

So you have a breeding recommendation. . . .

(A quick reference guide to bonobo breeding and birth Management)

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Birth management starts the very beginning, when you first get a breeding recommendation from the SSP. Knowing not only the individual personalities of the animals, but also their estrus cycles will help you achieve your breeding goals. The following information should assist you with all aspects of bonobo breeding and birth management.

The Bonobo estrus cycle

Bonobos cycles are easier to monitor than other species of great apes due to their visual labial and anal swellings. Swellings cycles should be monitored and recorded daily. It is essential that all keepers working with the bonobos be able to accurately read and record the different stages. It should be noted that no two females' swellings look exactly alike. For this reason it is recommended that you take photographs of each of your females during the different stages of their cycle to use in training/consistency of the keeper staff.

When properly read, the visual swelling cycle of the bonobo is one of the greatest management tools a keeper has. A bonobo swelling indicates more than reproductive receptivity, it can also indicate dominance issues within a group, or indicate that an individual has a medical issue. Unfortunately it is also one of the more difficult concepts to master. Although you are looking for the same cues, the swelling cycle of each female looks different and therefore must be learned on an individual basis. The best way to learn is to judge the females' swelling every day that you are at work, regardless of what area you are working in that day. Over time you will be able to see the differences in each stage of the cycle for that particular female.

Swelling cycles are judged on a scale from 1 to 3+. In addition to this, ½ numbers (1.5, 2.5) are sometimes used. The following information (taken from an article by Jeremy F. Dahl), describes each level used.

- 1- Detumescence. The peri-anum is conical and finely wrinkled; the wrinkles tend to converge toward the anus. The labia is also finely wrinkled, relatively inconspicuous and faces caudally. The vulval aperture is open throughout its length (figure 1A, B).
- 2- Tumescence- The peri-anum is rounded and protuberant, with some recession of the anus. All fine wrinkles are absent from the peri-anum and several deep sulci radiated from the anal recess. All fine wrinkling is also absent from the labia, which is enlarged, but not to the degree that there is prominent curvature of the ventral portion to the anterior. The vulval aperture is completely occluded by the swelling of the labia. (figure 2 C, D)

- 3- Maximal Tumescence. The peri-anum is highly protuberant and narrow at the base. The anus is recessed deeply and the radiating sulci are short. The labia minora is elongated and curved through 90 degrees so that the frenulum at the apex is carried between the thighs during quadrupedal locomotion. (figure 3 E, F). The surface of the labia is smooth in appearance. The vulval aperture remains fully occluded by the tightly oppressed labia minora.
- 3+ - The labia becomes shiny in appearance.

During times of lactational anoestrus, a “0” is also used. The “0” stage occurs during the latter part of pregnancy and continues after the birth of the infant until the female begins to exhibit a swelling cycle again (although the cycle does not have to be regular).

The standard sheet used for recording swelling cycles has been attached for your use.

Wrinkles, folds and lines, oh my!!

Now for the information that the article/diagram does not tell you; when judging swellings, you are not looking at size, but rather at the turgidity or tightness of the swelling. This is not necessarily as easy as it sounds as some females still have lines when they are at their maximum swelling whereas others have folds. In addition to this, not all females exhibit a distinction between the anal swelling and the labial swelling, meaning that you will not see the nice indentation between them as shown on the diagram.

This can be very confusing for new institutions. If you find that you are having difficulties, contact a more experienced bonobo facility for help. Pictures can be sent via e-mail for a quick response to help you determine swelling stages.

Management for Breeding through the use of Fission/Fusion

The SSP advocates keeping bonobos in multi-male, multi-female groups. However, to promote the best genetic management, the SSP might recommend that you breed a specific male and female. The most effective way to accomplish this without having to separate a pair long term is through the use of fission/fusion management. This tool should be used as a way of management, not just for breeding purposes. This will help to alleviate stress since the animals will be used to the separation.

