MONITORING GUIDE

FOR THE

AMBOSELI BABOON RESEARCH PROJECT

Protocols for long-term monitoring and data collection

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I. INTRODUCTION

1.Background

The Amboseli Baboon Research Project has been ongoing for over five decades. Over the years, a variety of data types have been collected. Of the data sets described in this guide, some (i.e., demographic data) have been ongoing since 1971, while others extend back for somewhat shorter periods. Many of the data types that we currently collect extend back to at least 1980. Still other types of data were collected for shorter periods of time and are no longer a focus of our research efforts. Whatever the data set, the value of the data collected at the Project lies in its consistency and in its consistently high quality across time. This guidebook describes the procedures we use to collect these data, which allow us to monitor the demography, behavior, ecology, physiology, and genetics of the Amboseli baboons. It is meant as a guide for the permanent staff in Amboseli, for short-term visitors to the Project, and for visiting researchers pursuing their own projects (Ph.D. students, post-docs and other collaborators that stay long enough to learn the baboon IDs and contribute to the long-term data). It is absolutely essential that everyone who contributes to the Project's data collect the data in accordance with the guidelines laid out here. Visiting researchers will collect additional data for their own specific research questions, which will extend beyond the monitoring data described here; these visiting researchers will still contribute to the monitoring data collection that is described in these procedures.

When you contribute to the data of the Amboseli Baboon Research Project, you are contributing to a data set that we believe is unique in its time depth, breadth, and detail. It is important to us that you take this responsibility very seriously. Never be satisfied with your data collection; always strive for more data of higher quality.

Permanent field staff should read this entire guide once every year. A good time to do this is during a visit from one of the directors. Visiting researchers should read it again after they have been in Amboseli for three months, and again after their eighth month. Each time, notify Susan, Jeanne, Beth, or Jenny immediately if there are any differences between what is described here and what you are doing, and if there are any sections that are not clear.

2. Data collection overview

The data we collect span a wide range of data types. Many of our monitoring data sets (e.g., grooming records, agonism records) are collected via representative interaction sampling (defined in Chapter 2, Section 9); others are collected as systematic scans (censuses and sex skin records), all-occurrences data (predation events, mounts and consorts), focal animal samples (individual), or focal group samples (SWERB and GPS readings). Virtually all data collection depends on individual recognition of baboons by observers, and if you are new to the project, learning baboon IDs will be your first task.

We work hard to achieve and maintain inter-observer reliability; the presence of long-term, extremely knowledgeable field assistants contributes to this task. If you will be contributing to the long-term data, it is very important that you learn to collect each type of data in the manner described here. If you have questions or concerns about a particular data collection method and your questions aren't answered here, ask the field team how and why they collect it the way they do. If you are still uncertain about how or why a certain collection method is used, consult with Susan, Beth, or Jeanne. Do not make decisions on your own about changing data collection protocols; with a long-term data set already in place, any change you make during

your stay will at best simply result in your data being discarded and at worst will compromise the integrity of the long-term data set.

We maintain a separate field notebook for each study group. The monitoring data are recorded in these field notebooks, which are used jointly by the field teams and are placed at the end of each day in the office, on the shelf with other data notebooks. Also at the end of each day some data that are collected electronically (GPS SWERB data, focal samples, photos, and behavioral interactions collected via the Prim8 app), and some hand-written data (groomings, agonisms, mounts and consorts, and corpse checklist, if a corpse is found that day) are scanned and emailed to the data managers at Duke and Notre Dame; these data are also uploaded to Dropbox and synced each day with folders shared with the data managers at Duke and Notre Dame. Data collected on the QuickTap Survey (e.g. predation and human disturbance) are synced with the data managers' files using the wifi network in the office. The WeatherHawk data, which are also electronic, are emailed and uploaded to Dropbox and synced each week with Project members at Duke and Notre Dame. Photos are sent once per month. At the end of each month, any hand-written data in the notebooks (e.g. census, sex skins, notes, male collar checks, the weather data) are removed from the notebooks or clipboards in the office, scanned in camp, and emailed to Notre Dame and Duke. In addition, agonism data that were hand-written are entered on the project computer in camp (the hand-written grooming data are entered in the US). The original data are stored in camp for 6 to 12 months, at which point the originals are carried back to Duke.

3. Field notes

Hand-written field notes that you contribute to the long-term files will be used for many years to come, well after your own recollection and familiarity with the data, format, abbreviations, etc., has diminished. Thus, it is of utmost importance that data sheets are clear and intelligible not just to the writer at the time of writing, but also to other researchers and technicians in subsequent years of the project. One test for a well-prepared data sheet is to give it to a naive observer and then ask that individual to interpret each entry on the sheet without reference to other entries or other data sheets. Any notes contributed to the long-term data files should not use any symbols or abbreviations except those that are given in this Guidebook. Exceptions are the standardized ABRP 3-letter animal codes, standard metric abbreviations, abbreviations that are well known and unambiguous in American English, or those that are defined on every page of notes where used. If you develop your own unique numeric codes for individuals or behaviors, these must never be used in the long-term records.

When describing events, do not use the simple present tense; it is ambiguous. For example, the statement: "Baboons eat mushrooms from elephant dung" could be a generalization, independent of time, or it could refer to what the baboons were doing at the time of the observation. Instead, use the simple past tense: "13 Mar 84. Baboons ate mushrooms from elephant dung at 14:00."

If you are describing events from several past days, use "today," etc., to avoid ambiguities: "13 Mar 84. Last week baboons ate mushrooms. Today they ignored them." An acceptable alternative to the past tense is the progressive tense: "13 Mar 84. The baboons are eating mushrooms."

4. Date and time conventions

Dates are always written only in the order day, month, year, and the month is abbreviated by the first three letters of its name, not by numerals. Thus, a standard date entry in the field

notes would be of the form "16 Jul 83." Formats such as "8/10/83" or "8-10-83" should not be used under any circumstances. Similarly, even if a page is labeled "Agonisms – 2003" or "Agonisms – May 2003", you should write the entire date on any entries on that page, i.e. 16 May 03 not just 16 May.

The time that events occur should be timed to the nearest minute and recorded as a four-digit number, without inserted punctuation, in the 24-hour system. e.g. 3:15 p.m. is written 1515 and 9:17 a.m. is written 0917. Use a digital watch in the field and synchronize your watch with the rest of the field team.

5. Monitoring study groups

The number of study groups that we monitor changes from time to time, usually because of group fission or group movement. As of January 2024, we monitor five social groups on a near-daily basis: Europa's, Yoda's, and Hokey's Groups (descendants of Alto's Group), Narasha's Group (a descendant of Hook's Group), and Acacia's group (which resulted from a fusion between Omo's and Laza's groups, which were descendants of Alto's and Hook's respectively). On a typical field day, two or three field teams go out to two or three different study groups; we alternate between morning and afternoon shifts. With five study groups, this means that each group is followed every 2nd or 3rd day, and that over the course of a week each group has been followed during all daylight hours (see "Field Schedule" section in the Camp Life document). We collect the same set of monitoring and behavioral data for each group during each shift.

5.1 Focal animal sampling during group monitoring

Soon after we arrive at the group, we begin focal animal sampling. The permanent field staff collects focal samples on adult females and on juveniles, using handheld Samsung tablets running a program we have customized for data collection, "Amboprim8," a customized modification of Prim8 (McDonald & Johnson 2014, *Anim Behav*). Visiting researchers who are pursuing their own research projects will sometimes also collect focal samples, but the protocol for these samples will typically be designed specifically for their research projects and will not be the same as the focal samples the team collects. Monitoring data are collected continuously throughout the day while focal sampling is occurring. Some types of monitoring data (e.g., grooming and agonism data, mounts and consorts data) are easy to collect while also conducting focal sampling, and these may even be collected as part of your focal samples. Other types of data (e.g., opportunistic censusing of non-study groups when they are near your study group, GPS readings every half hour) require special effort and may occasionally interrupt your focal sampling schedule. Long-term visiting researchers, who are conducting research as guests of the project, may be expected to collect some or all the monitoring data described here unless noted otherwise in specific sections, even if these data are not relevant to your particular research question. If you are not sure what data you are expected to collect, talk to Susan, Beth, or Jenny.

5.2 Other field work and office work

Several other types of field work are important, in addition to monitoring study groups and conducting focal animal sampling within these groups. We regularly conduct censuses of non-study groups in the population, we collect daily records of temperature and rainfall, and we periodically dart baboons in order to collect blood and tissue samples and affix a radio collar (we maintain at least one working radio transmitter collar in each study group). Each of these is described in Section III.

At the end of every month, we have an end-of-month staff meeting. We expect everyone who is actively collecting field data, of any kind, to attend these meetings. During this meeting, we review important demographic and behavioral events in the study groups that month, we discuss vehicle and camp maintenance, and we bring up any problems we had during the month. A summary of this meeting is written in during the meeting and emailed to Susan, Beth, Jenny, Jeanne, and the US-based database managers. We also check the GPS recorders and other equipment, prepare new sheets for the field notebooks for the coming months, scan handwritten data from the notebooks, and carry out various other kinds of office work (see Chapter IV).

5.3 Your behavior when observing baboons

When observing baboons, especially when you are on foot, the following guidelines are important.

- Do not wear red clothing (the Maasai wear red, and the baboons don't react well to this color).
- Do not stare at the baboons or make eye contact.
- When you eat food, keep it in the car and keep the car away from the baboons. They should never see your food or see you eating.
- Walk slowly and in a relaxed posture.
- Don't make loud noises or sudden movements.
- Stay at least as far away as the senior observers and usually further.
- Don't turn your head suddenly.
- If something makes you laugh, don't show your teeth.
- Be sensitive to how the animals are reacting to you. Sometimes they avoid you in a very subtle manner; try to become accustomed to when they are really ignoring you (this should be your goal). If they are not ignoring you, then change your position or behavior until the most shy/sensitive animal does. Avoid displacing them or causing them to move; you must be willing to take long detours and sometimes miss interesting behaviors rather than disturb the baboons.

II. MONITORING STUDY GROUPS

1. Demography and demographic events

Data on group size, composition and the reproductive state of females are basic information required for nearly any short-term study (e.g. Ph.D. thesis) and are some of the most important information for the long-term monitoring of the Amboseli population. Our data collection protocols for demographic monitoring are in this section, and our protocols for monitoring reproductive states and events are in the next section.

1.1. Demography notes

Each daily census should be accompanied by notes about changes in group composition and the cause of such changes (see Chapter II, Sections 1.21-1.23). These notes will include information about demographic events (births and deaths) and also information that may not appear in the census, such as sightings of extra-group males near the study group. It will also include detailed notes on wounds and pathologies as well as immigrant males, their spatial and temporal relationship to the group and interactions with group members, which are used to determine whether the male is considered to be a group member on that day. All the demography notes from a given day should be headed by the date they were collected. Each

individual note should include the time the event occurred and the initials of the observer(s) that contribute to the note (multiple notes from the same observer do not need initials on each note).

In making notes, imagine that you are working with the data 10 years from now, and are unable to ask questions of the person who wrote the notes. Is everything you need to know clearly written in the notes? Would you be able to draw the right conclusions about what happened? More notes are always better than less.

1.2. Daily census sheets

We complete a daily census of the group under study as soon as possible after we arrive at the group. Each census sheet has a list of animal codes (the three-letter codes that represent each animal's name) along the left-most column and days of the month along the top row.

- "X" opposite an individual's name on a given day means that the individual was present in the group that day, at the time of the census. In the case of immigrant males, it is sometimes difficult to tell whether he is part of the group or not, particularly if he is quite peripheral for most of the day. Any male that is seen to sleep with the group should be considered part of the group and should be recorded as present on that day. If you don't know whether a male slept with the group, make a determination by the end of observations that day based on interactions with group members, including whether these interactions are more than a single or fleeting one (If a male interacts with more than one group member and does more than simply run away from them, he should be considered a member of the group. This determination should be accompanied by thorough and specific demographic notes to assist in a final determination of immigration date by the database managers.
- "0" indicates that the individual was absent, either verified by seeing the individual in another group or elsewhere, by the presence of a corpse, or by failure to find the individual after several complete searches through the group.
- A combination of "X", "2", or "3" indicates that the individual was found in two or more ranging or sleeping sub-groups when the census occurred. At the beginning of observations, it is often unclear whether a group is subdivided, so animals present in the first subgroup (on days where subgroups occur) will often be marked with 'X', and members of other subgroups will be marked with '2,' '3,' and so on. For instance, all the animals present in the first sub-group should be marked with a "X". Animals in the second subgroup should be marked with a "2" and so on. These subgrouping patterns should be noted in the subgroup notes (see Section 4). Sleeping and ranging subgroups are defined in Section 4.
- "Blank" (no entry) in a cell of the census record means that no census information was available for that individual on that day. This will be the case for all individuals on days when no observer was in the field. It will also be the case for a subset of individuals when time or other conditions permit only a partial censusing of the group. However, a full effort should be made to complete all censuses.

It is important for each daily census that you also record the time you complete the census, that is, the time when you have either made an entry for each individual or have convinced yourself that one or more individuals are indeed not present. An individual that leaves the group or dies after the census is completed should still be recorded as present on the census for that day – that is, you should not change the status of the census if this occurs – but you should make clear notes in the demography notes (see Section 1.1 above) describing that individual's departure or death. However, an individual that enters the group (or is born) after the census is complete should be added to the census for the day on which they entered or were born

(although the time should not be changed), and clear, extensive demography notes should be made describing the entry or birth. In the case of immigrant males, it can be difficult to determine when a male has actually joined a group (as opposed to just following it).

1.21 Births and neonatal assessment

If a birth has occurred, record the sex and name of the new infant in the demography notes and add a line for the infant on the census sheet; you will also add a reproductive note (see Chapter II, Section 2.14) and update the reproductive records (see Section 2.16). The infant should be added to the daily census sheet starting with the first day it is seen.

Naming conventions: Each new individual (whether an immigrant or a birth) must have a name whose first three letters are unique, i.e., have never been used before in our database. See Section 1.25 below for rules on how animals must be named.

You will also provide information on the condition of the infant through the use of a neonatal assessment sheet. A neonatal assessment sheet should be filled out on the first day an infant is seen. This form has a space for the last date and time that a female was seen without the infant and another for the first that she was seen with the infant. The Notre Dame database manager uses these and the other information to assign or estimate the birth date later at Notre Dame. The second assessment should be completed 3-7 days after the first assessment. You will find checksheets for first and second assessments in the office in camp; spare sheets should always be available in the group notebooks.

1.22 Immigrations

If a new individual (one that was not with the group on the most recent observation days) has immigrated to the group, add a line for it on the census sheets. In the demography notes, give details on the individual's entry, as well as information on previous group of residence (if known). Also record any previous contact between the new individual and the study group or refer to earlier demography notes that describe this contact. Photograph the immigrant as soon as possible and be sure to discuss the immigrant with other members of the team in order to determine whether the individual is known.

It is extremely important to get an age estimate on the immigrant male, and an assessment of his degree of hybridity, as soon as possible after he emigrates. We schedule these estimates and measures for the last days of each month, but whenever possible you should try to obtain them as soon as you can after immigration. See Sections 14.3 and 14.4. It is also important to get multiple fecal samples for genetics from immigrant males (up to five samples), which can help determine or confirm if they have been seen in the population before and can help identify their position in our genetic pedigree (fecal sampling is discussed in Chapter II, Section 13).

1.23 Deaths, disappearances, and emigrations

Usually when an individual dies or disappears you will have very little information about the nature of its death or disappearance. Nonetheless, it is very important that you provide as much detail in the demographic notes as possible. If the individual was wearing a collar, you should immediately listen for the collar and track it. If you find it and the animal is dead, bring the collar back to camp and alert the project leaders and the database managers. If you see a corpse you will record where, when, its state, and whether you can identify the individual, using the corpse

checklist. You should also collect hair samples and tissue samples in RNALater or ethanol (see Chapter II, Section 13.3). If the animal disappears, record any information that might be relevant to the disappearance. Is there alarm calling when you arrive at the group? Leopard tracks or other signs of predators? Any other clues? If an adult male or a large subadult male (or even a juvenile male) disappears, you should make an effort over the course of the next week to check other study groups and non-study groups for him.

