses has also been suggested (and will be made available) but will be used as a second option as past experience suggests it is less likely to be effective with these particular apes. All orangutan spaces (indoor exhibit and holdings) will be heavily bedded with wood wool to prevent injury from any potential falls. All orangutans will only have access to the indoor displays and holdings due to the expected birth occurring during our Minnesota winter months. Therefore, no outdoor access will be available due to cold temperatures.

In the event that the infant needs to be reintroduced to either Markisa or the surrogate, a different approach is demanded. The condition/age of the infant, previous behavior of maternal figure (Markisa or surrogate) and the amount of time the two have been separated will all have to be factored into an introduction plan. While a specific procedure will need to be formulated depending on the scenario, several key strategies may be implemented. First of all, an acclimation phase during which the infant and the mother (either Markisa or the surrogate) are encouraged to engage in and rewarded for all positive interaction through the mesh will be necessary prior to allowing them full access to each other. This process is also vital for better discerning how the mother is likely to act towards the infant. When a full introduction is performed, creep doors may be used if the infant is mobile enough to take advantage of such a strategy.

The use of diazepam to facilitate introductions is currently under review by Como vet staff and will be considered once the health of the infant is assessed.
Plan B – If All of the Prior Scenarios Fail

If we are unable to get Marisa to take care of her infant, we have the following options to pursue:

1. Sedate Markisa, put the infant on her breasts to nurse and allow her to recover from anesthesia with the infant clinging to her. During Markisa’s recovery, a continual watch would be done to assess the infant’s condition and Markisa’s maternal skill level.

2. Remove the infant for hand rearing. Begin working with the infant to take a bottle through the cage mesh. During the infant’s training, we would work with Markisa to allow us to feed the infant through the cage mesh. This may take several months of hand-rearing and infant training prior to reintroduction.


4. Send the infant to another institution for surrogate rearing.

Surrogate Training

Como Zoo is fortunate to have a proven mother, #1335 Joy, available to serve as a surrogate should Markisa refuse (or be unable) to rear her infant. Joy currently has an 8 year old offspring, #2374 Willie, who still demonstrates nursing behavior. Should Joy still be able to nurse (with the aid of a lactation stimulant such as Reglan®) we will begin work with Joy nursing the baby through the mesh during the introduction phases of the infant to surrogate Joy. Regardless of lactation success, we will train the infant to accept a bottle through the mesh for supplemental feeding purposes during sessions in which Joy observes this nursing behavior. We will also work with Joy to present an object (“infant”) to the mesh for daily inspections and bottle feedings by a keeper. The attached table depicts the behaviors that we will establish with Joy:

<table>
<thead>
<tr>
<th>Surrogate Training Behaviors, Benefits &amp; Level of Mastery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Behavior</td>
</tr>
<tr>
<td>Present nipple and allow it to be manipulated</td>
</tr>
<tr>
<td>Shift into holding</td>
</tr>
<tr>
<td>Present arm for hand injection</td>
</tr>
<tr>
<td>Present the baby</td>
</tr>
<tr>
<td>Supplemental feeding</td>
</tr>
</tbody>
</table>

Key: Polished = any trainer can successfully request behavior; Trained = only specified trainers can successfully request behavior; In progress = behavior is still in process of being shaped; Not trained = shaping for behavior has not yet begun. Table 3

We will also consult with the SSP and other institutions that have successfully introduced an infant to a surrogate and utilized operant conditioning techniques in the resulting care and management of the infant.
Professional Resources / Contacts

Kirk Ramin, Como Zoo’s consulting OB/GYN
Jane Quandt serves as the anesthesia/critical care resource at the University of Minnesota-

Lori Perkins, Orangutan SSP Coordinator
lori410@mindspring.com

****SSP Vet Advisors  The vet advisor is Dr. Chris Bonar at Cleveland Metroparks (cjb@clevelandmetroparks.com), and he is assisted by Dr. Maria Crane (Zoo Atlanta, mcrane@zooatlanta.org). Dr. Brigetta Hughes (Great Ape Trust of Iowa, bhughes@greatapetrust.org), Dr. Adrian Mutlow (Rolling Hills Wildlife Adventure, vet@rollinghillswildlife.com), and Dr. Joe Smith (Fort Wayne Children's Zoo, vet@kidszoo.org). Chris has had experience with pregnant females, as has Maria -- Joe, too, though of course his experience was unexpectedly tragic, with the death of little Dumadi’s mother an hour after his birth.