The SSP strongly recommends spending time at a bonobo facility that has experience using fission/fusion management. Although many institutions are now using some degree of fission/fusion, those with larger groups such as Milwaukee, Columbus, and Jacksonville have the most experience using this as a tool for breeding management.

When to put the pair together. .

Bonobo estrus cycles last an average of 35 days. The female might achieve maximum swelling and remain there for 15 days or more. However there are no visual cues during this period of maximum tumescence that indicate when ovulation will occur. A study by Dahl (1986) noted that peaks in estrogen (usually occurring immediately before ovulation in primates) occurred about 3 days before the first onset of detumescence, which was on average within one day of the first rise seen in urinary progesterone metabolites (taken from the Bonobo standardized guidelines section 4.2)

Human ovulation tests have been used by some institutions to narrow down the window when pregnancy is likely to occur. To do this, urine must be collected from a clean area. Training the females for urine collection will make this process less time consuming. First morning urine is recommended, but is not required for the test. This test detects the LH surge. When the test is positive it indicates that ovulation should occur within the next 24 to 36 hours. The use of ovulation tests is not necessary; rather it is just one of the tools that is available to you.

If a pair is kept together too long during a cycle, a decrease in breeding frequency may be seen. If this occurs consider trying the following things to spark interest in breeding again:

- Separate the pair for a day or two. Absence often makes the heart grow fonder and the breeding stronger.
- Add another bonobo to the group. Sometimes shaking things up is all that is needed to get breeding going again.
- Try feeding exciting foods, or giving novel enrichment. In bonobos excitement causes breeding.
- Since food often plays a large roll in breeding behavior, consider breaking your normal feeding routine up into several smaller feedings.

Remember that another bonobo institution has likely faced the same challenges that you are having. If you are having trouble getting animals to breed, post something on the listserv at bonobos@azalists.org. Another keeper might have the answer you have been waiting for.

Confirmation of Pregnancy

Records from the Columbus Zoo indicate that their female bonobos mense between 3 and 10 days after they drop to their minimum swelling stage. Menses is usually visible and lasts for 2-3 days. It is possible to see signs of “postconceptive vaginal bleeding” following conception. In addition, some zoos have reported that the female bonobo may continue to swell after becoming pregnant. The use of human pregnancy tests are recommended for confirming a pregnancy. Various brands have been used at bonobo

institutions with good result. It is best if the test is performed using fresh morning urine and the sample should not be contaminated with foreign materials or other bodily fluids.

Running a pregnancy test a few weeks after the female has dropped to her minimum swelling stage each cycle will ensure that you catch a pregnancy as early as possible.

Determining a due date

The two accepted methods of determining gestation are listed below. These paragraphs have been taken directly from the bonobo husbandry manual.

1. Gestation based on the interval between the last menses and parturition. This method includes the entire follicular phase of the menstrual cycle, which can range from 17 to 34 days (Heistermann et al. 1996). With the utilization of this method, Bolser and Rumbaugh (1989) report a gestation length of 245 days for one pregnancy, while Thompson-Handler (1990) found a gestation range of 227-277 days, with a mean of 246.4 days for 11 pregnancies
2. Gestation calculated from the last day of maximum tumescence. Van Elsacker et al. found a gestation length of 235 and 238 days for two pregnancies. For three pregnancies, Thompson-Handler (1990), reported gestation lengths of 230, 241, and 234 days. Thus for these two studies the mean gestation length is 235.6 days, producing a lower mean and less variability than calculating gestation length from last menses.

Since it is possible to miss menses and breakthrough bleeding has been known to occur, the second method is probably the more accurate of the two. Starting from the last day that the female was at maximum tumescence, count forward 235 days to find a rough estimate of the due date. If the female has had other offspring, use her previous gestations to determine a due date rather than the average listed in the book. Remember to give yourself a window of time so that you are prepared for the birth. Two weeks on either side of the “due date” should be sufficient.