1.24 Radio collar checks

In each group, we have one or two females and a few males with VHF radio collars. We have also periodically deployed GPS collars (e.g, between 2008-2010, in the early 2020's), but this collar type is used to support short-term research projects and we do not routinely deploy them. Each field notebook has a checklist of all the active collars in that group, as well as a checklist of collars on males in non-study groups or males that are not currently known to be in a group (see Chapter II, Section 8.3, below). All the collars in each group should be checked at least twice per week – check the signal, but also fit, antenna, and mortality alert (if the collared animal isn't in sight). Whenever a male leaves a study group, his collar should be moved to the appropriate group's checklist or to the non-study checklist (in every field notebook).

1.25 Naming infants and new males

All new males and infants should be named according to the following rules. (1) The first three letters of the name must be different from any other name that has previously been used for an Amboseli baboon. This rule allows us to unambiguously identify every animal in our database by the first three letters of their name alone. Visitors are sometimes disappointed that they cannot use a given name because its first three letters have already been used, but this rule is very important for fast and efficient data collection, storage, and retrieval and must not be broken. (2) When it is spoken, the name should sound different, to Kenyan as well as US fieldworkers, from other names, especially those currently in the group. This helps a lot in learning IDs and in keeping animals straight in our heads. Any new name must be discussed and approved by all research staff. (3) An infant's name will begin with the same letter as the mother's, except in the case of females with very common first letters. These exceptions are listed in the notebook in camp entitled "Baboons and names". The names of immigrant males can start with any letter, but it's good to avoid letters (like S and V) that are heavily used. The "Baboons and names" notebook also contains a list of names that have already been used for baboons in all groups in the population as well as the standardized three letter abbreviations for those names. Please be sure to help keep this list updated by adding new names as they are assigned. The notebook also has a list of suggested names for most letters of the alphabet.

2. Reproductive states and events

2.1 Sexual skin charts and associated notes

For all females four years of age or older, data on reproductive events, sexual skin swelling size, and perineal condition should be recorded daily in standardized format. You should assess the state and size of the sexual skin, color of the paracallosal skin, presence or absence of menstrual bleeding, and information on rapid or unusual changes in the color or physical characteristics of the sexual skin and perineum.

2.11 Sexual skin state and size

A few days after a female menstruates, her sex skin begins to swell (Fig. 1 on the next page). The swelling phase continues for approximately 2 weeks. During this swelling phase, the skin is shiny (light will often reflect off it), smooth, and looks tight and swollen. We call this a turgescent sex skin. After about 2 weeks of turgescence (but the time varies) the sex skin changes from shiny to dull and from smooth to wrinkled. It loses its tight, swollen appearance and you can often see areas that are flattened or "dished". We score every swelling as either turgescent (indicated with an open circle on the sex skin charts) or deturgescent (indicated with a closed circle). We pay close attention to the sex skin when the female has had a large swelling for several days, because we use D-day (the day a female's sex skin changes from turgescent to deturgescent, which is estimated at Notre Dame from the field records) to estimate likely days of ovulation (lab studies have shown that ovulation is most likely to occur within the 5 days before D-day). When you are first learning to differentiate turgescent from deturgescent swelling it is important to consult often with the experienced observers, as this is a skill that can take some time to learn. At the beginning of a female's swelling phase (the first day or two) her sex skin can look somewhat deturgescent. This is especially true for older females, but it usually clear by the second day that she is turgescent. When in doubt, always ask an experienced observer. Figure 1 may help you picture the structures we describe here, but as soon as you get to the field you should have an experienced field person show them to you.

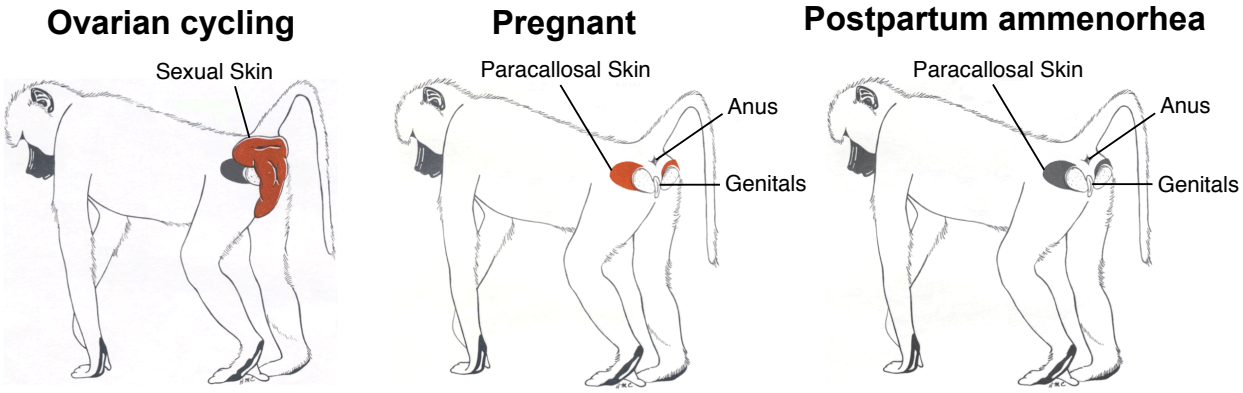


Figure 1. Drawings illustrating changes in female sex skins and paracallosal skin during different reproductive phases. Drawings are modified from Altmann, S.A. 1973. The pregnancy sign in savannah baboons. Zoo Animal Medicine. 4: 8-12.

A small sex skin swelling that does not extend beyond the level of the callosities should be considered a size 1 swelling. Use integer multiples of the average volume of the upper limit of a size 1 swelling to score the size of larger swellings. We find that most females show a size 5 - 8 swelling at maximum turgescence, but maximum size varies quite a bit among females and the size of a typical swelling may have changed over the years. Note that the sexual skin size scale is an absolute scale, not a relative scale. Consequently, swellings of the same absolute size are given the same number even if they are on females of different sizes. It is important to "calibrate" your size scoring against the scores of experienced observers; check with other observers after you have assigned a size score to a sexual swelling, especially when you are first beginning or have been away from the field for some time. A good opportunity to do this is when multiple observers are in the field together (ask if you would like to arrange some days in

the schedule to do this). It can be helpful for each observer to independently decide on size scorings for females, and then compare and discuss the scores.

Juveniles' sex skins are particularly difficult to categorize as are those of very elderly females. Moreover, even "normal" adult females have individual differences in the shape and maximal size of the sex skin. However, what is most important is that the observers establish and maintain consistency on a day-to-day basis in the scoring of the sexual skin size for each individual female and among females. Remember that the goal is to make a visual estimate of the swelling volume, so take shape into account. When more than one observer is contributing data to the reproductive state records, it is extremely important that the multiple observers work to establish consistency among themselves in judgments of sexual skin size.

2.12 Paracallosal skin color

The paracallosal skin (PCS), is a patch of bare skin next to the callosities (see Figure 1 above). You should have an experienced team member show you the PCS on several baboons during one of your first few days in the field. It is completely black in juveniles, adult males, and non-pregnant adult females, and is pale-to-bright pink in infants. When adult females become pregnant, the PCS gradually changes color from black to bright pink. The pink usually begins at the top of the PCS and gradually spreads downwards. On the data sheet, on the lines beneath the sex skin size records, score the color of the PCS using the following color designations:

- B - black or gray in color
- P/B - pink upper portion, black or gray lower portion
- P - pink in color (record a PCS as pink only when it is solid pink over the entire PCS; a pink tinge throughout the PCS, with black and gray still visible, is scored as P/B).

Other noticeable changes in the color or brightness of the PCS should also be recorded. After several pregnancies, some females retain permanent pink "islands" in their otherwise black PCS. If a female still retains pink in her PCS 45 days after a pregnancy, this is deemed “permanent pink”. In this case, the female should be scored as B beginning 45 days after the end of the pregnancy. When a female has permanent pink, observers must be careful to learn her pattern of permanent pink so that they will be able to tell when she starts to turn pink after becoming pregnant again; it can be helpful to make drawings in your notebook of the permanent pink islands.

2.13 Menstrual bleeding

The presence of menstrual bleeding should be indicated in the reproductive state records. Enter an "M" on the sexual skin chart in the same lines used to note PCS coloration. You should also enter an “M” on the sexual skin chart when bleeding is suspected to indicate a fetal loss or miscarriage.

2.14 Reproductive notes

Changes in reproductive state or in the physical condition or color of the sex skin or PCS should be noted on a page labeled "Reproductive Notes", as should the name and sex of new infants (which are also recorded in demographic notes). Each note should have the date, time, name of the individual, and have a number that is continuous for the group for that month; that index number should also appear on the appropriate date in the sex skin sheet for that individual. Each note should be followed by the initials of the observer(s) that contribute to the

note. Changes in sex skin characteristics (how shiny is it? How smooth is it?) usually precede or accompany the onset of deturgescence and so special attention should be paid to such changes around the time of peak turgescence. The goal here is not to record every nuance of change in color of the sexual skin, but rather, rapid and consistent changes in perineal appearance that may provide clues to the time of ovulation, deturgescence, birth, etc. (Wounds to the sexual skin should be recorded on the Wounds and Pathologies form, see Chapter II, Section 5.)

2.15 Updating of records

Reproductive state records and notes should be updated during the day if a noticeable change in swelling size or coloration occurs, or if menstrual flow is noticed. Be sure to differentiate clearly the updated record from the initial record and to give the time of the update entry. Again, attention to changes in color and size is especially important once a female is near peak turgescence or near term, to help pinpoint the time of reproductive events, including miscarriages. Also note when a suspected fetal loss or miscarriage occurs.

2.16 Reproductive, pregnancy, and due date records

In the field notebook for each group, we keep a summary record sheet of the reproductive state of every adult female in the group (one row per female, one column per month). At the end of every month in the field, we review the sex skin sheets and update this record sheet, noting for each female whether she was pregnant, cycling, or in post-partum amenorrhea that month. This record is for use in the field and is not photocopied with the primary data each month; it ensures that we do not miss important reproductive events and it alerts us to calculate a due date when a female becomes pregnant. When a female is not cycling and is showing pink in the PCS, we estimate her due date by adding 177 days to her last D-day (date on which she began to deturgescence during her last cycle; we have a simple excel spreadsheet for calculating due dates on the project computer). A record of pregnancies and due dates is kept in each field notebook (again, for field use and not photocopied each month as primary data), just after the reproductive record sheet, so that we know when a female is likely to give birth. This sheet also serves as a convenient record of the approximate birth dates and the ages of juveniles.

3. Home range use (SWERB records & GPS readings)

Our methods for collecting data on home range use and group movement have changed more than any other methods over the years. Changes in technology have played a large part in these changes. Until 1981, we charted group movement every day on large scale aerial photographs. Beginning in 1981, this continuous record was exchanged for point samples of the location of individuals, collected every thirty minutes and recorded as grid locations on the aerial photographs (grid size 170 m on a side). In 1993, we began using handheld GPS units to record the position of the group as a whole, recording the GPS readings as handwritten SWERB notes (B, W, and E stand for Begin, Water, and End, and S and R in the word SWERB refer to sleeping subgroup notes and ranging subgroup notes). Beginning in January 2004, all of our SWERB and GPS records are saved electronically on our handheld GPS machines as digital waypoints, and the data are transferred to the camp computer and emailed to the US every day. Detailed instructions for use of the GPS machines and file name conventions are in a separate document.

We take SWERB and GPS records as follows.

1. At the very beginning of our field day, as we are leaving camp, we record the time of departure for the observer and driver (a set of D records).
2. We take a “begin” reading (a B record) when we arrive at the group and begin monitoring.
3. We take a “water” reading (a W record) when one or more baboons drinks water during the day.
4. We take an “end” reading (an E record) when we end observations and leave the group at the end of the day.
5. Throughout the day when we are with a baboon group we take a reading every thirty minutes, standing close to or within the group.
6. We take careful notes about subgroups as handwritten notes, and we also indicate whether a B, W or E record was associated with a subgroup instead of with the whole group, by putting an “S” before the B or E. Beginning in mid-2012, we also put an “S” in the name of the half-hourly readings when it is taken on a subgroup (see Section 3.3 below). This practice of putting an “S” in the half-hourlies began in June 2012, and for the first two months may have been a bit inconsistent, but as of Aug 2012 this became standard procedure.

The GPS and SWERB records are often recorded by the field assistants/drivers. However, the researchers are responsible for these data: the drivers are not always present in the field, and even when they are, your input and supervision are crucial. Therefore, you should become familiar with all aspects of the SWERB records and GPS readings and should check these records periodically in the field as well as before sending to the U.S.

3.1 SWERB records

These records provide information on sleeping grove usage, descent and ascent times, drinking, and the total number of hours that observers monitor each study group. Among other things, they allow us to estimate the rate of various events, e.g. predator attacks per hour. Therefore, the periods between your Begin Monitoring ("B") and End Monitoring ("E") Records, as described below, should correspond to periods during which you are actually carrying out the monitoring activities described in this Guide.

When you take any of the GPS readings described below, always wait until the "accuracy" indicator is less than 3 meters (prior to the deployment of the Garmin 64st units on 03 January 2019, the accuracy was <10 meters).

3.11 “D” Records: Departure from camp

The first entries under each day's date should be a record of the time you left camp, a set of "D" records - one line for observers and one for drivers/field assistants. People who are in training and not contributing to the data collection should not be entered. The point of the D records is so that we know how much observer effort went into collecting the data, and also to help us keep our departure times prompt. So, we want a record of which observers and which drivers/field assistants are associated with each set of readings (not people who are not contributing to the data). D records also let us estimate our travel times to the groups. The D record also indicates which GPS unit you are using that day (a single letter, as in “E”).

3.12 "B" Records: Begin monitoring, AM grove, and median descent time

The next should be a "B" record, your arrival at the group and the beginning of monitoring activities. The "B" record includes the number/letter of the sleeping grove that the baboons slept in the previous night.

The next record taken is of the median descent time of the group, if known. The median descent time (MDT) is the time of descent to the ground from the sleeping trees of the median individual in the group—the time at which half the animals have descended. If MDT occurred prior to your arrival at the group, enter BA ("Before Arrival"). Enter AA ("After Arrival") if MDT occurred after your arrival but you did not record it for some reason. If the group has subdivided between two separate sleeping groves (see Chapter II, Section 4), we generally take the median descent time of the subgroup that the observer is with.

Sometimes when you arrive at the group most or all baboons have already descended from the sleeping grove. On some occasions, you will have no doubt that they slept in a particular grove, even if most or all baboons have descended: some members of the group may still be resting in the trees, or the group will be beneath or beside a particular grove and sitting quietly while it is still early. However, if you are not certain about which grove they slept in but a particular grove is very likely considering the baboon's line of movement, the hour of the day or the location of known sleeping groves, then indicate that grove number/letter but use an uppercase case "P" before it (e.g., P118). If you arrive at the group late in the morning and cannot identify the sleeping grove, or if you are doing an afternoon shift, enter the code "UNK", for Unknown, in place of a grove number.

If you stop monitoring the group at some point during the day, so that you will not see monitored events (e.g., if you have to change a flat tire), you should record both the time observations ended (an “E” record; see 3.13 below) and, using another "B" record, when you resume monitoring. Such secondary "B" records will not contain information on sleeping groves or descent times but should include GPS readings.

3.13 "E" Records: End monitoring, PM grove and median ascent time

The last entry in a SWERB record will be a record of the time that monitoring ended on that day. The "E" record should also contain information on the likely sleeping grove of the group that night, if known, the median ascent time of the group, and a GPS reading. PM sleeping groves should be scored as certain, highly probable, (e.g. P118) or unknown (UNK) using the same rules as for Begin records and AM sleeping groves. Median ascent time (MAT) is defined as the time of ascent from the ground into a grove by the median individual in the group (when half the animals have ascended). If ascent occurs after your departure write AD ("After Departure") for ascent time. Write BD ("Before Departure") if it occurred while you were still with the group but you did not record it for some reason. If the baboons sleep in subgroups, score the MAT of the subgroup that you are with, make sure it is clear which this is.

As with "B" records, you will occasionally have more than one "E" record during the day, if you have to stop monitoring the group for some reason. These secondary "E" records (the ones that occur before your final ending) will not include sleeping grove information but should include a GPS reading.

3.14 "W" Records: Drinking water

"W" records include the time you saw at least one baboon drink water, either from a permanent water hole or a rain pool. If many baboons drink water over a period of time, consider all the drinking to be part of one bout, unless at least 30 minutes elapse between one bout ending and the next beginning (i.e., at least 30 minutes elapses with no drinking). In addition to the time of the drinking bout enter the code for the waterhole (if it is a permanent waterhole), using the waterhole map on the GPS for identification, or "rain pool". Take a GPS reading whenever the baboons drink from a permanent water hole and when they drink from rain pools. Use “Rain” in place of the waterhole name for drinking from rain pools.

