HAMADRYAS BABOON
(Papio hamadryas)
CARE MANUAL

CREATED BY THE
AZA Hamadryas Baboon Species Survival Plan® Program
IN ASSOCIATION WITH THE
AZA Old World Monkey Taxon Advisory Group
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Introduction

Preamble
AZA accreditation standards, relevant to the topics discussed in this manual, are highlighted in boxes such as this throughout the document (Appendix A).

AZA accreditation standards are continuously being raised or added. Staff from AZA-accredited institutions are required to know and comply with all AZA accreditation standards, including those most recently listed on the AZA website (http://www.aza.org), which might not be included in this manual.

Taxonomic Classification

Table 1. Taxonomic classification for *Papio hamadryas*

<table>
<thead>
<tr>
<th>Classification</th>
<th>Taxonomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kingdom</td>
<td>Animalia</td>
</tr>
<tr>
<td>Phylum</td>
<td>Chordata</td>
</tr>
<tr>
<td>Class</td>
<td>Mammalia</td>
</tr>
<tr>
<td>Order</td>
<td>Primates</td>
</tr>
<tr>
<td>Suborder</td>
<td>Haplorrhini</td>
</tr>
<tr>
<td>Family</td>
<td>Cercopithecida</td>
</tr>
</tbody>
</table>

Genus, Species, and Status

Table 2. Genus, species, and status information for *Papio hamadryas*

<table>
<thead>
<tr>
<th>Genus</th>
<th>Species</th>
<th>Common Name</th>
<th>USA Status</th>
<th>IUCN Status</th>
<th>AZA Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Papio</td>
<td><em>Papio hamadryas</em></td>
<td>Hamadryas baboon or Sacred Baboon</td>
<td>Not listed</td>
<td>Least Concern</td>
<td>SSP</td>
</tr>
</tbody>
</table>

General Information

The information contained within this Animal Care Manual (ACM) provides a compilation of animal care and management knowledge that has been gained from recognized species experts, including AZA Taxon Advisory Groups (TAGs), Species Survival Plan® Programs (SSPs), biologists, veterinarians, nutritionists, reproduction physiologists, behaviorists and researchers (visit the AZA Animal Program page to contact these individuals). It is based on the most current science, practices, and technologies used in animal care and management and is a valuable resource that enhances animal welfare by providing information about the basic requirements needed and best practices known for caring for *ex situ* hamadryas baboon populations. This ACM is considered a living document that is updated as new information becomes available and at a minimum of every five years.

Information presented is intended solely for the education and training of zoo and aquarium personnel at AZA-accredited institutions. Recommendations included in the ACM are not exclusive management approaches, diets, medical treatments, or procedures, and may require adaptation to meet the specific needs of individual animals and particular circumstances in each institution. Statements presented throughout the body of the manuals do not represent specific AZA accreditation standards of care unless specifically identified as such in clearly marked sidebar boxes. AZA-accredited institutions which care for hamadryas baboons must comply with all relevant local, state, and federal wildlife laws and regulations; AZA accreditation standards that are more stringent than these laws and regulations must be met (AZA Accreditation Standard 1.1.1).

The ultimate goal of this ACM is to facilitate excellent hamadryas baboon management and care, which will ensure superior hamadryas baboon welfare at AZA-accredited institutions. Ultimately, success in our hamadryas baboon management and care will allow AZA-accredited institutions to contribute to hamadryas baboon conservation, and ensure that hamadryas baboons are in our future for generations to come.
The hamadryas baboon (*Papio hamadryas*) is a baboon from the Old World monkey family. They were once worshiped by ancient Egyptians and thought to be descendants of Thoth, hence their other name of Sacred Baboon. They are currently listed in IUCN as Least Concern. Hamadryas baboons are threatened by habitat loss and by harvesting for food and for research. CITES lists *Papio hamadryas* on Appendix II (OWM RCP, 2013).

Hamadryas baboons are a terrestrial, medium sized monkey. The skin on their face is hairless and grayish-brown, and they possess a long, dog-like snout. These monkeys are highly sexually dimorphic in size and pelage characteristics. Males are much larger and weigh twice as much as females. Males can weigh approximately 18–20 kg (40–45 lbs) (higher in managed environments) and females weigh approximately 9–11 kg (20–25 lbs) (higher in managed environments). Males are silver colored and have a pronounced mantle that they develop around the age of ten, while the females are capeless and brown. Both sexes have ischial calllosities that are highly developed and bright red.

Both sexes have ischial callosities that are highly developed and bright red.