Behavioral Changes Associated with Pregnancy

No two pregnancies are exactly alike and therefore you may see some or none of the following behavior changes from your females. Some changes you might see are lethargy, withdrawal, changes in appetite, increased thirst, increased sleeping and loose stools. In addition you may see changes in the way the rest of the group treats the individual including aggressive behaviors. All changes should be monitored closely and recorded daily.

Medical Problems associated with Pregnancy

Little information has been published regarding medical problems associated with pregnancy in bonobos. A recent review (Keller et al 2010) identified cases of blighted ova documented through repetitive reproductive sonograms, spontaneous abortion, placental insufficiency with resultant low-weight infant, pre-eclampsia, abruptio placenta with subsequent death of the dam and fetus, and uterine fibroids. These issues are typical

of reproductive problems seen in humans, and the SSP Veterinary Advisor feels that bonobos are prone to most of the gestational problems seen in human females. In order to gather further information it is essential that a pathological exam is performed on the fetus and placenta and the information is reported to the vet advisor.

Most institutions perform at least one ultrasound examination during a pregnancy to look for potential problems and many are doing this without the use of anesthesia. The Milwaukee Zoo has a licensed ultrasound technician perform reproductive sonograms on all of their pregnant bonobos and have published this information. In addition more information can be obtained by contacting Barbara Bell at Barbara.bell@milwcnty.com

Reproductive-Related Bonobo Literature

Keller, DR, Clyde VL, Bell B, Beehler L, and Wallace RS. 2010. A review of reproductive medical conditions in a collection of captive bonobos (*Pan paniscus*). 2010 Proceedings of the AAZV – AAWV Joint Conference. Abstract pg 122.

Drews, B., Harmann, L. M., Beehler, L. L., Bell, B., Drews, R. F. and Hildebrandt, T. B. (2011), Ultrasonographic monitoring of fetal development in unrestrained bonobos (*Pan paniscus*) at the Milwaukee County Zoo. *Zoo Biology* 30: 241–253. (*This article was published online on 13 January 2010, but the article was corrected on 7 March 2011*).

J. Andrew Teare, Barbara Bell, Randall Kuhlmann and George Geanon. (1996) Ultrasonographic measurement of fetal growth in a bonobo (*Pan paniscus*). *Journal of Zoo and Wildlife Medicine* 27(4): 477-481.

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Clyde VL, L Roth, B Bell, RS Wallace, D Slosky and J. Dolan. 2002. Cardiac and gestational ultrasound parameters in nonanesthetized bonobos (*Pan paniscus*). *Proceedings of the Annual Conference of the American Association of Zoo Veterinarians*: 365-368.

Jurke MH, Sommovilla RH, Harvey NC and Wrangham RW. 2001. Behavior and hormonal correlates in Bonobos. *Proceedings of The Apes: Challenges for the 21st Century*, Brookfield Zoo May 2000: 105-106.

Bell B and Khan P. 2001. Training multi-task medical behaviors in the Bonobo (*Pan paniscus*). *Proceedings of The Apes: Challenges for the 21st Century*, Brookfield Zoo May 2000: 128-130.

Bell B, Clyde VL, Khan P and Maurer J. 2001. Advanced operant conditioning and reproductive applications in the Bonobo (*Pan paniscus*). Proceedings of The Apes: Challenges for the 21st Century, Brookfield Zoo May 2000: 373.

Diet Changes and Vitamin Supplementation

Bonobos receiving nutritionally complete diets with large amounts of fresh vegetables and nutritionally complete pellets should not require additional supplementation, other than a slight increase in the amount of food offered in late pregnancy. However, breeding and pregnant females are generally offered prenatal vitamins. Monitoring of the pregnant female for a reduction in body condition can help to determine whether an increase in food is necessary. Diet increases are often provided during pregnancy and lactation, especially for lower ranking females. An increase of 20% during pregnancy and 30% after parturition is given at the Jacksonville Zoo. Little weight gain is necessary based on the small size of the fetus and it is essential that obesity is avoided. Depending on your female, more fluids may be necessary as well.