3.15 Naming new groves and waterholes

Occasionally, a baboon group will sleep in a “new” (not yet named) grove, or drink from a “new” water hole. When this occurs, record groves with the name “NG” (“new grove”, e.g. a ‘begin’ in Acacia’s group would be “ABNG”) and water holes with the name “NWH” (“new water hole, e.g. Acacia’s group drinking at 14:40 would be “AW1440NWH”). After a new grove or water hole has been used 3 times, it needs to be given a name.

If an old grove or water hole breaks up into smaller groves/water holes, consult with the other observers and drivers to decide if each of the smaller ones should each be separately named or if you should keep using the “old” name for all of them. For example, during a drought a water hole might begin to dry up and break into several smaller holes, but after the rains return it will just be one hole again. Whether this should continue to be recorded as one water hole or many is likely a judgment to be made by the senior observers.

When naming a new grove or water hole, all observers and drivers should consult together to agree on the new name, and an abbreviation for the GPS units if needed (e.g. “Chairman’s Well” is abbreviated as “CWEL” in the GPS units). The Saturday meeting is an ideal time to do this. There are only a handful of rules to consider when naming a new grove or water hole:

- Do not use a name or abbreviation that has been used before, even if the name hasn’t been used for a long time.
- The abbreviation cannot be more than 4 characters long.
- (For groves only) Remember that sometimes you may enter a “P” before the grove’s abbreviation when indicating that a group “probably” slept there. Because of this, do not use abbreviations that will make it impossible to know if a “P” is part of a grove name or if it is intended to mean “probably”. Examples:
    - We already have grove “151”, so don’t make a grove named “P151”.
    - We already have grove “PG1”, so don’t make a grove named “G1”.
    - We already have water hole “PHA”. This is not a grove, so a grove named “HA” is allowed.

Be sure to collect a reference GPS point as close as possible to the center of any new grove/water hole, and email it to the project leaders and data managers as soon as possible. This should ideally be done the day that the new grove/water hole is used for its 3rd time, after everyone agrees on its new name. This GPS point is a special point, specifically used as the grove/water hole’s reference point. Do not use a grove’s begin/end line or a water hole’s “W” line from the baboon groups’ SWERB data as a grove’s/water hole’s reference point.

Also, don’t forget to record new groves and water holes with their name, abbreviation, and coordinates in the monthly report at the end of each month.

3.2 GPS readings every 30 minutes

Take a GPS reading every 30 minutes on the hour and the half hour. Stand within the group if you can, or on the edge of the group if it will disturb the baboons to enter the group. Usually the field assistants/drivers take the GPS readings. The goal is to stand as close to the center of the group as possible without disturbing the animals. The observers are responsible for supervising the collection of these and any other data collected by the field assistants/drivers.

When you take a GPS reading, wait until the "accuracy" indicator is less than 10 meters. Name the waypoint in the GPS machine with the single letter that designates that group and the time of the reading (e.g., W0930 for Weaver's group 0930 reading).

3.3 Subgroup records in SWERB/GPS records.

Whenever a baboon group that you are watching divides into subgroups (defined in Chapter II, Section 4), this should be reflected in all the GPS waypoints (with one exception, discussed below). If you arrive at the group in the morning and it is already in subgroups, this should be indicated in the B waypoint and in the waypoint for MDT. For instance, HSB (HokeySubgroupBegin) are the first few letters of the name of a Begin waypoint for Hokey's group, which you found in subgroups. Subgrouping should also be indicated in subsequent half-hour waypoints (e.g., HS0930). When the group rejoins, simply drop the S from the next waypoint name. Similarly, if you arrive at the group in the morning and there are no subgroups, but subgroups form during your observations, you should add an S to the waypoint name for the first half-hour waypoint on which there is a subgroup, and to all subsequent waypoints thereafter until the end of observation or until the subgroup ends, whichever comes first.

There is one kind of GPS waypoint that does not need to include a subgroup "S" when the group is in subgroups at the time: "W"ater hole points. Garmin units do not allow more than 10 letters/numbers to be used when naming a waypoint, so when a subgroup drinks from a water hole that is 4 letters/numbers long, it's not possible to include a subgroup "S". E.g. if a subgroup of Narasha's group drinks from the Chairman's Well at 09:45, "RSW0945CWEL" cannot be recorded because it's 11 characters long, so you should leave out the S. That row will be presumed to be in subgroups anyway, as long as the point just before it and just after it does have the subgroup "S".

You must always note when subgroups split and rejoin in the subgrouping notes that go in the field notebooks; you should also indicate the identity of all individuals in each subgroup, if possible. This is not a change from standard procedure; we have always done this (see Chapter II, Section 4, below, for more information). As of 2012, we initiated a system where the subgroups are indicated in all GPS waypoints taken while subgroups occur. This rule applies to all the half-hour waypoints, not only Begin and End and MDT and MAT.

3.4 Examples

Below are two examples of SWERB records. The only column that you actually enter is the waypoint name – the date, time, reading and altitude are all recorded automatically by the GPS machine when you save a waypoint. In the first example the team encountered two non-study groups and took "other group" readings (OGXXX – see Section 8.2 below) on them before they found their focal group (Narasha's, which is designated by the letter "R"). They ended observations at 0843 (RE) and began them again at 1024 (RB). They did not know where Narasha's slept the previous night (RBUNK), so naturally they also did not get the median descent time because it happened before they arrived (RMDTBA). They also did not know

where Narasha's slept that night (REUNK). In the second example, Weaver's group slept in grove 151 (WB151 for Weaver's Begin at 0628) and median descent time was 0638.

Example 1:

Waypoint name	Date and time	GPS Reading	Elevation
DDEBOO	01-Jun-11 05:32	37 M 301775 9703040	1145.0 m
DERSM	01-Jun-11 05:33	37 M 301775 9703043	1139.0 m
OGJIL50	01-Jun-11 06:32	37 M 285099 9697262	1148.4 m
OGSIN80	01-Jun-11 06:37	37 M 284163 9696852	1134.7 m
RBUNK	01-Jun-11 06:41	37 M 283996 9697074	1138.8 m
RMDTBA	01-Jun-11 06:43	37 M 283995 9697071	1136.2 m
R0700	01-Jun-11 07:03	37 M 284283 9697120	1142.9 m
R0730	01-Jun-11 07:32	37 M 284436 9697957	1136.6 m
R0800	01-Jun-11 08:03	37 M 284410 9698027	1132.8 m
RE	01-Jun-11 08:43	37 M 284280 9699089	1139.8 m
RB	01-Jun-11 10:24	37 M 284108 9699405	1131.1 m
R1030	01-Jun-11 10:34	37 M 284108 9699404	1131.8 m
R1100	01-Jun-11 11:02	37 M 284111 9699406	1132.6 m
REUNK	01-Jun-11 11:30	37 M 284111 9699405	1135.4 m
RMATAD	01-Jun-11 11:31	37 M 284113 9699404	1136.2 m
OGHOK20	01-Jun-11 11:48	37 M 285698 9700369	1137.8 m

Example 2:

DHSNS	01-Jun-2011 05:32	37 M 301770 9703047	1140.2 m
DDHILS	01-Jun-2011 05:33	37 M 301771 9703047	1137.8 m
WB151	01-Jun-2011 06:28	37 M 287780 9699472	1132.3 m
W0630	01-Jun-2011 06:30	37 M 287780 9699473	1136.4 m
WMDT0638	01-Jun-2011 06:38	37 M 287778 9699472	1145.0 m
W0700	01-Jun-2011 07:02	37 M 287934 9699548	1140.5 m
W0730	01-Jun-2011 07:31	37 M 288119 9699347	1143.1 m
W0800	01-Jun-2011 08:08	37 M 288258 9699189	1147.0 m
W0830	01-Jun-2011 08:31	37 M 288802 9699333	1145.8 m
W0900	01-Jun-2011 09:00	37 M 288882 9699262	1134.2 m
W0930	01-Jun-2011 09:43	37 M 289169 9699569	1140.2 m
W1000	01-Jun-2011 10:01	37 M 289489 9699790	1140.2 m
W1030	01-Jun-2011 10:30	37 M 289491 9699790	1141.9 m
W1100	01-Jun-2011 11:02	37 M 289533 9700054	1139.5 m
WEUNK	01-Jun-2011 11:30	37 M 289534 9700054	1138.8 m
WMATAD	01-Jun-2011 11:32	37 M 289534 9700054	1137.8 m

4. More information on sleeping and ranging subgroups

The study groups sometimes split into discrete subgroups, either to sleep or during the day while they forage. In several of the seven fissions that have occurred in Amboseli since 1990, sleeping and ranging subgroups formed regularly for several months (or more) before the actual fission. Subgroup formation should therefore be viewed as a possible indicator that fission is

likely to happen, and special effort should be made to record the identities of individuals in the subgroups. Even when fissions do not occur, subgroup formation can be an important clue to patterns of social bonding within the group.

Whenever you see subgroups, record the identity of every animal in at least one of the subgroups, and make a note about whether it was a sleeping subgroup or a ranging subgroup. Usually, you will start a new page in the field notebook for this; each notebook has a Section for subgroup notes. The only exception to listing the names of the members of one group is if the group is in subgroups when you first arrive at the group; in this case, you should use numbers in the census to record which animals were in which group (see Chapter II, Section 1.2). Note the time the subgroups formed (or write that you didn't see the onset) and the time they came back together (or write that you didn't see the joining), along with any other *ad lib* notes relevant to the subgrouping. Ideally you should do this for both subgroups but often this is not possible. The presence of sleeping or ranging subgroups will also be indicated in all the GPS waypoints that are collected while subgroups are occurring (see Section 3, above).

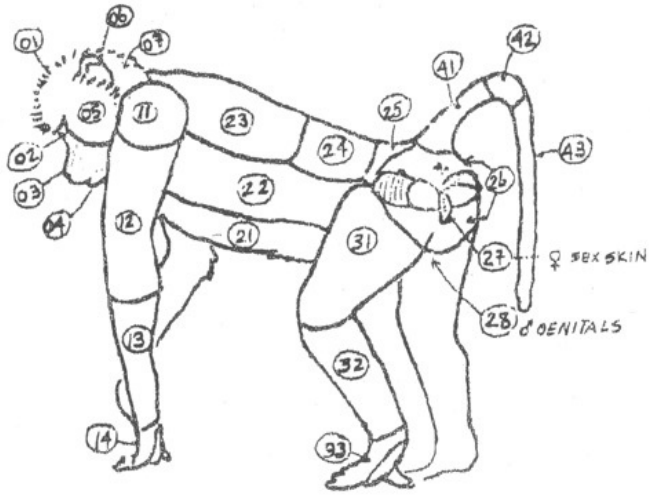
Sleeping subgroups occur if the group is divided between two (or more) sleeping groves such that they could not get from one grove to the other without descending to the ground, and you are confident that you are not just seeing individuals that have gone into the second grove, say to feed, shortly before your arrival. Ranging subgroups (subgroups that form during the day when the group is foraging) occur whenever a subset of individuals (other than a consorting pair) are separated from the rest of the group by a gap that is substantially greater than the distance across the main part of the larger subgroup.

5. Wounds, disease, pathologies, and deaths

Any time a baboon shows wounds, injuries, symptoms of disease, or other pathologies, you should start a Wounds and Pathologies sheet. On the sheet, you will note the time of day the pathology was first noticed, the name of the individual and a description of the individual's condition. The sheet has a checklist of different types of wounds and pathologies; check all that are appropriate. The sheet also includes a diagram (see the following page) that gives numbers to all body parts; when you identify an injury you should indicate the affected body part and whether it is on the left or right side. In addition, make a description in the "notes" section of the sheet that provides as much information as possible, so that we can assess causes and consequences of injuries or pathologies. If you know the cause of the injury (predator, fight with another baboon, etc.), please record this as well. Give as much information as possible; even if you are making guesses about what happened, this can be useful, just be sure to indicate what is a guess versus what you really know.

Symptoms of disease and other pathologies include unusual redness or swelling around the eyes (apart from late pregnancy), diarrhea, vomiting, stiffness of the limbs or fingers, limping, indications of fatigue or weakness, tremors or convulsions, persistent coughing and sneezing, unexpected discharges from any part of the body, and excessive thinning or lightening of the coat. Problems with movement or with other bodily functions should be indicated.

You should follow up on all injuries and pathologies that you record. It is important for us to know how long the wound takes to heal or how long the illness or pathology lasts. In the case of serious injuries or illnesses, follow up every day you are with the group, in the area indicated for that purpose on the Wounds and Pathologies sheets. To make sure that Wounds and Pathologies records are followed up, observers should check and update all current wounds sheets during the last day of the month with the group (see Chapter 4).



If you find a baboon carcass or parts of a carcass, you should record its location, the date and time you found it, and notes about its state of decomposition, with an indication of how long you think the animal has been dead. It will also be very valuable if you collect a tissue sample from the animal, and we urge you to make every effort to do so. To do this, the team normally brings the carcass back to camp and collects the samples using tools in camp (see below). To collect the carcass, you will find plastic garbage bags, gloves, masks, and surgical scrub for handwashing in each vehicle (see Chapter II, Section 13.3). Once you are back in camp, use a blank “corpse sample checklist” to guide you through collecting the tissue sample(s) and hair samples, and tracking its storage medium and storage condition (e.g., “room temperature,” “-20 C”). Blank corpse checklists are kept in the office. To help you collect the sample, you will find tweezers, scissors, and collecting tubes in one of the darting tackle boxes in the lab. When you collect a carcass and/or tissue sample, please make a note in the demography notes that you have collected the carcass and/or sample. In addition, label the sample tube(s) with as much information as possible: minimally, the name of the baboon (or “unknown” with sex and age class information, if known), the date of collection, the source of the tissue (e.g., “skin,” “muscle”), and the storage medium for the sample (usually “RNALater” or “ethanol”). A tube that simply says “unknown baboon” and the date, with no accompany demog notes is hard to work with (we have received a number of these tubes in the US, and it is very hard to connect them to a given death, so they are often ultimately discarded).

If the carcass is fresh enough that we can recover part or all of the skeleton, you should make an attempt to bury it in camp, so that it can contribute to our collection of skeletons (which resides at the National Museums of Kenya). The field team knows our well-established protocol for burial.

Whenever possible, take photos of wounds, pathologies, and dead animals. When you do so, be sure to make a note about the photograph in the demography notes and on the corpse sample checklist. Finally, after you are done and have fully filled in the corpse sample checklist, it should be scanned and sent to the data managers and the project leaders the dame day.

6. Mounts and consortships

Most mounts by an adult male of a sexually cycling adult female that include intromission take place during consortships. Consortships are defined by close, persistent following between a male and an adult female who has a turgescent swelling. Usually, the male follows the female more than the female follows the male. However, occasionally the female is very attentive to her consort partner's movements and actively stays near him. Our genetic studies confirm that consorting activity is a good predictor of paternity: males that consort more have more offspring. We keep careful track of both consortships and mounts (during and outside of consortships). These are recorded daily by each observer on a designated page of their “small notebooks”. This page is scanned and sent daily with the rest of the daily data.

6.1 Mounts

We record mounts in order to identify sexual activity that could lead to conception. Therefore, you should only record mounts between males that are at least four years of age (i.e., may be producing viable sperm) and females that have reached menarche, whether or not they occur during a consortship. Only record mounts if the female has a turgescent swelling of at least size three (or, in the unusual case of females who tend to have very small swelling, if she is suspected to be within one week of D-day, the onset of deturgescence). Only record mounts that include intromission, or probable intromission if you don't see the whole sequence (i.e., fresh ejaculate or pelvic thrusts by the male in a position suitable for intromission). Record all mounts that fit these criteria whether or not they occur during consortships.

Use the format "0810 MLO m VIX" to indicate that Mlozi mounted Vixen at 0810. When possible, we distinguish between mounts for which there is evidence of ejaculation (e) and others (m). If you saw an ejaculatory pause or you saw fresh ejaculate on the female's sex skin or the male's penis immediately after the mount, you should assume that the male ejaculated during the mount. Record "0810 MLO e VIX" to indicate that Mlozi mounted Vixen at 0810 and ejaculated. Females give distinctive post-copulatory calls, and these can alert you to mounts. If you hear a post-copulatory vocalization, be sure to look in that direction and you may see the end of the mount. If you miss the mount, but see that the female is close to but moving away from the male as she is giving post-copulatory calls, and there is ejaculate visible on her sex skin or his penis, you should record a mount with ejaculation.