Dr. Ray Ball, Busch Gardens Veterinarian
Experience with placenta previa, c-sections and use of progesterone
dr.ray.ball@buschgardens.com

****Carol Sodaro, Orangutan SSP Husbandry Advisor
CAROL.SODARO@CZS.org

Dusty Lombardi, Ape TAG Birth Management Advisor
Dusty.Lombardi@columbuszoo.org

Deb Schmidt, Orangutan SSP Nutrition Advisor
dschmidt@sandiegozoo.org

Maternal Training & Hand Rearing Contacts:

- Rob Liddell, MD Radiologist and Volunteer, Woodland Park Zoo robliddell@comcast.net
- Beth Schaefer, Houston Zoo (formerly Kansas City and Disney) pongopower@earthlink.net
- Megan Fox, Los Angeles Zoo maefox@earthlink.net
- Angela Shoffstall, Busch Gardens Angela.Smith@BuschGardens.com; 813-987-5621
- Angie Baldwin, Ft. Wayne’s Childrens Zoo Indo@kidszoo.org

Misc:
Mike Marshall, Oregon Zoo (Markisa’s former institution and home to her mother)
mike.marshall@oregonzoo.com
Works Cited


MARKISA BIRTH PLAN TRACKING SUMMARY
& STAFF ASSIGNMENTS

Pre-Parturition Needs

1. Notification of pregnancy to the Orangutan SSP
2. Assignment of OB/GYN to Markisa’s case regarding reproductive history and medical concerns and for monitoring and counseling of current pregnancy
3. Begin pre-natal supplementation and termination of oral contraception, multi-vitamin and aspirin regimen
4. Development of birth management plan document
5. Facility review and procurement of necessary hand-rearing supplies
6. Development of surgical intervention plan, should dystocia occur again
7. Focus on maternal training behaviors, especially ultrasound work

Day of Birth

When labor is confirmed:

1. Separate Markisa from group, preferably in a bedded down holding
2. Keepers begin continuous observations, take detailed notes, videotape birth
3. Keepers notify zoo management, veterinarians, primate staff (off-duty) & interns
4. Vet cart, ape crate and transport vehicle is brought to the Primate Facility
5. Restrict access to service area to “as needed basis”
6. Keepers begin to warm incubator

When infant is born:

1. Continue to monitor Markisa and baby, take detailed notes
2. Notify zoo management, veterinarians, primate staff (off-duty) & interns

After Hours Birth

Same as above but zoo managers will dictate after-hours shifts and assign keepers
**Post Partum**

*If the infant is medically compromised:*

1. Meet with keepers, managers and veterinarians to formulate an action plan

*If Markisa is aggressive towards the infant:*

1. Separate infant from Markisa
2. Meet with keepers, managers and veterinarians to formulate an action plan

*If Jambu is present for birth and is aggressive towards the infant:*

1. Separate Jambu from Markisa and infant
2. Give Jambu access to Joy, Willie and Amanda

*If Markisa is ignoring the infant or interested in the infant but not carrying it:*

1. Attempt training session to encourage Markisa to pick up the infant and hold it in a nursing position to her breast

*If the infant nurses within 24 hours:*

1. Document all bouts/lengths of nursing
2. Maintain continuous observations and take detailed notes

*If the infant does not nurse within 24 hours:*

1. Maintain continuous observations, closely monitoring condition of infant as well as Markisa’s behavior, take detailed notes
2. Notify veterinarians to assess medical condition of infant
3. After 24 hours (or time to be determined), attempt a training session with Markisa to encourage maternal behaviors (refer to Post Partum Training Plan)

*If the infant’s condition deteriorates:*

1. Maintain continuous observations, take detailed notes
2. Separate Markisa from infant
3. Notify veterinarians to assess medical condition of infant
4. Feed infant (if there are no medical concerns)
5. Meet with keepers, managers and veterinarians to decide on how to proceed with the introduction (if infant is healthy)

If the infant is healthy and a re-introduction could take place:
1. Re-introduce the infant to Markisa
2. Maintain continuous observations of infant and Markisa, take detailed notes
3. If necessary, attempt a training session with Markisa and infant to encourage maternal behaviors

If Markisa has no interest in the infant:
1. Sedate Markisa and allow the infant to nurse from both of her breasts (if infant is being bottle fed, do not feed infant prior to this)
2. Leave infant in holding during Markisa’s recovery period
3. Keepers begin continuous observations, take detailed notes

If all efforts to get Markisa to take care of her infant fail:
1. Begin hand-rearing process
2. House infant in holding area in front of Markisa’s holding and begin modeling parenting behaviors
3. Determine an action plan with keepers and zoo managers
Primate Keepers: (Megan Elder, Tami Murphy, Geoff Jungheim, Adam Nigon)
1. Provide daily care, observation and documentation
2. Pre and post partum preparations for the birth:
   - Designate birthing location and set-up - complete by 11/15
   - Secure necessary hand-rearing supplies and protective equipment - complete by 11/1
   - Develop and implement reintroduction procedures
3. Maternal training
4. Alert other staff members (vet staff, zoo managers, night security) if signs of labor or medical concerns are observed
5. Secure emergency transport needs: vet cart, ape crate and transport vehicle
6. Record birth using video camera (if possible)
7. Direct and monitor primate interns & volunteers as needed