After the baby is born, supplemental fats can be added to the diet in order to promote lactation. Examples of these are hard-boiled eggs, coconut, avocado, and flax seed oil. Extra fluids should also be given to lactating females.

Development of A Birth Management Plan

A birth management plan should be established as early as possible, starting from when breeding recommendations have been received. This should include a review of social reproductive and medical history of the pregnant female, staff assignments, determination of due date, pre-partum plan, birth day plan and other considerations relating to the birth. It should also include history of the expectant female, discussion of intervention types, record keeping or documentation, housing situations, previous maternal skills, labor and delivery, problems associated with birth and delivery, physical appearance of the newborn, post partum behavior, diet and supplementation during lactation. A local OB/GYN and neonatologist should be recruited for the mother and infant.

History of the expectant female

Knowledge of the complete history of the expectant female can help to eliminate potential problems with the birth. Start with a review of staff records and any records from previous institutions in order to obtain a clear vision of what potential issues may need to be addressed. Is this her first baby or has she had other offspring? Did she raise previous offspring? Does the female have any medical or social issues that might affect her ability to raise the baby? If this is a first time mother, has she been in a group with other females who are rearing their offspring? If the records are unclear, try to find someone who was working with the individual during the specified time that might be able to clarify things.

If the female has neglected offspring in the past the following questions should be asked:

- What was her housing situation at the time of the last birth?
- Who was in the group with her during her last birth, and what was their social interaction like?
- Was the routine constant before and after the birth, or were there new changes made during this time? (this may include bedding type, food, feeding schedules, holding cages, cage mates, caretakers, etc.)

A maternal training program may be useful for females who have not reared infants in the past or for first time mothers who have not been in a mixed social group. Behaviors trained with apes include:

- breast desensitization
- manipulation of the breast with a breast pump
- training them to pick up and position a “baby”. A number of objects have been used as the “baby” including buckets, bottles, recycled plastic blocks and dolls.
- Bringing the baby over to the mesh for supplemental feedings.
- Retrieve the baby (done with other females to help get babies back from others who may have stolen them from the mother.)

Pre-partum Plan

A thorough evaluation of all exhibit space should be conducted. The exhibit should be complex and have multiple platforms for resting as well as escape routes so that all individuals in the group feel secure. When planning for a baby, walk through the exhibit to see if there are any gaps where infants might get their hands or feet stuck. Avoid gaps that are < 1” in diameter. Check to make sure that all rope or firehose are taught; avoid loops that can flip over on themselves providing a noose like configuration. Unsecured hard enrichment items should be removed as the due date approaches. It is often good to remove these types of enrichment devices until the baby is aware enough to get out of the way if one is thrown in their direction (usually at 1 year of age).

Decide where the bonobo will give birth. This may be in any of your exhibit or holding spaces, but keep in mind that you will want to have them in a place where you can access them easily in case of an emergency. This may eliminate the outdoor exhibit depending on your facility design. The birth location should be an area that the animal is familiar with and that provides comfort and minimal stress. If your animals are consistently rotated through all of your cages, it is not necessary to limit them to one particular area as the birth approaches, provided that all spaces are baby proof. Giving the female a choice of where she wants to give birth can lead to an increase in comfort and a reduction of stress during labor.

Discuss with the staff who the female will be housed with when birth occurs. It is important to include all members of staff in this discussion, particularly if this is your first birth as keepers and managers may not have the same perspective on the group. It is not necessary to remove males from a group as labor approaches as female bonobos lead the group and males can be very comforting to them. Again, if your groups are constantly rotated it may not be necessary to change any aspect of your routine. However if there

are any particular cage mates who cause the female stress, separating them out as the birth approaches may help to reduce stress and increase the chances of a successful rearing.