6.2 Consortships

Record each consortship (male name, then female name) that occurs in the group, the time it was first observed, and the time it ended. Record consortships as follows: "0712 MLO C VIX" or "0712 MLO C VIX (B)" to indicate that male Mlozi consorted with female Vixen, and that the consortship was first observed at 0712 (use the (B) if this coincided with the beginning of observation). If the consortship is “loose”, that is you’re not sure if the male is really guarding the female, you can record a question mark after the consort as in “0712 MLO C VIX?”. In general, we prefer that you err on the side of assigning a consortship that you’re not sure of, rather than not assigning it. On the line beneath this, record the time the consortship ended, and connect the two lines with an arrow. If the pair was still consorting when you left, record the time you left instead of the time the consortship ended, and put an "E" in parentheses after the time, to indicate that this was the end time in SWERB rather than the end of the consortship. If you are not sure what time the consortship started or ended but you strongly suspect that it happened before the first time you saw it, you can use the word "by" or "before" in front of the time, to indicate that it happened by or before that time. If the same male and female are consorting for several days in a row and you do not observe any interruptions (you suspect it is one continuous consortship), you should still make a new record of that consortship on each day you

are with the group. However, a consortship between a particular male and a particular female should be scored only once on any given day, unless the consortship was interrupted during the day, e.g., a consortship that occurred for a few hours in the morning and a few hours in the afternoon but not during the noon hours would be scored twice.

7. Predation and human disturbance

Observing predation on baboons or predation by baboons on other vertebrates is relatively uncommon. Disturbance of the groups by humans (usually Maasai with cattle) is more common. We record every instance that we see of each of these events, because they are important for understanding the behavioral ecology of Amboseli baboons and the likely sources of mortality. Therefore, we ask all participants in the project to make a special attempt to obtain detailed information on these events. Records of predation on or by baboons, and records of human disturbance, are collected using specialized forms in the QuickTap survey app on the Samsung tablets.

As a matter of historical record: Up until May 2014, human disturbances were recorded in prose (i.e. a few sentences in the notebooks), ideally on a dedicated page of "Predations/Human Disturbances" but sometimes they'd be in demog notes or something like that. Beginning in Mary 2014 until 17 Oct 2017, human disturbances were exclusively recorded on dedicated paper forms. From 17 Oct 2017 until ~Jan-Feb 2018, human disturbance events were recorded both on the paper forms and QuickTapSurvey. Since ~Jan 2018, human disturbance events are recorded exclusively in a QuickTapSurvey.

7.1 Predation on baboons and predator sightings

The main predators on baboons in Amboseli are lions, leopards, and hyenas. In the recent past, pythons and wild dogs may have also been important predators, and we suspect that eagles or hawks regularly attack young juveniles. You should record the date, time, species and location (preferably the GPS reading) of the predator every time you sight lions, leopards, hyenas, pythons, and wild dogs in or around Amboseli, whether or not you are with baboons (see instructions for collecting GPS records of predators during baboon monitoring below). Birds of prey are too numerous and too mobile to make it worth it to record every sighting.

You should also record every time you see baboons encounter any predator (the QuickTap survey will guide you to provide the needed information). These records include not just the large predators listed above, but any other species of predator (e.g., jackals, eagles, hawks, other kinds of snakes) that you see actually harass or attack baboons or to which the baboons react with alarm. This includes situations in which you witness sustained alarm barking by baboons, but are unable to see a predator. For each encounter with a predator, indicate whether you actually saw the predator or only heard alarm barking by the baboons, what species of predator it was, how many were seen, and what the outcome of the encounter was. Record any other details of the encounter that are relevant. Whenever feasible and potentially useful, obtain and document with photographs.

If you witness an actual or attempted predation on baboons, you should record the date, time, and species of predator and other details of the event (again, the QuickTap survey will guide you in making these records). If you find a baboon corpse that you suspect was killed by a predator describe the situation in which you found it, the nature of the wounds, the time and the GPS location or a very good description of the site (e.g., under a particular sleeping grove), and whether predator footprints were seen nearby. More detail is better than less. Photographs are often feasible and very helpful; when you obtain them, document that in the demography notes.

In May 2019 we added GPS readings when predators are actually sighted during baboon monitoring (including on the way to and back from the field). All such GPS readings of predator sightings will also have a 'Predation on' record collected in the QuickTap survey app, but not all 'Predation on' records will have a GPS reading – only when a predator is actually sighted. Note: the team records sightings every time they see most terrestrial carnivores, but they only record snakes, jackals, and birds of prey when those animals interact with the baboons or the baboons react to them in some way (this is discussed above).

When observers see a predator, they should note it in their GPS units using the format:

PR[3-letter-code for predator][distance in meters].

Note that you should always record the distance, no matter how far away the predator is.

Three-letter codes for predators include:

STR	Striped hyena
SPO	Spotted hyena
LIO	Lion/Lioness
SNA	Snake
JAC	Jackal
BIR	Bird of prey
LEO	Leopard
CHE	Cheetah
SER	Serval
OTH	Other (e.g., wild dogs)

For example, if you see a cheetah and are 50 m from it, the entry would be "PRCHE50". If you're ~100 m away from it, it'd be "PRCHE100". Domestic dogs are not included in the GPS readings of predator sightings.

7.2 Predation by baboons

Incidents of baboons chasing, harassing, capturing, killing, and/or eating other vertebrate animals, including lizards, birds, and bird eggs as well as mammals, should also be recorded in the predation records in the QuickTap survey app on the Samsung tablets. Please note the date, time, prey species, age-sex class of prey if known, first baboon seen with the prey, and as much additional description as time permits, including a descriptive location (e.g. "near grove TZC; north of Sinya hill"). If extensive notes are taken, please include an assessment of the completeness of the observational record (e.g., did you see the whole predation from start to finish, or are you not sure which animal made the initial capture of the prey). Try to document with photographs when valuable and feasible, particularly for rarely documented aspects of predation.

7.3 Human disturbance of the baboons

Record all instances in which the baboons' activities are affected by humans, e.g. change of group movement in response to herdsmen and their cattle, approaches to or flight from tourists. These records are collected in a dedicated form in the QuickTap survey app on the Samsung tablets. Interactions with tourists were not uncommon in the late 1970's through mid 1980's but have become rare since the groups moved west of the park. Usually the response of

baboons to Maasai is simply to move away and avoid them. Occasionally this results in the creation of subgroups if different subsets of animals move off in different directions. This happened repeatedly during the two years that Alto's Group spent slowly fissioning.

Occasionally the baboons give alarms when they see Maasai, particularly if the Maasai are accompanied by domestic dogs. These dogs sometimes chase baboons. Record all reactions by baboons and interactions between baboons and dogs in the QuickTap survey app.

8. Intergroup encounters and sightings of other groups

Two types of data are combined in the "Other Groups Notes" in each field notebook; encounters between groups, and sightings of non-study groups and lone males.

8.1 Intergroup encounters

Encounters between baboon groups vary. Sometimes two groups simply sit quietly near each other and apparently ignore each other; other times friendly interactions such as play occur between groups; occasionally baboons behave aggressively towards members of another group. Most often, one group moves away from another's persistent approach, often somewhat quickly. We call this "being pushed", as in "Linda's Group was pushed by Weaver's Group", meaning that when members of Linda's Group saw members of Weaver's Group, Linda's moved away from Weaver's in a decided manner and Weaver's Group followed. Another common occurrence is for adult males to chase and attack the adult females in their own group when other groups or lone males are seen.

Every time you see a baboon group near that day's study group, or if you see a baboon group while you are searching for or leaving your study group, you should record the date, time, identity of the group, and location of the encounter in Other Groups Notes (even if the other group is another study group). As with other notes, these should be initialed by the observers who contributed to the observation. You should also take an "other groups" (OG) GPS reading; the name of the waypoint should indicate the identity of the group and the distance between the study group and the other group (or between you and the other group if you are not with a study group). For instance, OGHOK70 means you are taking an Other Groups reading on Hokey's group, and you were 70 meters away. You should always record the distance, even if you are close to the other group (e.g. within 50 m). Note: these distance recordings were not consistent prior to December 2022.

If you are with a study group, record how your study group reacted (record this even if they apparently did not see the other group; if you saw it, they almost certainly did too) and also how the other group reacted if known. More information is better than less, particularly with encounters that include social, sexual or aggressive behavior. Useful information includes (1) the nature and extent of the contact, (2) the individuals closest, most attentive and most interactive with members of the other group, and (3) an assessment of the completeness of your observational record. Changes of behavior within the group (e.g. within-group attacks on females as describes above) and behavior directed to the other group are important.

8.2 Sightings of non-study groups and lone males

Every time you see a non-study group or a lone male, no matter where you are or what you are doing, you should record the date, time, location and identity of the group or male if known. You should also take a GPS reading that you save as an "Other Group" (OG) waypoint or a "lone male" (LM) waypoint, including the distance to the group or lone male. You should always record the distance, even if you are close to the other group (i.e. record a "0" if that's how close

you are). In your handwritten notes, record the names of any known individuals that you see in the group and the reproductive state of any known females that you notice, as well as any other demographic or reproductive information that seems unusual or important. Information on known individuals that are no longer in one of the study groups is extremely important to our documentation of the lives and patterns of membership and group movement of adult males. During sightings of non-study groups and lone males you should also check the status of any radio collars that are active on the animals you see (see Section 8.3, below). If you see a lone male that you don't recognize, you should discuss with all the observers to determine his identity if known. If possible, call them on the radio and ask them to come over and look.

One responsibility of all participants in the Amboseli study is censusing of other groups (see Chapter II, Section 12). If you see a non-study group and the conditions for census are very good, you should carry out a full census, even if this means that you have to leave your main study group for some time. Good census conditions do not occur very frequently, so you should rely on Raphael, Kinyua, or Long'ida to decide whether this is a good idea. We also have one day per month dedicated to searching for and censusing non-study groups. This day is marked on the schedule as an "OG" or other groups day.

8.3 Radio collar checks on males in non-study groups.

A number of males in non-study groups are radio-collared. This helps us gather dispersal and mortality data on males. It is extremely important to maintain a record of the status of collared males in non-study groups. Each field notebook has a checklist of collared males in non-study groups; these collars should be checked at least twice per week and more often when possible, even if you don't see the non-study group (listen for the collars whenever you are in the neighborhood of a non-study group) and the checklist should be updated, photocopied monthly, and sent to the US. Whenever you see a non-study group, this is a particularly good time to check for these males. Many collars (not all) have a mortality signal; the beep pattern changes when the collar (and hence the male) has been still for 8 hours and so is probably dead. When you hear a mortality signal, drop everything and track the collar.

In 2015, we added a protocol to search the wider Amboseli ecosystem for collared animals. Specifically, once a month, on the office day (last working day) of the month, the drivers drive to several of the major hills in the ecosystem and systematically listen to all putatively active collars belonging to animals not included in our study groups. In addition, the drivers locate and directly observe one of these collared animals to check on collar functioning, to monitor animal health and whether there are any problems with the fit of the collar, and to collect a GPS point on the animal's location. The drivers record the results of these collar checks on a standardized sheet, which allows them to record whether the collar was heard or not on each hill, and any notes about the animals they directly observed.

9. Grooming

Grooming is one of the most important affiliative social behaviors that the baboons exhibit. Approximately 5% of the daytime is spent in grooming. We record all grooming interactions that we see. Data are collected using a combination of handwritten and digital data entry using the Prim8 app (McDonald & Johnson 2014, *Anim Behav*) on a Samsung tablet. For handwritten grooming data, each observer should record each interaction on a dedicated sheet for each group on each day; the sheet should be headed with the observer's initials, the group's name, and the date. We use these data to examine the strength of social bonds (e.g. social connectedness) as well as reciprocity in grooming relationships.

Grooming data are collected continuously during any visit to a group using a procedure we call “representative interaction sampling”. We originally described these data as *ad lib* data, however in 2016 we decided that the term “*ad lib*” does not accurately reflect the systematic methods we use to ensure that all group members are evenly represented in our observations. Specifically, representative interaction sampling occurs when the observer moves through the group (as in focal animal sampling), following an order of subjects dictated by a randomized list. The observer remains with each subject for 10 minutes and records all observations of grooming for all individuals within their line of sight. After 10 minutes, the observer moves to a new subject, ensuring representative sampling of the whole social group.

Michael Pereira and Carol Saunders compared grooming data from focal group sampling (similar to our manner of representative interaction sampling) with grooming data from focal samples, and found that both types of data show the same patterns of grooming rates and partner preferences (see Pereira's thesis, 1984, p. 290). Therefore, we have sometimes used the grooming data collected via representative interaction sampling to examine the relative frequencies with which particular dyads groom each other. However, in order for the data to be reliable in this way, observers must make an effort to observe grooming whenever it occurs, and must record every grooming bout they see without exception.

You should record a grooming interaction every time you see one baboon grooming another. Do not record self-grooming. Grooming is generally done with two hands; one-handed grooming is usually short in duration and low in intensity. Grooming bouts that use only one hand and that are very short in duration and low in intensity are not recorded. Grooming bouts that use only one hand but are longer in duration and higher in intensity are recorded, as when the groomer has an injured arm, for instance, or has a new infant that she is clutching with one hand. To avoid rescoring continuous, uninterrupted grooming of one animal by another, make a new record only if you know that the grooming stopped in between (for instance, the groomer and groomee changed roles), or (if you are not watching the pair continuously) if at least 5 minutes has elapsed since you saw them, and you see them again in the same grooming configuration. An animal is considered to have stopped grooming if its hands leave the body or fur of the groomee for more than a few seconds.

For grooming by infants, be especially careful not to record grooming unless the behavior is coordinated grooming (coordinated picking and scraping, almost always with two hands, and coordinated hand-to-mouth movements). With young infants, you will sometimes see uncoordinated stroking of the fur. This should not be recorded as grooming until the more coordinated picking is seen. This usually occurs when infants are about 8-10 months old but is individually variable.

10. Agonism

Among Amboseli baboons, dominance rank is a good predictor of several aspects of life history. Therefore, pay special attention to agonistic interactions. Like grooming data, agonisms are also collected via representative interaction sampling using a combination of hand-written and digital data collection as described above in Section 9. After you are fully trained on agonisms and IDs, you are expected to contribute to this data set. We record three different types of agonistic interactions, (1) dyadic decided agonistic interactions, (2) dyadic undecided agonistic interactions, and (3) multiparty agonistic interactions.

Agonisms are collected using a combination of handwritten and digital data entry using the Prim8 app on the Samsung tablet. For handwritten decided agonisms, each observer should record each agonistic interaction on a dedicated sheet for each group on each day; the sheet

should be headed with the observer's initials, the group's name, and the date. Undecided interactions and multiparty interactions are less common, so these interactions should be collected on a separate section or separate sheet, also headed with the observers initials, the group, and the date.

Section 10.1 shows the list of all the behaviors that we consider to be aggressive, all those that we consider to be submissive, and several that we see during agonistic interactions that are not clearly aggressive or submissive. You should become very familiar with these behaviors. Scoring decided and undecided interactions in the field requires being able to recognize these behaviors as they are occurring, and agonistic interactions can be very rapid. Stuart Altmann took videos of many behaviors in 1971 and these are available on DVD at Duke if you are interested in getting a feel for some of these behaviors before going to the field. For the first few weeks, we strongly encourage you to record the details of each interaction (i.e., write down which animal did which behavior during the interaction) until you are experienced enough to recognize the nature of the interactions (decided or undecided, and winner and loser) without writing down a detailed narrative.

Sections 10.2 through 10.5 describe the various types of agonistic interactions and how we record them. The first step is to understand the behaviors underlying the interactions (Section 10.1). The interactions can be complicated, but once you see the behaviors clearly they are often simple to record. This can require a good bit of training, so be patient with yourself.

10.1 Agonistic Behaviors

This section lists all aggressive and submissive behaviors, as well as several that occur during agonistic encounters that are not clearly aggressive or submissive.