Husbandry Trainers:
- Megan Elder serves as Markisa’s primary trainer for all maternal behaviors (as well as Joy’s surrogate training behaviors)
- Tami Murphy serves as Markisa’s secondary trainer
- Geoff Jungheim and Adam Nigon (the gorilla trainers) will also be cross-trained on all of Markisa’s trained maternal behaviors in the event that Tami and Megan are not present

Zoo Managers: (Mike Hahm, John Dee, Joanne Kelly, Allison Jungheim)
1. Monitor and support Primate Keepers, as needed
2. Approval of all action plans that are developed and employed subsequent to the birth

Veterinary Staff: (Dr. Micky Trent, Dr. Ralph Farnsworth, Dr. Mary Boyce)
1. Provide medical support and services for all aspects of the birth, pre/post partum
   - Implement prenatal supplementation regimen
   - Participate in maternal training sessions (particularly voluntary ultrasound)
   - Provide medical oversight and counseling, especially during parturition
   - Develop surgical intervention plan
   - Research the use of colostrum versus plasma in the event that the baby doesn’t nurse from Markisa
   - Adjust dietary needs of Markisa, post parturition
2. Network with SSP veterinary advisors, neonatologist &/or OBGYN regarding medical history, subsequent health issues and overall counseling
3. Initiate the emergency veterinary phone tree for selected veterinary professionals to be on stand-by at the University of Minnesota should an emergency intervention be necessary

Primate Interns: (Sarah Johnson, Kevin Loula)
1. Assist other staff members as necessary
2. Observe and record information during parturition or as needed during other phases
Addendum

Resulting Birth and Reintroductions

On 13 December 2007, Markisa went into labor and again experienced dystocia. After four hours passed with no progress, staff performed a successful voluntary hand injection for immobilization. Markisa was examined, a sonogram was performed, and she was rushed into surgery. She gave birth to a male infant who initially experienced pulmonary edema, stopped breathing, and required intensive care. The infant recovered, was able to breathe on his own, and received supportive care as Markisa healed from surgery. After three days in the University of Minnesota’s College of Veterinary Medicine Intensive Care Unit, he was discharged to the zoo for 24 hour care in the Primate Building. Keepers worked with Markisa to gauge her behavior and encourage interest in the infant (which was instant). Keepers spent as much time as possible caring for the infant in Markisa’s presence while demonstrating proper maternal care. She was reinforced for any interest shown towards the infant. Visual contact progressed into limited tactile contact through the mesh. All interactions appeared positive and the staff felt ready to reintroduce the infant. A few doses of an oral lactation stimulant (Reglan or metoclopramide) were given to Markisa a couple days before the scheduled reintroduction attempt to ensure milk production. “Jaya” (an Indonesian name meaning “a celebration or victorious”) was successfully reintroduced to Markisa, a first time dam, on day 12 - making this the fastest reintroduction of a c-section infant orangutan to a first-time dam.

Once nursing was confirmed and bonding established, Markisa was given access to a well-bedded exhibit for one week on her own with the infant. Then, reintroduction plans were made for the remaining group members who had visual, and some limited tactile contact through mesh, the entire time. The original order in which the group was reintroduced to Markisa and her new infant was altered. It was decided to instead start with our dominant female “Amanda” since she tends to watch out for Markisa and has historically had no interest in infants. The second intro (which was on hold until Markisa has been on a progestin-only contraceptive for at least two weeks) was the sire “Jambu”. Besides having to wait for the contraceptive to kick in (something that was overlooked during the initial planning process and deemed necessary due to Markisa’s pregnancy history), it was decided to introduce Jambu when there were two females on exhibit. He can be a violent breeder so the thought was to disperse his interest between two girls rather than just towards Markisa, for the safety of the infant. Fortunately, both reintroductions went very smoothly.

Como Zoo did not have to reintroduce “Joy” and “Willie” – the two orangutans who potentially posed the most risk to the new mother and infant. Busch Gardens contacted Como Zoo a couple months before Markisa’s due date, expressing an interest in them for a new exhibit. However, any transfer plans were put on hold until it was determined that Markisa was going to rear her infant, in the event that we needed “Joy” to serve as a surrogate. Fortunately, Markisa proved to be very competent and the transfer to move Joy and Willie moved ahead. This left Como Zoo with four orangutans: Jambu, Amanda, Markisa, and the new infant named Jaya.