Decide whether or not a birth watch will be done on the female as the due date approaches. Doing a birth watch for first time mothers, females who have had difficulties with labor, or those who have not reared their offspring in the past may help you respond more quickly to troublesome situations.

In case the female is unable to raise the baby, a hand rearing plan should be developed. In addition, potential surrogates should be identified. For a list of proven or potential surrogates, contact the SSP advisor. For assistance in developing a hand-rearing plan, contact the APE TAG committee for hand-rearing, surrogacy and birth management. The chair of this committee is Dusty Lombardi (dusty.lombardi@columbuszoo.org)

Staff Assignments

Prior to the birth, staff assignments should be determined. This includes which keepers will work in the building following the birth and who will watch for nursing. It is important to stick to staff members that the female and the groups are most comfortable with. If the presence of the veterinary staff or the curatorial staff tend to make your animals nervous, you will need to determine if it is necessary for them to enter the area during labor or after the birth to check on the mother/infant. Cameras can be a very useful monitoring tool in this situation. If this is not an option, then working on a positive relationship between the troop and the vets/curators should be a top priority from the beginning of breeding.

It is important to determine who will be responsible for making the call on whether or not a baby should be pulled for hand-rearing and when.

Signs of Labor

A few weeks prior to birth, the pregnant female may have a decrease in appetite and activity along with an increase in thirst, urination, and restlessness. Labor times vary, but can be as short as two hours or as long as 10-12 hours. Birth videos are available and have been included in this packet. The following are some behaviors and events you might see to indicate that labor has begun.

- ◆ Nest building and re-building. (This differs from normal as they seem as if they “just can’t get it right)
- ◆ Shifting positions frequently, unable to get comfortable.
- ◆ Pacing or wandering throughout the areas.
- ◆ Female rubbing her lower back.
- ◆ Water breaking may or may not be evident as a gush of clear fluid. It could be mistaken for urinating (or vice versa).

- ◆ Touching and tasting (T & T) of vaginal fluids. This does not usually happen after urination. This will include blood that may be seen on or dripping from vaginal area.
- ◆ Female may insert fingers or toes into vaginal area.
- ◆ Lying on belly with legs drawn up.
- ◆ Legs extended and stretched out.
- ◆ Using mesh, shelf or whatever to push or pull on.
- ◆ Contractions may be visible on the abdomen and anal area as they move down the body.
- ◆ Change in genital area. Bulging in the vagina and anal area indicates the infant is moving down the birth canal.
- ◆ Walking in a squat position, or with legs abnormally apart.
- ◆ Standing on their heads with legs extended into the air (see video from Columbus Zoo of Susie)

Passing of the placenta follows shortly after birth. The female severs the placenta by biting through the umbilical cord. Females typically consume the placenta. Other members of the group that are present during birth may help to consume the placenta. If the female does not sever the placenta immediately, close monitoring of the placement of the cord is necessary to ensure that it does not become wrapped around the neck of the infant or constrict the body in any way. If the cord is wrapped, but the mother is attending to it and keeping it from constricting around the infant, monitoring is warranted, but intervention may not be necessary. Any placental material that is not consumed should be retrieved and given to the veterinary staff for examination. In addition to the consumption of the placenta, it is common for the group to assist the mother in cleaning up all of the blood expelled during delivery. The female may continue to vaginally bleed for a few days.

Post-Partum Behavior

Maternal attention is usually directed to the infant immediately following birth. Positive behaviors include grooming or smelling the newborn. A new mother may be unsure of what to do and may hold the infant in an awkward position at first; however the female should respond to the newborns vocalizations. For the first few days after giving birth, the female may spend more time resting than usual. When she is not resting a bulk of her time will be spent grooming and inspecting the infant. The infant is kept ventro-ventral for the first few months. Although the infant will be grasping onto the mothers hair, it is not unusual to see one limb grasping while the other three are hanging free, particularly when the mother is not moving. Touching of the infant by other group members should be controlled by the mother. If any of the group are not respectful of the mothers' cues and seem to be causing her stress, it may be necessary to remove them from the group for a short period of time.