10.11 Aggressive behaviors

Behavior	Code*	Description
Raised brow or eyelid display	RB	Display of unpigmented skin beneath eyebrows either by raising brow itself or tilting head dorsally; often accompanied by jutting forward of the head.
Open mouth face or attempted bite	OF	Jaw held open, teeth not exposed or only slightly exposed, often accompanied by forward jutting of the head.
Bobbed head and thorax	BH	Abrupt, rapid raising and lowering of head and trunk; body may show a forward movement component.
Ground slapped	GS	Palm of hand or hands struck against ground, often audible.
Lunged at	LG	Forward leaping or jumping towards another individual; no lateral movement.
Chomped or gave exaggerated chewing motions	CH	Repeated and exaggerated chewing or grinding movements of the jaws, often with extreme lateral excursion, copious salivation and audible grinding.

Gave threat yawn or directed gape	GP	Directed gape or yawn-like moving, usually exposing canines.
Rubbed muzzle on substrate	RM	Muzzle and chin rubbed laterally on ground or tree limbs. Often accompanied by gaping and chomping.
Hit or slapped	HT	Rapid, open-handed striking or attempted striking of another individual.
Pushed	PU	Open-handed shoving or attempted shoving of another individual.
Grabbed	GB	Closed-handed gripping of another individual, usually brief.
Held down	HD	Closed-handed gripping of another individual, forcing that individual against substrate, usually prolonged.
Bite	BI	Obvious.

* note that these codes are not used in collecting decided agonisms (see below), but we retain them here in case additional detail is needed for future behavioral protocols.

Historic note: In earlier versions of the monitoring guide, an additional aggressive behavior, “stare” was described as follows: “Fixed and prolonged looking at another individual; often accompanied by ears back, brows lowered and scowling, and head ventroflexed.” Current observers agree that fixed and prolonged looking at another individual can often accompany a raised brow or other aggressive behaviors. However, the rest of the description of stare - “often accompanied by ears back, brows lowered and scowling, and head ventroflexed” - does not correspond to any aggressive behavior that we recognize. Further, we never use a stare alone as an indication of an agonistic bout. Hence, we have dropped “stare” from our list of aggressive behaviors.

10.12 Submissive behaviors

Behavior	Code	Description
Averted head and/or body	AH	Turned head aside at approach of another individual, often accompanied by fixedly looking away from the other individual, but without the tensing or twisting associated with a cower.
Cowered or leaned aside	CW	Lateral flexion of the spine, often from a seated or crouching position; limbs usually held against the body but not always.
Gave fear paralysis	FP	Subject leaned forward or lay on ground in rigid, tensed and motionless position. Often accompanied by screaming, urination and defecation.
Grimace	GM	Corners of mouth retracted and teeth (often clenched) exposed. Grimaces are sometimes given without being specifically directed toward another individual, e.g., during

		copulations. Be sure grimace occurs as a directed behavior before you record it as an agonistic interaction.
Gave tail-up	TU	Tail held upright, or nearly so, or even 'pointed' forward over back. Note that tail movements occurring during "presents" should not be scored as agonistic behaviors unless they are unambiguously so (in this case there will usually be other submissive gestures also).
Gave high-pitched shrill scream or screech	EE	Obvious.
Gave cackle or gecker vocalization	IK	Obvious.
Repeated rapid glances	GL	Subject glances repeatedly and rapidly in the direction of a conspecific. Sometimes this involves looking over the shoulder or behind; it almost always interrupts the current activity at least briefly.

10.13 Other Agonistic Behaviors

The following behaviors often occur in an agonistic context, but are not clearly submissive or aggressive.

Behavior	Code	Description
Walked at or ran at	WT	Obvious.
Walked away or ran away	WY	Obvious.
Head flagged	HF	Rapid repeated lateral head movements and/or eyelid flashing oriented first toward one individual and then another. We define this behavior as "requesting support"; see Section 10.32. May be accompanied by rapid full or partial closure of the eyelids producing flashes of unpigmented skin.
Low-pitched vocalizations such as grunt, roar, bellow and cough	GR	Obvious.

Brush past	BP	One animal (usually a male) walks briskly towards a second animal (usually a male) and then suddenly turns and walks away again just when he is very close. Often he literally brushes against the other animal.

10.2 Decided dyadic agonistic interactions

Decided agonistic interactions between a pair of animals occur when one animal gives submissive gestures (and no aggressive gestures) during the interaction and the other animal gives aggressive or neutral gestures (but no submissive ones). In these cases, the animal that gave the submissive gestures is considered to have "lost" the interaction, and the animal that gave aggressive or neutral gestures is considered to have "won" the interaction. The winner is then generally considered to be higher ranking than the loser (depending on the outcome of other interactions between them that month).

10.21 AS and OS interactions

When one animal (for instance, Rocky, ROC) gives only aggressive gestures and another animal (for instance, Aman, AMA) gives only submissive gestures, or a combination of submissive and “other” gestures, within the same continuous agonistic interaction, we record this interaction as "ROC AS AMA". This is shorthand for "Rocky was Aggressive, Aman was Submissive". Our verbal shorthand for this is "Rocky AS'd Aman."

If Aman gives submissive gestures (and “other” gestures, but no aggressive gestures) and Rocky gives no aggressive or submissive gestures, for instance simply walks towards or past Aman, we record this as "ROC OS AMA". This is shorthand for "Rocky did something Other than aggressive or submissive, Aman was Submissive." Our verbal shorthand for this is "Rocky OS'd Aman."

10.22. DS interactions

Beginning in March 1995, we began to record displacements as well as OS and AS interactions. DS's occur when neither animal gives aggressive or submissive gestures, but one clearly displaces the other. A displacement occurs in three situations. (1) when one animal (e.g., ROC) moves steadily towards the spot where a second animal (e.g., AMA) is sitting or standing, the second animal moves away when the first is less than five meters away, and the first comes to stand or sit, at least briefly, in the spot where second was. (2) when one animal moves steadily towards the spot where a second animal is sitting or standing, the second moves away when the first is within 5 m, and the first passes right through the spot where the second was. (3) When one animal is on a path that does not intersect with the position of a second animal but comes within one or two meters of it, and the second animal glances in the direction of the first and immediately moves away from its spot. In these cases, we record "ROC DS AMA".

10.3 Undecided agonistic interactions

Undecided interactions are those that are dyadic but that do not fall within the criteria for decided encounters; these are often ones in which one or both participants give some mix of aggressive and submissive behaviors. Common undecided interactions include "A-A" (both participants give aggressive gestures), "A-O" (one is aggressive, the other gives some other, non-submissive gesture or ignores the aggressor), and "A-AS" (one animal gives aggressive gestures and the other gives both aggressive and submissive behaviors). "S-S" (both submissive), "AS-AS", "AS-S" and "AS-O" bouts are also possible but rare.

Undecided interactions between a pair of animals often indicates that a change in their rank relationship is occurring. You should pay special attention to the behavior of this pair until you are certain of their relationship. We will welcome detailed information about the nature of undecided interactions, including information on the specific aggressive and submissive behaviors used by each individual (two-letter codes for each agonistic behavior are given in Section 10.11). However, this is not required as long as you record basic information about the interaction (e.g. ROC AS-AS AMA).

10.4 Multiparty interactions

Most agonistic interactions involve only two animals, but some involve more than two. These are multiparty interactions, also known as coalitions or interventions. Beginning in July 1999, we greatly expanded our recording of these interactions by recording every multiparty interaction we see in the study groups, and by providing a detailed, structured recording scheme for these records. The protocol given here is a slightly modified version of the one written for the Project by Joan Silk in 1999.

There are four parts to the record of a multiparty interaction:

- The first interaction;
- Requests for support, if any;
- Support given, if any;
- Context of the interaction (e.g., consortship).

Below are descriptions for how each of these is recorded. We have given these descriptions in a lot of detail. However, they all follow the same simple protocol. (1) record the first interaction, (2) record whether anyone requested help, and (3) record whether active help (+) was given (and to whom it was given), whether passive help (P) was given (and to whom), or whether no help (-) was given.

10.41 The first interaction

Observation of multiparty interactions will usually begin with an agonistic interaction between two animals. This should be recorded like any other decided or undecided interaction. This first interaction will appear on the decided or undecided interactions sheet with an asterisk (*) next to it (this tells us that it was part of a multiparty interaction) and it will also appear on the multiparty interactions sheet.

Sometimes, you won't know exactly what happened at the beginning (often you will just hear someone screaming). In these cases, you can just record that two animals are fighting. Use the abbreviation VS (versus) for this, as in SOU VS DUD. In this case, you will NOT record the interaction in the decided or undecided dyadic interactions sheets; we only record decided and undecided interactions when we are confident that they are dyadic and when we know what happened.

If the first event that you see involves more than two animals, i.e. is already a multiparty interaction, you should write down who is involved (e.g., SOU, SAU AS DUD or SOU, SAU VS DUD, for Soupe and Saudi AS'd Dudu together, or (in the case of VS) were seen together fighting with Dudu but the nature of the interaction was not seen. These interactions will not appear on the decided interactions sheet, because only dyadic interactions (between pairs of animals) go on those sheets. If Soupe and Saudi are AS'ing Dudu together, you will not be able

to tell whether Dudu is giving submissive gestures to Soupe or Saudi, so you can't write down either one in the decided interactions.

10.42 Requests for support

Baboons request support in four ways that we recognize. These are (1) "head-flagging", moving their head quickly back and forth between their opponent and the animal they are requesting support from, (2) lying down on the ground (usually screaming but not necessarily) and lifting the head and looking all around as if to see who is there to help, (3) running toward the animal they are requesting support from and sitting or standing very close to them (sometimes in their ventrum or behind them), and (4) running directly to the animal that they are requesting support from and grooming them in a hurried manner, usually accompanied by quiet grunts and nervous glancing towards the opponent (this nervous glancing often escalates into head-flagging). Screaming may also be a request for help, but we cannot differentiate screams that are requests from other screams, and so we do not record screams as requests.

If you know who the request is directed to (for instance, if the direction of the gaze is very obvious), record this as:

DUD ? DRO

meaning Dudu requested support from Drongo.

If a request is directed to several animals, record them on separate lines:

DUD ? DRO
DUD ? AMI

Sometimes it is not clear who the request is directed to. In this case, record that someone (e.g., Dudu) requested help from an unknown animal, as follows:

DUD ? UNK

10.43 Support given

Support by a third animal (or by several animals) may be ‘active’ help or ‘passive’ help. Active help is when the third animal intervenes and acts aggressively towards either of the two animals in the first interaction. Passive help is when the third animal approaches or vocalizes, but does not give aggressive gestures.

Support may be given in response to requests, or it may be given even if neither animal in the first interaction requests help. Support should be recorded regardless of whether it is in response to requests.

If an animal responds to a request for support by giving active help, add a "+" to the request record:

DUD ? DRO +

meaning Dudu requested help from Drongo and Drongo responded with aggressive gestures against Dudu's opponent. This can also be recorded as follows (the field team sometimes uses this notation):

DUD ? DRO
DRO + DUD

If an animal responds to a request for support by giving passive help, add a "P" to the request record:

DUD ? DRO P

meaning Dudu requested help from Drongo and Drongo responded with passive gestures (approaching the disputing pair and/or vocalizing in their direction while looking at them). This can also be recorded as follows (the field team sometimes uses this notation):

DUD ? DRO
DRO P DUD

If an animal does not respond to a request for support, add a "-" to the request record:

DUD ? DRO -

meaning Dudu requested help from Drongo and Drongo did nothing.

Sometimes animals provide help even if help is not requested. If an animal gives active help without any request, write:

DUX + DUD

meaning that Dux helped Dudu, even though there was no request for support.

If an animal gives passive help without any request, write:

DUX P DUD

meaning that Dux provided passive help, even though there was no request.

Often when one animal helps another, the helped animal will groom its supporter immediately following the interaction (within about 2 minutes). Make a note of this underneath the record of the multiparty interaction:

SER AS DUD
DUD ? ICA +
(DUD g ICA)

meaning that Dudu requested support from Icarus, who provided active help. Immediately afterwards Dudu groomed Icarus. If a grooming interaction occurs during a multiparty interaction, it should also be recorded in the groomings sheets.

Here are three example multiparty interactions from start to finish:

(1) Soupe AS'd Dudu, Dudu requested support from Drongo, who gave aggressive gestures towards Soupe. Dux and Cheka provided passive support to Dudu, even though they were not asked for help.

SOU AS DUD
DUD ? DRO +
DUX P DUD
CHE P DUD

(2) Serah AS'd Hammer, Hammer requested help from Humble who did nothing, but Soupe and Saudi joined Serah in attacking Hammer; immediately afterwards SER groomed SOU:

SER AS HAM
HAM ? HUM –
SOU + SER
SAU + SER
(SER g SOU)

(3) Voyage AS'd Vibrant, who requested support from an unknown animal (he headflagged but it was not clear who he was headflagging towards). Mlozi gave Vibrant passive help and Velcro gave Voyage active help by AS'ing Vibrant

VOY AS VIB
VIB ? UNK
MLO P VIB
VEL + VOY

There are many possible variations of multiparty interactions. For instance, sometimes one animal requests support from another, but the second animal attacks the first instead of helping. This would be recorded as:

CHA AS WIZ
WIZ ? WEM –
WEM AS WIZ

meaning that Charlie AS'd Wizard, Wizard requested support from Wema, who did not help him but did AS him.

Sometimes one animal requests support from another before beginning aggression against an opponent. For instance, Tinker asks Godot for help, then Tinker directs aggression toward Felix. Record this as:

TIN ? GOD
TIN AO FEL
GOD + TIN (if Godot aggresses against Felix also)

After a male is threatened by another male, he sometimes tries to recruit the aggressor against an imaginary opponent. For instance, Godot threatens Tinker, and then Tinker looks off into the distance as if he sees an opponent, but there is no one there. He requests support from Godot by headflagging. Males seem to do this to distract their aggressor from continuing to fight with them. Sometimes the aggressor will respond by providing support to his victim, against the imaginary opponent. Record these interactions as follows:

GOD AS TIN
TIN ? GOD vs no one
GOD – TIN (if Godot does not help Tinker)

10.44 Decided and undecided dyadic interactions that occur as part of multiparty interactions

Multiparty interactions often start with a dyadic interaction (involving only two animals) that will be recorded on the decided or undecided interactions sheet as well as in the record of multiparty interactions. Sometimes there will be other clear dyadic interactions within the multiparty interaction. For instance, if Viola AS'd Vibrant and Vibrant requested help from Mlozi, Mlozi may then AS Viola without help from Vibrant in a clear dyadic interaction, which will then be recorded on the decided agonism sheet. However, you should NEVER record anything on the decided agonism sheet that is not clearly dyadic. In particular, if you see two animals (e.g., Soupe and Saudi) aggressing against a third (e.g., Dudu), and Dudu is being submissive, you will not be able to tell whether Dudu is submitting to Soupe or Saudi. This should never be recorded as a decided agonism, but you should include it in the multi-party interaction.

10.45 Context

Currently, the only context information that we record is whether the multiparty interaction involved a consortship takeover or an attempted takeover. Record this information on the sheet, just beneath the record of the multiparty interaction. Record (1) that it involved a consortship, (2) who the female was, and (3) who ends up with the female.

10.5 Rules for recording agonistic interactions

Most agonistic interactions are very brief and discrete. However, some last for several minutes and include multiple instances of AS'ing or OS'ing. These can involve running and chasing, sometimes even away from the group for several minutes. This can make it hard to decide whether you are seeing one interaction or several. When an interaction continues for some time, do not record a second AS or OS unless (1) You know that the interaction stopped and then started again (e.g., the animals came to rest quietly for a few minutes and then interacted again), or (2) at least five minutes (during which you saw no interactions) have elapsed since you saw the first interaction.

Sometimes a long continuous interaction will include changes in who wins and who loses. For instance, in a long continuous interaction you might see ROC AS AMA, followed by lots of chasing in both directions, and then Aman suddenly turns and AS's Rocky. Do not record this as two decided interactions of ROC AS AMA and then AMA AS ROC. Instead, you should record this as an undecided bout (unless, as described above, you know the interaction stopped or at least five minutes elapsed between the time you saw ROC AS AMA and AMA AS ROC). Undecided bouts are described in Section 10.2.

You will see nearly all types of aggressive and submissive behaviors when juveniles play together. Generally, these appear to be "practice" bouts and are not scored on the agonistic sheets. However, play bouts often escalate into actual decided agonistic interactions. It is usually easy to tell when this happens, because the relaxed atmosphere of play changes suddenly. Often one juvenile will begin to scream, and it is not uncommon for adults to become involved. If you are not sure whether a bout between juveniles is play or agonism, do not record it as agonism.