<table>
<thead>
<tr>
<th>Physical Characteristic</th>
<th>Males</th>
<th>Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>18–20 kg (40–45 lbs)*</td>
<td>9–11 kg (20–25 lbs)*</td>
</tr>
<tr>
<td>Pelage</td>
<td>Silver colored mantle covering head to hips.</td>
<td>Capeless, hair is brown in color.</td>
</tr>
<tr>
<td>Ischial callosity</td>
<td>Larger, more pronounced.</td>
<td>Smaller, less pronounced.</td>
</tr>
</tbody>
</table>

*Higher in managed populations

Hamadryas baboons are found in sub-desert, steppe, plains, and savannas of northeastern Africa. They are the northernmost of all the baboons. Their range extends through Egypt, Ethiopia, Somalia, Saudi Arabia, and Yemen. Their distribution is limited by the availability of watering holes and appropriate sleeping cliffs. In parts of Ethiopia, they are found in agricultural areas and are considered vermin due to crop raiding (Kummer, 1995).

Hamadryas baboons are omnivores and eat a wide variety of foods including: grass, rhizomes, roots, tubers, eggs, nuts, small birds, and mammals. They also consume fruits, leaves, flowers, and small invertebrates. Food resources are limited and generally widely dispersed. Foods utilized during the rainy season consist of Acacia flowers and grass seeds. Although hamadryas baboons are a terrestrial species, they will utilize trees for food. Hamadryas baboons are able to locate water sources underground in their arid habitat (Swedell et al., 2008).

All baboons are highly social monkeys; however, unlike other baboons, hamadryas baboons are not matrilineral. Males are the absolute leaders over their females. Hamadryas baboons have a very complex and unique fusion-fission, four-layered social structure which has enabled the species to exploit limited resources of desert life. The scarcity of food promotes smaller groupings, while the scarcity of suitable sleeping sites favors very large groupings that are also better protection against predators. A troop is the largest baboon grouping and can consist of over 100 individuals. The troop assembles at night on sleeping cliffs and disassembles each morning in bands to search for food. A troop contains several bands of hamadryas baboons. A band contains two to four clans consisting of approximately 50 individuals. Members of the band will search for limited resources together and are often observed utilizing watering holes together. A clan is defined as two to four one-male units (OMU) consisting of approximately 15 individuals. The OMU leaders are often related to one another. Males will stay in their natal clan while females will emigrate to other clans or bands. Members of the clan often search for food together and utilize the same small feeding sites. A one-male unit (OMU), also known as a harem, is the core of the hamadryas baboon society. The OMU contains a sexually mature adult male, one or more “follower” males, and up to 9 adult females with their young. Male leaders of the OMU will maintain the loyalty of their females by various methods, including raised eyebrows and aggressively pinning the female and biting her neck. In the wild, the OMU grouping allows individuals to utilize limited food resources with little competition. Males may leave their natal unit, but they typically remain within the same clan. Females transfer from unit to unit (usually two to three times during their life) and will transfer between clans and bands (Kummer, 1995).

All females belong to a one-male unit. Young males without a unit normally maintain a loose relationship with a particular one-male unit, in attempts to win over young females. Females within the one-male unit typically do not interact much with one another. Aggressive displays seem to be associated with winning the attention of the male. The central female is the socially active female of the unit. She spends most of her time with the male grooming and is the first to greet new units. The peripheral female
is less socially inclined, but is more ecologically adept. She spends her energies on searching for food rather than relations between herself and the male. It is the peripheral female that the male and the central female look to for hidden water sources and novel foods (Kummer, 1995).

Aggression between familiar males is rare and often avoided. There is no obvious dominance hierarchy amongst hamadryas baboon males. Fighting and fleeing leaves females vulnerable to kidnapping by bystanders. Fighting does occur between stranger males, usually between bands. The fight is normally between two individuals over a female. Often members of each band will back each other up. Both bands will separate and move to different quarters. In most cases the fights are merely screaming and threatening matches. Male baboons, as a rule, have no friendships with other males once they’ve obtained their first females. Interactions among the males take the form of notifying behavior, the presentation of the anal field between males. This alerts the neighbor that the spatial relationship between himself and the notifier is about to change in a way that is important to the cohesion of the group, e.g. before one leaves the other or before settling in the immediate vicinity of the other.

Males begin their arduous task of obtaining females at sexual maturity. They often spend several celibate years establishing their first one-male unit, called an initial unit, with a juvenile female. He will win over his females in three different ways: 1) he will adopt an orphan female; adult females generally do not adopt orphans, 2) he will kidnap a young female from her mother or 3) he will spend months, even years luring a young female from her family. He will accomplish the third method by playing with the youngster, earning her trust, and gradually making her dependent on him rather than her father for protection and food sources. As the males get older and older they begin to gradually lose their females to younger males. They tend to lose interest on expending their energy maintaining the cohesiveness of the group. The elderly male will then concentrate his efforts on the movement of the troop rather than his unit.