In bonobos, nursing is usually seen within the first 24 hours, although inexperienced mothers may take longer than 24 hours to begin nursing. Nursings are short in duration and seem to occur every 1-3 hours. Breast size varies between females. Small breast are not an indicator of a lack of milk production. As the baby nurses, breasts tend to fill out a

bit more. If the infants health and general condition are good and there are no immediate threats, the mother and infant should be given as much time as possible to form a bond with one another before intervention. If the situation is stable, The AZA Ape TAG recommends 72 hours before intervening.

Nusing logs from various institutions have been included in this packet for reference.

Circumstances That Might Warrant Hand Rearing (adapted from the gorilla SSP standardized guidelines)

In virtually all circumstances, mothers should have the opportunity to rear their infants themselves and without human intervention. The rare circumstances of human intervention include maternal abuse, neglect, significant illness or injury to the mother or infant. In these conditions, where the life of the mother or infant is in danger, managers may be forced to intervene. In some circumstances, the infant may be able to be reintroduced to the mother soon after the initial separation, and mother-rearing may be continued. However, in cases of life-threatening abuse or neglect, alternative rearing strategies must be considered.

A birth management plan should be established as early as possible, starting from when breeding recommendations have been received. This should include a review of social reproductive and medical history of the pregnant female, staff assignments, determination of due date, pre-partum plan, birth day plan and other considerations relating to the birth. It should also include history of the expectant female, discussion of intervention types, record keeping or documentation, housing situations, previous maternal skills, labor and delivery, problems associated with birth and delivery, physical appearance of the newborn, post partum behavior, diet and supplementation during lactation. A local OB/GYN and neonatologist should be recruited for the mother and infant. Training, monitoring and medical intervention needs, as well as planning for a rapid retrieval of the infant, should be established if it becomes necessary. Each birth event and neonate/mother relationship should be evaluated on a case by case basis, but if the mother does not clean the membranes from the face, hold the infant soon enough to prevent hypothermia, or if nursing is not confirmed within 72 hours, the infant should be given a thorough examination. In most cases, this will require at least light sedation of the mother. During this time the infant can be placed on her breast and allowed to suckle and the breast can be further manipulated by hand or via breast pump, in an attempt to stimulate milk production. The results of the exam should be used to determine what level of further medical/nutritional attention is needed. Oftentimes, one or more reintroduction attempts can be made, once the infant's condition is stabilized through intensive care. Reintroduction attempts of neonates can generally be accomplished safely by placing the youngster on bedding in a warm enclosure and giving the mother access. If the mother does not respond appropriately, the youngster should be removed within a short period of time to prevent chilling. Care should be taken against the premature removal of infants due to anticipated or perceived maternal incompetence. Inexperienced bonobos have proven to be competent mothers, and many bonobos show improvement in

maternal care during the first few days of an infant's life. According to Bahr (1995), physical and psychological stress can potentially inhibit the initiation and early maintenance of lactation. Milk letdown may not occur until 48 hours postpartum, although increased fluid intake may help to stimulate milk production (Bahr 1995).

The Lincoln Park Zoo (Rosenthal 1987) has developed a 72-hour, postpartum observation protocol for gorillas based on their experience that infants can be pulled and successfully hand-raised after 72 hours of not nursing. This protocol can be applied to bonobos as well. The protocol lists four aspects that should be checked immediately after a birth:

- The ability of the infant to cling to its mother. Fossey (1979) reports that a 1-day-old infant can cling, unsupported, for 3 minutes.
- The presence of mucus and placental membranes that could obstruct the mouth and/or nose of the infant.
- The care the mother provides the infant. Has she cleaned the infant? Does she keep the infant with her, and in what position does she carry the infant? Is she protective of the infant?
- Whether the placenta has been passed. Some, but not all females, eat the placenta. If the umbilicus remains attached to the infant, it should dry and detach by the third day.