11. Focal animal sampling

Focal sampling, currently done only by Raphael, Kinyua, and Long'ida, is also a part of our standard set of monitoring procedures. Each visiting researcher (except those staying only short periods) will pursue their own focal sampling scheme aimed at addressing their particular research questions. Prior to July 2009, representative interactions were recorded in the Psion only if they involved the focal individual. In July 2009, the protocol was revised to allow all agonisms and groomings to be recorded during a focal sample, regardless of the focal individual's involvement.

Raphael, Kinyua, and Long'ida all do focal sampling on adult females and on juveniles of both sexes as part of our behavioral monitoring. This was started in 1982 and has occasionally been modified slightly since then. Juvenile sampling was added in the mid-1990's. To collect these data, we currently use a Samsung tablet, which runs a custom version of Prim8 data collection app (McDonald & Johnson 2014, Anim Behav). The protocol for data collection is given below.

While we expect and encourage visiting researchers to develop their own sampling scheme for their individual projects, we also encourage them to read the description of our focal and

point sample scheme for pointers and ideas. This will also enhance our ability to link the data of visiting researchers with our long-term data where this is appropriate, for collaborative purposes. Of course, we also expect that visiting researchers will participate in collection of the other data described in this Monitoring Guide, in addition to their focal sampling.

11.1 Point and continuous samples collected using the Prim8 App on a Samsung tablet

We began using the Prim8 app (McDonald & Johnson, 2014. *Anim Behav*) on Samsung tablet computers in July 2015. Between mid-1999 and 2015, we used Psion Workabouts to collect these data, and before this we collected the data by hand. We made no collection changes when we switched from the Psion to Prim8. When we switched from handwritten to Psion data, we made only a very few collection changes to the data collection protocol; copies of the old protocol for manual data collection are available at both Notre Dame and Duke.

Points are collected once each minute, when the timer beeps. Samples are 10 minutes long. Four samples are collected each hour. Two are on adult females, two are on juveniles.

11.11 Adult female point and continuous samples

Samples on adult females consist of point data on the following things:

1. Activity
2. Position
3. Infant position
4. Infant suckling
5. Nearest neighbor within 5 meters.
6. Nearest adult within 5 meters.
7. Nearest adult of the other sex within 5 meters. A focal female can have a maximum of ONE adult female as a neighbor and ONE adult male as a neighbor. Hence, if the nearest adult is a female, this field must be blank (coded as 999) or an adult male. If the nearest adult is a male, this field must be blank (i.e., 999) or an adult female.
8. Food code if the activity was Feed. Otherwise this is left blank (see Section 11.13 for list of food codes).

- Activities are: Feed, Rest, Walk, Groom, Be groomed, H for groom infant, T for Be groomed by infant, Other social. Feed is recorded whenever the animal is handling food or there is food visible in the hand or entering the mouth. Once the food disappears into the mouth, the animal is not feeding anymore. Reaching for food, handling food, or processing food (digging corms, picking at tree gum, picking fruit, turning over plants or other things on the ground to look underneath them for food) are all scored as Feeding. If an animal is Feeding and Walking at the same time, score Feeding. If an animal is both Feeding and Being Grooming, score Being Groomed. If an animal is Grooming and Being groomed at the same time, Grooming takes priority. (Note: when data were collected manually, groom and be groomed by infant were formerly recorded by putting an I superscript next to G or B)
- Positions are: 1 = standing, 2 = sitting
- Infant positions are: Away, Ventral weight supporting, Dorsal weight supporting, Other (in contact but not weight supporting), None (none is used if the female does not have an infant).
- Infant suckling codes are: Suckling, Not suckling, Unknown

- Nearest neighbor = nearest adult or juvenile or infant within 5 meters. We differentiate the presence of an unknown individual (which we code as 998) from a situation in which we can't determine whether an individual was present (we code this as 997). The nearest neighbor may be any animal except the female's own infant; the female's youngest offspring is considered to be her infant until (a) she has another infant, (b) she has a miscarriage, or (c) her youngest offspring reaches two years old and she has not yet had another infant or a miscarriage. NOTE that we did not know the team was following rule (b) until May 2011 – this ambiguity had not been discussed with them. Specifically, they treat a miscarriage the same way they treat a live birth, in that both events end the "infant" status of the female's previous offspring. We do not know how long they have been doing this, but it will be consistent from now on. Note: In August 1999 data collectors were reminded that if a female's infant reaches 2 years old and the female doesn't have another infant, then the female is considered not to have an infant. With Dotty and her last-born, the last-born was considered her infant well into the juvenile period because Dotty did not conceive again. It could easily happen again with post-reproductive females; all observers should be alert to this possibility.
- Nearest adult = nearest adult male or adult female within 5 meters. This will be the same as the nearest neighbor if the nearest neighbor was an adult. It will be different from the nearest neighbor only if the nearest neighbor was a juvenile. Again, we differentiate the presence of an unknown individual (which we code as 998) from a situation in which we can't determine whether an individual was present (we code this as 997).
- Other adults within 5 meters. A focal female can have a maximum of ONE adult female as a neighbor and ONE adult male as a neighbor. Hence, if the nearest adult is a female, this field must be XXX (none) or an adult male. If the nearest adult is a male, this field must be XXX (for "none") or an adult female. As above, we differentiate the presence of an unknown individual (which we code as 997) from a situation in which we can't determine whether an individual was present (we code this as 998).
- Sometimes you will not be able to locate your focal animal and cannot conduct a focal sample. In this case, indicate that the animal was OOS (Out Of Sight) in your sample collection log and move on to the next focal.
- Sometimes in the middle of a sample your focal may be out of your line of sight during a given 1 minute scan sample. In this case, you should enter OOS (Out Of Sight) in place of a point sample to indicate that the animal was not visible.

NOTE: Sometimes you may have trouble locating your focal animal at the start of the focal sample. If this happens, you should search for 3 minutes before turning on your timer. You should then begin collecting OOS points for up to 5 minutes. However, if you have not found your focal at the end of 5 minutes of OOS points, you should switch to the next focal. This protocol is sometimes called "the 3-minute rule and the 5-minute rule".

HISTORICAL NOTE: In March 1996, the method of collecting neighbor data changed from what it was to what it is now (as described above). Before the change, the neighbor data were collected as follows. FIRST the nearest neighbor was recorded (anyone except the female's own infant). SECOND the nearest ADULT MALE was recorded. This might be the same as the nearest or it might be different. THIRD the second nearest ADULT MALE, if any, was recorded.

In addition, you should always collect every instance of grooming and agonism that you see during focal samples (data users should see the note at the end of this section). These data and other types of information, are collected during the sample as follows:

- All groomings should be recorded as Foc g Oth or Oth g Foc, in addition to being recorded as G or B in the point sample.
- All agonisms should be recorded.
- If "Other social" is recorded in the point sample, the nature of the social interaction is recorded.
- If the food being eaten is Other or Unknown, notes on the food are recorded.
- These behaviors that are continuously recorded and are entered into the Psion as given in the table below.
- The first letter of each row indicates the type of interaction (A = agonism, R = request groom, G = groom, C = consort, O = some other social behavior).
- Interaction types A,R,G, and C are constrained in the sense that the format of data entry after the interaction type MUST be "Sname XX Sname". That is, the Psion is programmed to only accept data in that format (see table for specifications).
- Interaction type O is without constraint; observers can enter text in any form after an O.

A	SN1	AS	SN2	Means animal 1 (sname 1) AS'd animal 2
A	SN1	OS	SN2	Animal 1 OS'd animal 2
A	SN1	DS	SN2	Animal 1 Displaced animal 2
R	SN1	R	SN2	Animal 1 requested grooming from animal 2
G	SN1	G	SN2	Animal 1 groomed animal 2
O				No set format. Commonly recorded are M (for mounts), present, embrace, play, or "mounted" or "mount" (rather than M) when one female mounts another

<u>NOTE to the end-user of the data:</u> During focal sampling, the team continues to collect representative interaction sampling on the focal animal as well as on the rest of the group. We consider these grooming and agonism data collected on the focal individual during the focal sample to be representative sampling data, not exhaustive, all occurrences sampling.

11.12 Juvenile/infant point and continuous samples.

Point samples are collected on infants and juveniles from the age of 6 months until testicular enlargement (for males) or menarche (for females). When a female reaches menarche she is added to the schedule of adult female point samples. Samples on these immature animals consist of data on the following things:

1. Activity
2. Position
3. The three nearest neighbors within 5 meters.
4. Food code if the activity was feed. Otherwise this is blank

- Activities are: <u>F</u>eed, <u>R</u>est, <u>W</u>alk, <u>G</u>room, <u>B</u>e groomed, <u>P</u>lay, <u>O</u>ther social. See details above under Female Point Samples.
- Positions are: 1 = standing, 2 = sitting, 3 = being carried (dorsal or ventral)
- Nearest neighbors = the three nearest adult or immature neighbors within 5 meters. As with adult samples, we differentiate the presence of an unknown individual (which we code as 998) from a situation in which we can't determine whether an individual was present (we code this as 997). If there is no neighbor, use XXX.

In addition, continuous event data for grooming and agonism, are collected during the sample, as well as some other information, as follows:

- All groomings should be recorded as Foc g Oth or Oth g Foc, in addition to being recorded as G or B in the point sample.
- All agonisms should be recorded.
- If “Other social” is recorded in the point sample, the nature of the social interaction is recorded.
- If the food being eaten is Other or Unknown, notes on the food are recorded.

As for focal samples on adult females, if your focal animal is out of your line of sight during a point sample, you should enter OOS (Out Of Sight) to indicate that the animal was not visible. Furthermore, if you have trouble locating your focal animal at the start of the focal sample. If this happens, you should search for 3 minutes before turning on your timer. You should then begin collecting OOS data for up to 5 minutes. However, if you have not found your focal at the end of 5 minutes of OOS points, you should switch to the next focal.

11.13 Food codes used during point sample collection

Each food that the baboons eat has a three-letter code that we use in the point samples. In most cases, the first two letters of the code are shorthand for the species (or the general category, e.g., GR for grass) and the third is the part of the plant that is eaten (B for blossoms, F for fruits, and so on – see table below for complete list). If you see the baboons eat a type of the food that is not on this list, please do not invent a new code for it without first consulting with the senior field team, who will communicate with the US team. Instead, categorize it as OTH (other) and make a note about what it was if you know the species. If it becomes common, as elephant dung juice did during the 1990's, we will add a new code for it. We have an herbarium in camp that has samples of many of these plant species. If you will be collecting any ecological or feeding data, or are going to be in Amboseli for an extended period, you should take the time to go through the herbarium when you get to camp.

Code	Type	Description
ABB	B	Abutelon blossoms
ABF	F	Abutelon fruits
ADG	G	Acacia drepanolobium gum
ADL	L	Acacia drepanolobium leaves
ATF	F	Azima tetracantha fruits
ATL	L	Azima tetracantha leaves
ATX	X	Azima tetracantha unknown part
BGF	F	Balanites glabra fruit
BGG	G	Balanites glabra gum
CAF	F	Commerina africana fruits
CAS		Commerina africana stems
CBF	F	Commelina benghalensis fruits
CBL	L	Commelina benghalensis leaves
CBS		Commelina benghalensis stems
CDL	L	Cynodon dactylon leaves
CMF	F	Comia monoica (sandpaper plant) fruits
CTF	F	Caparis tomentosa fruit

DOD		Dodder weed, Cuscuta spp. Implies also eating the plant that it parasitizes, usually Tribulus
EDJ		Juice from elephant dung
ESF	F	Euclea schimperi fruit (first observed in 2013)
FTB	B	Fever tree blossoms
FTD	D	Fever tree seeds
FTG	G	Fever tree gum
FTK	K	Fever tree bark
FTL	L	Fever tree leaves
FTP	P	Fever tree pods
FTX	X	Fever tree unknown part
GAL	A	Drepanolobium galls
GAR		Garbage
GBF	F	Grewia bicolor fruits
GRC	C	Grass corms of other or unknown species
GRD	D	Grass seed head
GRL	L	Grass leaves of other or unknown species
GRT	T	Grass blade bases
MCF	F	Maerua crassifolia fruits
NVR		Invertebrate
OTH		Other (formerly a 4-letter code, Othr)
PCM		Mother's milk
RMB	B	Ramphicarpa montana blossoms
RMF	F	Ramphicarpa montana fruits
RML	L	Ramphicarpa montana leaves
RNF	F	Rhus natalensis fruits
RPD	D	Ruellia patula seeds
SMF	F	Scutea myrtina fruits (first observed in 2014)
SCL	L	Sporobolus consimilis leaves
SCT	T	Sporobolus consimilis blade bases
SDF	F	Solanum dubium fruits
SFF	F	Commicarpus fruits
SKC	C	Sporobolus kentrophyllus corms
SPF	F	Salvadora persica fruits
SPL	L	Salvadora persica leaves
SUL	L	Suaeda leaves
TCF	F	Trianthema ceratosepala fruits
TCL	L	Trianthema ceratosepala leaves
TCX	X	Trianthema ceratosepala unknown part
TFB	B	Lyceum blossoms
TFF	F	Lyceum fruits
TFL	L	Lyceum leaves
TFX	X	Lyceum unknown part
TOB	B	Tortilis blossoms
TOD	D	Tortilis seeds
TOG	G	Tortilis gum
TOL	L	Tortilis leaves
TOP	P	Tortilis pods
TOX	X	Tortilis unknown part
TTB	B	Tribulus terrestris blossoms
TTF	F	Tribulus terrestris fruits

TTL	L	Tribulus terrestris leaves
TTX	X	Tribulus terrestris unknown part
UNK		Unknown
VRT		Vertebrate
WAX		Water
WSF	F	Withania fruits
XAF	F	Ximania americana fruits
XXB	B	Other or unknown blossoms
XXC	C	Other or unknown corms
XXD	D	In or under dung, or other or unknown seed
XXF	F	Other or unknown fruits
XXG	G	Other or unknown gum
XXK	K	Other or unknown bark
XXL	L	Other or unknown leaves
XXP	P	Other or unknown pods
XXR	R	Other or unknown roots

12. Census Data on Non-Study Groups

We obtain periodic censuses of non-study groups of baboons in the Amboseli area. Four of the groups that we try to obtain regular censuses on range far from our study groups, so we never encounter them while monitoring our study groups. These include groups that used to be study groups but were dropped (as of January 2024, they were Mica's, Snap's, the fission products of Dibble's, which are called Yvonne's and Eclipse's groups, and the currently identifiable descendants of Kelly's group, called Wheatear's and Zoe's groups), as well as groups we have never regularly monitored, such as Olkenya group, Jill's group (a fission product of Ositeti group), and the Sinya groups - Jedi's group, Tepedi's group, and Suluhu's group. The senior observers take one day per month to search for and census these groups (called the "other groups" day). The other groups that we try to census regularly range in the same general area as our study groups, so that we encounter them regularly.

We no longer try to census the group(s) in Ol Tukai; they are spread out all over the village and the lodge grounds to the point that it is impossible to figure out how many animals or even how many groups there are.

If a non-study group has not been censused for several months and is in close proximity to our study groups, you should make it a high priority to obtain a census at that time. In addition, there are three situations in which it is particularly helpful to obtain censuses on other groups or to at least check thoroughly for the presence of particular animals in those groups, if at all possible:

(1) when an animal has disappeared from our study groups and perhaps immigrated into some other group;

(2) when a recent immigrant into any study group is believed to have come from another group in the area, and

(3) if some pathology resulting in high mortality becomes prevalent in any study group or in a non-study group.

Censusing of other groups can best be done during group progressions, as described in Altmann and Altmann's Baboon Ecology (pp. 20-21, see also Section 12.1 below). There should be two people (it also works for one person to do it with a voice recorder, but we have not used this method for many years). One person calls out the age and sex class of the animals and the other person acts as scribe. Occasionally we do this with the scribe being on a 2-way radio in another vehicle.

Describe individuals that are easy to identify (e.g., who have very short tails or other unusual features) or who have known pathologies (e.g., broken limbs). Indicate for each female her reproductive state by describing the color of her PCS, turgescence or deturgescence of sex skin, presence of an infant, and presence or absence of elongated nipples. Ideally, we try to positively identify two or more distinctive adult or juvenile females as "marker" females, because females are the least ephemeral members of groups and marker females therefore provide the best long-term means for identifying each group. Determination of adulthood should be done according to the criteria in Altmann et al. 1981 (see Chapter II, Section 12.2 below) and by comparison with adults of study groups. For immatures, estimate age in years by the maturational descriptions in Chapter II, Section 14.4 or by comparison with study animals of known ages. Note signs of maturation – testicular enlargement for males and signs of menarche for females – whenever possible. Also, check for each individual that was identified in previous censuses and search for any additional new individuals. It is easy to make mistakes in this method if you don't stay with the group for a number of hours and don't know the individuals quite well.

If any part of a description is incomplete or questionable, make sure that it is clear from your notes which piece of information is questionable. For instance:

- (ad female)? means "I'm not sure this really is an additional individual; I may have counted it before.
- (ad?) female means there was definitely a female that should be counted but I'm not sure if she was adult.
- Juv-2 (Female ?) means there was a class 2 juvenile but I'm not sure if it was a female.

Have a set of conventions that you use regularly and that you describe in a sheet at the beginning of your census records. At the end of the census add a few sentences of supplementary notes as needed, e.g. "excellent visibility," "census incomplete for juveniles, complete for adults." If possible, obtain ID photos for members of other groups, particularly the adults of both sexes.

12.1 Detailed Censusing Techniques (excerpted with revisions from Baboon Ecology).

Our technique for taking censuses of baboon groups was as follows. We positioned ourselves in such a way that we could watch the baboons pass an arbitrarily selected 'counting point' that was clear of obstructing foliage. This was best done in the morning as the baboons were moving in file toward the foraging areas. Binoculars, often held in place by means of a small tripod, were kept aimed at the counting point, and one person kept continuous watch on the counting point while the other either took dictation or verified the counts and the age-sex determinations. A rear oblique view of the animals as they passed was best, since it gave a view of the ischial callosities (which are separate only in females) and the sexual skin. As each individual passed the counting point, the observer indicated its age class, sex, name or conspicuous identification marks, and, when possible, the condition of the females' sexual skin. If an infant was riding on its mother's back or belly, this was indicated.

At the end of each census, we indicated the overall quality of age-sex determinations, the estimated percent of observations that were verified by the second observer, and an 'error factor', which gives estimates of, first, the number of animals that might have been missed (due to obstructing foliage and so forth), and second, the number of animals that might have been counted twice (usually the result of young animals running back and forth across the counting point). For example, 'error factor (+2, -1)' means that two animals may have been missed and one may have been counted twice. As a further check on census accuracy, simple counts of

individuals were sometimes taken on groups. Simple counts were also made when observational conditions did not permit a more detailed census.

12.2 Age estimates of Amboseli baboons.

The following age estimate are used for censusing non-study groups. See Altmann et al. 1981, Amer. J. Primatol. Vol 1, pp 389-399.

Class	Description	Age class estimate (established 1980)
Infant-1	Hair completely or partially black (natal coat). Black spots in tail and shoulders remain longest. Skin pink or red from skin vascularity; ears and nose retain pink longest. Face usually has wrinkles.	0 – 8 months
Infant-2	Hair brown to cream-colored, often lighter (in Amboseli) than that of adults. Much of the visible skin is pigmented black, as in adults (except for male scrotum, see below). Face usually has wrinkles.	8 months – 1.5 y
Juvenile-1	Not sharply demarcated from previous class. Fur may still be lighter than adult. Face wrinkles disappear by end of this period. Scrotum changes from pink to gray near end of this period.	1.5 – 3 or 3.5 y
Juvenile-2	Not sharply demarcated from previous class. Hair often darker like that of adults. Males may be undergoing testicular enlargement but are not fully enlarged until subadulthood. Males' canines extend beyond tooth row at end of this period.	Females: 3 or 3.5 to 4.5 or 5 Males: 3 or 3.5 to 5.5 or 6 y
Adult female	Sexually mature (has experienced menarche and undergoes sexual skin swellings). Nipples pink and button-like when nulliparous; elongated and gray or pink in more mature, multiparous females. First pregnancy at about six years of age. Full size reached about seventh year for females.	4.5 or 5 y +
Subadult male	Secondary sexual characteristics partially developed (mantle, canine ridges, long canine teeth, greater musculature than females). Testes are enlarged. Larger than all adult females but smaller than adult males.	5.5 or 6 to 8 or 9 y

Adult male	Secondary sexual characteristics fully developed; male is roughly twice the size of adult females.	8 or 9 y +

13. Fecal samples and other tissue collection

We collect fecal samples for both hormone analysis and genetic analysis. From 2011 until ~2021 we also collected fecal samples for parasite analysis. For approximately five years from ~2016 to ~2021 we also collected frozen samples. We no longer collect either of these types of samples. We collect tissue samples opportunistically, whenever we find a corpse. We also collect small tissue and hair samples during darting; this is described in Chapter III, Section 3.

The field team has a well-established protocol for fecal sample collection. When an animal defecates, the observer waits until the animal moves away from the sample, and then collects the sample in a paper cup using a wooden tongue depressor-type stick. The observer writes the name of the animal and the time of collection on the wooden stick and also on a personal collection list that each observer maintains for the samples they collect. The observer hands the cup with stick to the driver, who collects either a genetic sample for microbiome analysis (labeled G-Beth), a genetic sample for baboon genetics (labeled G), a hormone sample (labeled H), or all three, depending on what is needed for that animal. Microbiome samples for Beth are collected only for the first three fecal samples per group per day. We keep updated lists of who we need genetic samples for in the field notebooks; the field assistants refer to these lists to determine when a genetic sample should be collected. We collect hormone samples every time we see a defecation unless we already collected one that day from that animal. The field assistant writes the animal's name, time and date of collection, and "H" for hormone sample, "G" for genetic sample, or “G-Beth” for microbiome samples. In the case of hormone samples, this is done on two labels, one on the body of the tube and one on the cap. The sample gets placed in our "fecal collection box" for transport home.

In each field vehicle, we keep a "fecal box" which includes cups, sticks, labeling tape, a pen, prepared tubes, a garbage box for carrying home used cups, and gloves. We also keep plenty of antibacterial soap and handwashing water in each vehicle. Upon return from camp, genetic and hormone samples are immediately placed in the solar fridge in the kitchen. Every 2 weeks, all samples are entered into a fecal sample log and sent to Nairobi via courier service. Careful recording of the fecal sample is essential for compliance with rules and regulations of KWS and WRTI.

Our collection procedure means that we write the name of the animal who donated the sample in three places, which differ for different types of samples.

- Samples in ethanol (fecal) or RNALater (tissue): samples are not listed on the daily data sheets. A list is made at camp every two weeks at the time that the samples are prepared for shipment, and the list is sent with the samples. In addition, the number of samples in ethanol, RNALater, and any other media (e.g., hair in plastic bags) are listed on the verification sheet for WRTI: our personal collection list, on the wooden collection stick, on the collection tube, and on the master log back at camp. This helps reduce labeling errors on the tubes.

Note that the procedure for samples in ethanol and formalin has changed somewhat over the years. See earlier versions of the monitoring guide for those procedures.

Our research increasingly depends on fecal sample collection, and it is critical that all members of the field team contribute to the effort. The various aspects of fecal sample collection, as described above, are often divided between the observers and the field assistants. However, all the observers are familiar with and often perform all aspects of this job. Visiting (non-permanent) researchers are also expected to do any of the different jobs associated with fecal collection after training, including actual collection of the dung, homogenizing and putting it into tubes, and updating the master log and checking it against the personal lists. They should therefore learn all of these techniques and procedures as soon as feasible.

13.1 Fecal samples for genetic analysis

We aim for five genetic samples in ethanol for each individual, including recent immigrant animals that we believe have known IDs (so that we can confirm that we have correctly ID'd the animal). This ensures that we have more than enough for verifying identity of samples by genotyping, and for genotyping as many loci as we wish. It also gives us extra in case some samples are hard to extract from (e.g. some plant compounds bind to DNA more than others, or the feces of some individuals seems to consistently contain less DNA, making it difficult to generate PCR-ready DNA). Ideally, we would have more, but there are real limitations to how much we can store in the US. We keep a list of "finished" animals in each notebook, along with a list of animals that we still need samples from (and the dates of any collection from these animals). As of July 2011, these are mostly infants, young juveniles, and immigrant males.

Fecal samples for genetic analysis are collected from the leading edge of the feces, and are collected before the fecal sample is homogenized for hormone collection (see below). Approximately 2 grams of feces are placed into a collection vial with 10 ml of ethanol already dispensed into it. When the feces are added, the vial will be filled up to the 15 ml line. Then, stir and/or shake vigorously to break up the sample (although this last step does not appear to be crucial).

13.2 Fecal samples for hormone analysis

We collect hormone fecal samples from individuals of every age-sex class and every reproductive state. We try to collect as many we can per day, except that generally we collect from each individual only once per day (although particular research questions may sometimes require more than one sample per baboon per day).

Fecal samples for hormone analysis are homogenized very well by stirring and mixing with the stick. Homogenized feces, to a level of 15 ml is placed into a collection vial with 10.5-11 ml of ethanol already dispensed into it, and mixed well to break up the sample.

Fecal samples for microbiome analysis are collected in the same way as fecal samples for hormone analysis. One piece of feces is put into ethanol (for microbiome) and one into formalin (for parasites).

13.3 Tissue sample collection from dead animals, and collection of dead animals

When we find a dead baboon, we collect tissue samples (muscle and skin) if it is possible to do this safely. In the fecal box, you will find small scissors for cutting tissue, as well as gloves and mask. The ideal sample is several small pieces of muscle from a limb and several similarly-sized pieces of skin. Try to collect at least 5-6 pieces of tissue that are each the size of a lentil (a small piece approximately 1-2 cm long and 1-2 cm wide) in RNALater (which is stored in the solar fridge with the date it was brought to camp/opened on the label; we aim to use RNALater that is within a year of arrival at camp). Storage in RNALater means you will have to bring the

samples back to camp before preserving them, or bring the whole corpse back and collect tissue samples. If there is no RNALater at camp, perform the same procedure but store in ethanol. Collect at least two replicate samples of muscle, skin, and hair (more is okay). Even corpses in a fairly advanced state of decomposition will yield good tissue samples for genetic analysis. You must use gloves and a face mask when handling dead baboons or their tissue, even if they appeared healthy at the time of death. Once muscle and skin are placed in RNALater or ethanol, freeze them at -20 until shipment to Nairobi (on ice packs). Hair samples do not need to be frozen. All sample types, including number, storage medium, and storage conditions, should be recorded on the corpse sample checklist sheet.

If the carcass is fresh enough that we can recover part or all of the skeleton, you should attempt to bring it back to camp for burial, so that it can contribute to our collection of skeletons (which resides at the National Museums of Kenya). Note that there is a well-established protocol for burial. There should be blank copies of the corpse checklist in camp; you should follow and fill out the checklist and send it with the monthly data. Skeletons are usually excavated 4-12 months after burial by our collaborator Shannon McFarlin, who helps to manage the collection at the National Museums.

14. Last days of the month with the groups

The last four observation days of each month are called ‘last days’. On a last day, each observer collects focal samples only for the last half of the day (i.e., they collect half the usual number of focal samples). ‘Last days’ are almost always morning observations. The rest of the time, the observer uses these days to collect several types of data that are time consuming and difficult to collect while focal sampling. We also use these days as an opportunity to collect more grooming and agonism data than usual; if two observers are together, they also use the time to talk about monitoring and data collection, and to check each other on IDs (this can be particularly useful for infants that are growing rapidly and changing color). If you are a visiting researcher with your own focal sampling project, it may be more efficient for you to continue focal sampling during these days rather than join the rest of the field team for "last days". Make sure you discuss this with a project leader before a decision is made, as this will depend on your project.

A copy of the list of things to do on "last days" with the groups is kept in each field notebook. The different types of data collected on these days are described below.

14.1 Male scrotal development

Males experience testicular (and therefore scrotal) enlargement usually between the ages of four and six years. We check the scrotum of each male who has reached four years of age, and continue to check him at the end of every month until his testes are enlarged. Once he has been recorded as “enlarged” for three consecutive months, the male is considered to be a subadult.

We use a scale of four different levels for assessing testicular enlargement (Not E, Slightly E, Almost E and E). Previously, three levels were used – Not E, slightly E and E — but the long-term observers are getting better at detecting the very early stages of enlargement. Therefore, they are scoring Slightly E earlier than it used to be scored and have added Almost E as intermediate between Slightly E and E. The category of E is scored consistently with the way it has always been scored. The four categories are:

- Not E. The scrotum is a thin flap of skin that makes an upside-down U with the legs when you look at it from behind. You can never see testes in it.

- Slightly E. The scrotum no longer makes an upside-down U, instead it makes a straight line between the legs. Looking from behind when the male's legs are spread, you can sometimes (but not always) see the testes; the male might retract them a lot. One side might be more enlarged than the other. Looking from the front when the male is sitting, you can begin to see that the scrotum is like a small pouch with something in it. When the male is Not E, the scrotum does not look like a small pouch with something in it, it just looks like a flap of skin. You need to look at the male repeatedly to score him when he is slightly E, because the testes are still small and he may often retract them.

- Almost E. The scrotum is no longer a straight line between the legs. Instead, it curves downward slightly like an adult scrotum, but the curve is very gentle. The male may still retract his testes often. As with Slightly E, you need to look at the male repeatedly to score him. One side may be larger than the other. But it does not hang down like the pouch of a male with fully enlarged testes.

- E. The scrotum hangs down between the male's legs almost all the time, retraction is less common now (but still occurs sometimes). The scrotum looks very much like a pouch that is full.

14.2 Canine condition checks

We check the condition of the canines for all maturing males in each group. Typically, this means that you have to wait until they yawn. Often this information is best collected on an *ad libitum* basis whenever possible, because whether or not a male yawns depends a lot on his situation. However, we try to pay special attention to yawns during the last days.

An assessment sheet is kept in each field notebook. It should be filled out as follows.

Codes:
During maturation, eruption
0= none, missing
pb= present, below (or at) the tooth row
pa= present, above the tooth row
L=canines are full length

Score every maturing male each month until he reaches a score of 'pa' for all 4 canine teeth for 2 months.

During age estimates
L= Long= looks like a full length tooth
S= Short= closer to the tooth row than a normal canine,
or below the tooth row, present
0= Missing

When a male immigrates and/or he is maturing (ideally in the first month when age estimation is done) score all four of his canines. Check repeatedly until a high quality complete record is obtained for all 4 teeth.

After this first assessment for immigrants, scoring will be done annually, usually the end of October or November when ALL adult males are scored for age estimation.

14.3 Hybrid scoring

The Amboseli baboon population occurs in a hybrid zone. Most Amboseli animals match the phenotype of yellow baboons, but we have a few anubis animals in the population and many hybrids. Hybrid scoring is done only by Susan and the long-term observers. In June-July 2000 they scored every animal in the study groups, using the protocol included below (and also described in Alberts and Altmann 2001, Amer. J. of Primatol. V 53, pp 138-154, filed in the baboon camp office; this article also includes illustrative drawings).

During the last days of the month with each group, we score all males that immigrated that month and all non-adult animals that reached their birthday or immigration anniversary that month. This annual scoring is done from 1 year of age and continuing to 6 years for females and 8 years for males.

Each field researcher scores each adult animal on 7 different characteristics. These are (1) coat color, (2) hair length, (3) body shape, (4) head shape, (5) tail length and thickness, (6) tail bend at the "hook", and (7) muzzle skin. For juveniles (up to 4 years of age for females and up to 5 years old for males), only the first 5 characteristics are scored, because the bending of the tail at the hook and the skin on the muzzle change during development.

Each characteristic is scored on a scale of 0 to 2, where 0 is pure yellow and 2 is pure anubis, and 1 is the midpoint between yellow and anubis. Scores of 0.5 and 1.5 can also be given. These scores can be combined into a single metric. We do not currently do this, but in theory, scores from each observer could be summed across the 7 characteristics (or 5 in the case of juveniles) to get a "total" score for that animal and observer. Total scores would range from 0 (pure yellow) to 14 (pure anubis) for adults, and 0 to 10 for juveniles. The total score could also be divided by 7 (or 5 for juveniles) to get an "average" score for each animal, which ranges from 0 (pure yellow) to 2 (pure anubis).

New adult males are scored once by each researcher when they immigrate, at the same time that they are given age estimates. These scores are generally done by two observers working together to agree on the scores. All adults more than 8 years old (for males) or 6 years old (for females) were scored once by each researcher (SCA, RSM, SNS and JKW) during June-July 2000.