Another useful guide is the continuum developed by Rogers & Davenport (1970) to evaluate maternal behavior in chimpanzee mothers in the first 12 hours post-partum. Some institutions have the capability of remote observations, thereby allowing the mother and infant more privacy. This method may be particularly useful for situations in which the female or other group members become nervous when observed. An additional benefit is that volunteers (i.e., "strangers" to the gorillas who may disturb the mother) could be used; increasing the amount of time the mother and infant could be observed.

Promoting appropriate maternal care: If females have a history of poor maternal care, or in situations where proactive measures are taken to ensure females show appropriate care, one possible management strategy involves incorporating an 'at-risk female' into a breeding group where she can observe other mothers raising their infants (Meder 1989).

An innovative but more uncertain approach is to develop a training program that is designed to teach a female certain maternal skills. Such a program generally entails training the female to respond to a series of commands that may increase the likelihood that she will hold, carry, and/or nurse her infant. Joines (1977) trained a female gorilla to gently handle a doll and raise it to her breast; the female successfully raised her next infant. Another training program involving a gorilla (Schildkraut 1982) was not successful. If being considered, such a program would benefit from the input of a professional animal trainer working closely with the keeper staff to develop a plan that is consistent and based on positive reinforcement and shaping techniques. Females that have shown a range of appropriate maternal behaviors, but have failed to raise an infant due to an identifiable behavioral deficiency, may prove to be good candidates for a training program. This approach could be used in tandem with the management strategies

discussed above. Such programs can also be initiated to train females to bring infants to keepers for supplemental feedings and even vaccinations.

Aspects of the physical environment that may also influence maternal competence include, an established daily routine, cage size and amount of vertical space; access to privacy; opportunities for activity, play, and exploration to reduce stress and boredom; access to live vegetation; access to nesting material and diet. Important social factors may include group composition, maternal rank and temperament, access to familiar companions, experienced staff and relationship to human caretakers.

Alternatives to hand-rearing: If observations indicate that the infant bonobo is not nursing after 72 hours, and human intervention is necessary, the following alternatives to hand-rearing should be considered.

- *Additional time and close monitoring:* If the mother is exhibiting aspects of maternal care, but the infant has not been observed to nurse during the 72 hours, it may be appropriate to provide the mother and infant with more time to coordinate nursing behavior by removing the infant, rehydrating it, and returning it to its mother.
- *Promoting natural nursing:* With a female that prevents an infant from nursing, it may be possible to sufficiently distract the mother to allow the infant to nurse. The prior development of a positive and flexible relationship with the female by one or more members of the caretaking staff would be beneficial. Alternatively, anesthetizing the female to permit the infant to suckle may stimulate further nursing. Such a procedure may be particularly helpful if the female's breasts are very full and tender, as milking will relieve her discomfort.
- *Supplemental feeding:* If the female bonobo exhibits acceptable to good maternal behavior, prevents the infant from adequately nursing or has insufficient milk, a supplemental feeding program may be possible (e.g., distracting the mother with hand-feeding while supplementing the infant with a bottle). This innovative method can allow the infant to be raised within the social group. This method must be established during early pregnancy.
- *Surrogate lactating mother:* An alternative to hand-rearing is possible if a surrogate mother is available to adopt the infant. A lactating female would be ideal, but the timing of such occurrences is mostly chance. Communicating with the SSP and initiating a nation-wide search may improve chances.

Female I.D. _____

Month: _____

Year: _____

Swelling

1 = Score area is wrinkled/detumesced

2 = Score area is partially tumescent, decrease in wrinkles

3 = Score area is fully swollen, no wrinkles, entire

area is taut and does not sway

3.1 = Scoring is same as 3, but a shine is visible on the labia/anus areas

Sex:

MIT = Mount, Intromission and thrusting

EJAC = Ejaculation

| Day | Labia | Anus | Menses | MIT | EJAC | Male I.D. | Comments |
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