Juveniles, including males that immigrate as juveniles, are scored once each year in the month of their birth (or immigration) by each researcher. Juvenile scoring is done every year from one year of age to five years of age.

Subadults (beginning at the sixth birthday for males, fourth birthday for females) are scored as adults (i.e., tail bend and muzzle skin are included in the assessment). They are scored on the 6th, 7th and 8th birth months (for males) and 4th, 5th, and 6th birth months (for females). This applies to males and females that mature in the study groups as well as immigrant males that are estimated to be less than 8 years old.

14.4 Age estimates of immigrant males

We estimate the age of all males that enter our study groups and do not have known birth dates (all immigrants from non-study groups). These age estimates are done during the last

days of each month with the group if not before. Our method of estimation was developed by Susan during the late 1980's. We have worked hard to improve it and calibrate it over the years. We rely extensively on comparisons with males of known ages (of which there are now many in the population). A list of known-age males in the population is kept in each group's notebook.

Basic rules are (1) compare the male to males of known age, and (2) examine him with binoculars while he is standing. For juvenile and young subadult males, age should be assigned by comparing him to males of known age in the study groups. Also for juvenile and young subadult males, the accuracy will generally be 1 (i.e., accurate to one year, specifically to six months on either side of the estimate you gave).

1. Assign age according to size
   - 6-7 years = bigger than adult females and smaller than adult males, but closer in size to adult females than males. Scrotum enlarged.
   - 7-8 years = bigger than adult females and smaller than adult males, but closer in size to adult males than females.
   - 8-9 years = taller and longer than small adult males but smaller than many adult males. Grows after joining group.
   - 9+ years = looks fully adult in size.
   - Note about size: males in garbage feeding groups grow substantially faster than males in wild-feeding groups. A 6-7 year old male from a garbage group resembles in size a 7-8 year old male from a wild-feeding group. Adjust your age estimate accordingly. You can usually identify a male from a garbage-feeding group because he will be very well-habituated and will often be somewhat fat, with unusually thick, smooth fur.

2. Assign age according to fur condition
   - 8-10 years = smooth, shiny fur with no breaks in mantle or elsewhere.
   - 10-13 years = fur rough in a few places, from none to a few breaks in mantle.
   - 13-15 years = breaks in mantle present and quite noticeable, fur rough all over body.
   - 15+ years = dull fur with many breaks in mantle and elsewhere, rough all over.

3. Assign age according to body carriage
   - 8-10 years = carriage straight, chest held high, body almost rigid looking and the animal struts while he walks.
   - 10-13 years = back is beginning to sway a bit, chest begins to sag a bit, but carriage is still mostly straight. Rigid look is beginning to disappear.
   - 13-15 years = back definitely swayed, chest sags noticeably, carriage can no longer be described as straight. Sagging and swaying especially seen when standing.
   - 15+ years = more swaying of back, hips protrude, limbs often seem stiff when first moving.

4. Assign age according to scarring and wrinkles on face and body
   - 8-10 years = face smooth and shiny, few or no scars on muzzle, usually none on body.
   - 10-13 years = More than one or two scars on face, and wrinkles beginning so that skin is no longer smooth and shiny. One or two scars may be visible on body.
   - 13-15 years = skin on face no longer smooth, wrinkles noticeable and several scars (sometimes numerous scars) are visible. Almost always one or two visible body scars.
   - 15+ years = many scars on face, one or two body scars almost always visible.

5. Assign age according to teeth (wild feeding only!)

- 8-10 years = canines very sharp and long with slight or no discoloration
- 10-15 years = canines shorter (somewhat blunt) and sometimes one or more broken. Teeth are brown.
- 15+ years = 2 or more canines very blunt or broken, teeth very brown.

6. Using all 5 categories, plus comparison with males of known age, assign an age estimate to the male. There is no strict rule for how to do this but all categories above should be taken into account. Then assign an accuracy to the estimate.

- 0 = exact (male has known birthday – this does not apply to estimates)
- 1 = accurate to one year (six months on either side of the estimate you gave). So, if you estimate he is 9 years old with an accuracy of 1, you are saying that he could be as young as 8.5 or as old as 9.5 years.
- 2 = accurate to within 2 years (1 year on either side of your estimate: a male with an estimate of 11 years with an accuracy of 2 is between 10 and 12 years).
- 3 = accurate to 3 years (1.5 years on either side or your estimate: a male with an estimate of 11 years, accuracy of 3 is between 9.5 and 12.5 years)
- 4 = accurate to 4 years (2 years on either side of your estimate: a male with an estimate of 11 years with accuracy 4 is between 9 and 13 years).

III. OTHER FIELD WORK

1. Weather monitoring

1.1 Daily rainfall and temperature readings

Every morning we read the minimum and maximum temperature recorded during the previous 24 hours, as well as the rainfall in millimeters. We have two min-max thermometers, one that reads ambient air temperature and one that reads air temperature inside our charcoal "refrigerator" (our evaporatively cooled hut that stores perishables and biological samples); you should read min-max temperatures in both places every morning (we keep a separate sheet for each). This duty is shared by all field workers that live in camp. We used to keep a rain gauge at Nado Soito in the Kerr and Downey camp site, but we have not done so for several years.

1.2 Weather station

In November 2003, we added an automated WeatherHawk weather station in camp to sample a variety of parameters (including temperature, humidity, barometric pressure, and solar radiation), at hourly intervals throughout the day. In October 2023, the WeatherHawk was replaced by a ClimaVue50. These data are of particular interest as a part of our monitoring Amboseli's changing weather and its effects on the baboons, particularly the growing relevance of heat stress. The digital stations readily store a week's worth of data, which we download onto the Dropbox folder in the laptop computer weekly and email to the data managers in the US, usually in early evening on Saturdays or Sundays.

2. Tree grove monitoring (this protocol is retired as of 2011, maintained here for completeness)

Trees are important to the ecology of Amboseli baboons because they provide both food and refuge. Amboseli has experienced extreme tree loss over the past 4 decades, which has greatly affected the ecology and behavior of the study animals. Tree health is also an important indicator of the overall status of the Amboseli ecosystem and so is important to researchers outside the baboon project. We monitor tree groves in Amboseli in collaboration with African

Wildlife Foundation (AWF); Alfred Kikoti is the field representative of AWF who monitors groves with us.

To monitor the use and status of trees, we name and, if possible, tag or label the trees in all groves that the baboons use as sleeping groves. We also monitor a specific subset of groves in the baboons' home ranges so that we can keep track of changes in the health and status of the groves.

2.1 Procedure

The purpose of this monitoring program is to track changes in condition—loss, regeneration, maintenance--in the current range of the baboons or elephants under study by AWF and ABRP. We have identified ten groves for monitoring, based on usage by baboon study groups; six are currently monitored by AWF, four by ABRP observers. AWF may add additional groves in other parts of their study area. In practice, this is done after the fifth study group is visited on the third day of the last days of the month with study groups (see Section 14).

Pick tree groves that are actively visited/used by wildlife. These clusters of trees could be relatively small, such as a grove as defined by Stuart Altmann for baboons (connectedness, for a baboon, across the canopy) or some other easily identified cluster that can be followed over time.

Sketch the grove shape. Take a GPS reading at a point you mark on the sketch. Describe the basis for identifying the boundary of the grove. Count the total number of standing live trees at the start of this monitoring; if feasible, mark these on your sketch. This should be done initially when you start monitoring the grove but does not need to be done repeatedly after that.

Monitor grove condition monthly by filling out the grove monitoring spreadsheet as follows:

- Date/observer(s): if you just use your initials, put your full-name key at the bottom of the sheet.
- Grove name (if the grove does have a name in one of the research projects, e.g. Grove 98N in ABRP); this will be the same each time the grove is monitored.
- GPS location: see above; this will be the same each time the grove is monitored
- Distance to nearest boma: Alfred Kikoti of AWF will make a list of GPS locations for bomas and will be tracking whether these bomas are occupied, particularly in TZ where ABRP personnel often do not have this information.
- Tree species: usually this will be either *Acacia xanthophloea* (fever tree) or *Acacia tortilis*, but it may be other species in some TZ locations monitored by AWF.
- Number of standing healthy trees: Check for inter-observer agreement by several observers making independent evaluations and then comparing and discussing these. Be sure to walk around a tree to get a view from all sides. If approximately 75% of the tree looks healthy, score as healthy.
- Number of standing live trees in trouble: see previous description; count a live tree as ‘in trouble’ if more than 25% of it is dead or seriously wounded, defoliated, etc.
- Notes and comments: add additional information about signs of human activity, of elephant damage or other sources of tree wounding. Also make notes of regenerating trees in the grove and any other information about grove status that is relevant. These notes will be especially helpful at first as a guide to information that perhaps should be incorporated more formally into the monitoring.

2.2 Definition of a grove

By definition, a sleeping grove consists of all trees that are `connected' to any tree that baboons sleep in. A cluster of trees is said to be connected if the baboons could if necessary get from any tree to any other (possibly via intermediate trees) without descending to the ground. In recent years, the death of fever trees has broken up many former sleeping groves, many of which were mapped and numbered while they were still connected groves. To avoid confusion, we shall when necessary refer to these original numbered locations as "grove sites." The AM groves, PM groves (Chapter 2, Sections 3.11 and 3.12) and subgroup groves (Chapter II, Section 4) will be identified in your records by the number of the grove site that they are in, even if, at the time of your study, that number refers to a cluster of several groves. (Note: this definition of a tree grove was developed by Stuart Altmann.)

3. Darting and radio collars.

We maintain at least one active radio collar on one adult female in each study group (often two). This makes it possible to find the baboons relatively quickly at any time of the day, which saves fuel, increases the efficiency of data collection, and makes it possible to obtain behavioral data during all daylight hours. We also place collars on adult males to track dispersal and capture male mortality events. See Chapter II, Sections 1.24, 8.2 and 8.3 for information about monitoring these radio collars.

In order to affix a radio collar, we dart an adult male or an adult female that is not beyond the first trimester of pregnancy, does not have a young dependent infant (general rule is that we do not dart mothers with infants less than a year old, but we always discuss each candidate's specific situation prior to targeting them), and is not consorting at the time. We rarely dart to replace a female radio collar more than once or twice a year (collar batteries last several years).

Since 2006, we have also invested in more regular darting projects that involve larger numbers of individuals, so that we can get high quality samples (DNA, RNA, cells, microbiome, etc.). When we dart an animal, we draw blood and take a number of body measures, including mass and long bone measures. We release the animal the same day we dart him or her, and they return to their study group by the time they ascend their sleeping trees. All procedures for darting are described elsewhere. Raphael, Long'ida, and Kinyua have extensive experience with darting and will continue to do all the darting that is necessary in collaboration with a veterinarian that is approved by KWS; visitors do not dart the animals, but often assist in the processing.

IV. DATA/OFFICE WORK

1. Saturdays

Every Saturday, after field work, the senior and junior observers work together to answer emails and process data-related questions. They also proofread the data from the previous week and make corrections to the data. We have checklists to assist in this data checking and proof reading. The team also sends Weatherhawk data to the US every Saturday. If you are in the field for more than a week or so, you should plan to attend this meeting and help the team check the data. This will be an important learning experience for you and a useful service to the project.

This is what the weekly data checklist looks like:

Check	Item
	Do all census dates match the GPS SWERB dates?
	Do all other groups GPS points have a corresponding other groups note in the appropriate notebook?
	Are all groves and waterholes in GPS files correctly coded?
	All Departure records present in GPS files? All observer names added to GPS files?
	Are ID files updated for all groups in all Samsung tablets?
	Are all questions in emails answered?
	Are VHF collar checks and other group pages in the notebooks?

This is what the monthly data checklist looks like (the team goes through this on Saturdays as well as at the end of the month):

Check	Item
	Are all census records complete or clearly recorded if they are incomplete?
	Are all census and demography notes pages numbered and labeled by group?
	Do all census records have completion time and the initials of the observer(s)?
	Does the information in the demography notes match the data in the census sheet?
	If the demography notes mention a wound, is there a corresponding wound sheet completed or in progress?
	Do dates for demography notes, sex skins, reproductive notes, subgroups, other groups, and everything else occur on census days? If not, please note exceptions.
	Are all sexskin and repro pages numbered and labeled by group?
	Are all names on sex skin records clearly written?
	Are there sex skin records for all females on all census days (check for size and color for each female)?
	If a female has no data for a given census day, does it say “no data” on the sexskin (please do not leave it blank.)
	Do reproductive notes match the little numbers on the sex skin pages?
	Are all canine and scrotum sheets labeled with the name of the group?
	Are all sexes and snames of new infants recorded on the neonatal sheet as well as demog and repro notes and do they all match?
	Are there two neonatal observations for each new infant?
	Are all new males given snames, hybrid scores and age estimates?
	If a new male appears in multiple groups, is it clear that this is the same male? (please give his sname whenever possible rather than “new juv male”).

	Are all hybrid score sheets and age estimate sheets ready for photocopying? Do they have dates on them?
	If any corpses were collected, did you fill in all items on the corpse checksheet and send the scanned sheet to the States?
	Have you checked old emails from Niki and Jake to make sure you have included any additional data sheet or photocopies that they requested?
	At the end of the month, check if the "Data Sent" checklist matches the datasheets you put into the monthly data package. Check that no sheets are missing on the photocopies and that all photocopies are clear and complete.
	Are all mistakes that have been whited out, fixed, and filled in?

2. End of month office work and staff meeting.

Every month after the last field days are completed we have a full day of data work (i.e. the "office day"), including preparation of data for sending to Duke and preparation of census sheets, reproductive sheets, and other sheets for the field notebooks for the next month. In addition, we hold a staff meeting. We discuss both scientific and logistical issues at the meeting. Short-term visitors to the project are generally exempted from these meetings, but visiting researchers who stay for longer periods (especially students pursuing research projects) will usually be expected to attend. In any case, you may be asked to attend part or all of one or more staff meetings by Raphael, Susan, Beth, or Jeanne.

In addition to the staff meeting, a number of other things happen at the end of the month. The exact set of office/data work varies according to how data are collected (electronic vs. handwritten, for example) and transmitted to the US. As of January 2020, the tasks are as follows:

1. Using the monthly data checking list (see above), proof read and check the data.
2. Update reproductive and pregnancy lists.
3. Check for young females to add to sex skin list
4. Check for young males to add to scrotal monitoring and to begin to score mounts.
5. Update the Prim8 ID lists in the Samsung tablets.
6. Check that information on infant sex and names and neonatal assessments is complete. List infants born at the end of the month for whom any information is needed at the beginning of the next month.
7. Check the GPS machines at camp washstand to make sure they are each reading the same thing and the same as the previous month. Record this information on a sheet to go to Nairobi with data to be copied.
8. Remove from the notebooks all <u>completed</u> (i.e. healed) wound sheets and neonatal assessments, the sheets for scrotal development, canine condition, and those for hybrid scoring and age estimation for new males. If a wound is not yet healed, it should be scanned and returned to the notebook to be updated the following month.
9. Remove all other monthly data from the groups notebooks for scanning. Check that sheets such as census and sex-skin sheets are numbered sequentially to facilitate proper scanning and subsequent data entry. Also, remove other group censuses from that notebook for scanning.
10. Make the adult female and juvenile sampling schedule for the month and the field schedule for the first week of the month.
11. Check vehicles and make a parts list for purchase in Nairobi as needed.

12. Remove fecal collection sheets and those for rainfall and min-max temperature for scanning.
13. Complete supplies lists and data preparation for Nrb.
14. Scan and email the data to the US.
15. Monthy dominance matrix. At the end of each month, Ben and Serah (in Oloitokitok) enter all the decided agonisms for that month into excel and produces a dominance matrix for adult males and adult females in each group. The matrices are printed out periodically and filed in the "Agonism" notebook in the office in camp; they are printed out more often if someone requests it. This ranking is very useful in the field and we encourage people to look at them and use them. However, they should not be taken as the final ranking; final ranks are produced at Duke (for adult males) and at Notre Dame (for adult females).
16. Prepare new sheets for each group's notebook. Number the sex-skin sheets in each notebook. On a front sheet in each notebook, add any special 'alert' notes that emerge from discussion of data (e.g. changing dominance relationships, fecals that are especially needed, etc) during the staff meeting.
17. Hold staff meeting and send the monthly meeting report to Jeanne and Susan.