Hamadryas baboons breed throughout the year, and after a gestation period of approximately 180 days, one infant is born. At birth, the young baboon is black in color and remains black until 6 months of age. Hamadryas baboons become independent at two years of age, and females reach sexual maturity at four years old. In the wild, females will give birth every second year after reaching sexual maturity. Female’s estrous cycles are approximately 30 days, and during ovulation, females will have a pronounced genital swelling. Males reach sexual maturity at four to six years of age.

Hamadryas baboons are very social and stressed by isolation. A direct stare is a threat. To return a threat, they will raise their eyebrows, showing their white eyelids, and partially open their mouths, displaying impressive canines in the male. Intensifying the threat they may yawn, raise their hair, slap their hands and feet on the ground, grind their teeth, and scream. Fear is shown by a grin with no eyelid threat. See Figure 1 below for photographed examples of different facial communications. Baboons also have a number of calls. Alarm is given by a dog-like bark. Kecking, a staccato coughing sound, suggests the performer is fearful of the receiver. Kecking coupled with the presentation of the anal field signifies submission. Additionally, baboons spend much of their time grooming one another. This has hygienic purposes as well as social value. Grooming rids the body of parasites, dirt, and vegetation, but it also serves to solidify social relations and calm each other. See Appendix L for complete behavior and vocalization chart (Kummer, 1995).

Figure 1. Examples of facial communication. a. Eyebrow raise; b. Yawn; c. Fear grimace
Photo courtesy of J. Wiley
Chapter 1. Ambient Environment

1.1 Temperature and Humidity

The animals must be protected from weather, and any adverse environmental conditions. (AZA Accreditation Standard 1.5.7) Animals not normally exposed to cold weather/water temperatures should be provided heated enclosures/pool water. Likewise, protection from excessive cold weather/water temperatures should be provided to those animals normally living in warmer climates/water temperatures.

The natural range of hamadryas baboons is primarily focused in Ethiopia, extending into Northern Somalia, Eastern Sudan, Yemen, and Saudi Arabia. The elevation of 3,300 m (10,827 ft) combined with the proximity to the equator creates a temperate climate with an average temperature range of 22–27 °C (59–81 °F). This is the optimum temperature range for managed hamadryas baboons (Kummer,1995).

Indoor enclosures should be temperature controlled to accommodate this range. Although hamadryas baboons are hardy, extreme temperatures can cause hypothermia or heat exhaustion (J. Wiley, personal communication, 2008).

Shade should be available on exhibit and accessible by all troop members. Individual shade structures are recommended to be large enough to provide coverage for multiple individuals sitting together. If the temperature exceeds 32 °C (90 °F), caution should be taken, and it is recommended that access be given to a temperature controlled enclosure. When temperatures fall below 4 °C (40 °F), it is also recommended that access be given to a temperature controlled enclosure. Humidity should be taken into consideration to prevent heat exhaustion during warmer days. These guidelines may be adjusted for animals with health concerns (J. Wiley, personal communication, 2008).

AZA institutions with exhibits which rely on climate control must have critical life-support systems for the animal collection and emergency backup systems available, while all mechanical equipment should be included in a documented preventative maintenance program. Special equipment should be maintained under a maintenance agreement or records should indicate that staff members are trained to conduct specified maintenance (AZA Accreditation Standard 10.2.1).

1.2 Light

Careful consideration should be given to the spectral, intensity, and duration of light needs for all animals in the care of AZA-accredited zoos and aquariums. Hamadryas baboons are diurnal, meaning they are most active during the day. It is recommended that this species be given access to natural light as often as possible to promote mental and physical well-being. In the event that access cannot be given outdoors, lights should remain on during the day and turned off at night to mimic the natural photo period. If lights cannot be manually turned on or off, the use of light timers is recommended. Indoor lighting should use bulbs that provide the full UV spectrum in order to receive full health benefits (J. Wiley, personal communication, 2012).

1.3 Water and Air Quality

Clean, fresh water should always be accessible, unless otherwise advised by veterinarian staff. Multiple sources are recommended, each accessible to all troop members. Size, age, and injuries or disabilities should be considered when choosing placement of water bowls or Lixit® spouts. Bowls and Lixit®s should be cleaned regularly to prevent bacteria growth. This can be achieved by having and following written Standard Operating Procedures in place for each institution. Lixit®s should be tested daily to ensure water is accessible. Indoor areas should be well ventilated at all times when animals are present. This can be achieved via windows, vents, fans, air conditioners, or air filtration systems. Ventilated air should not be shared between human and animal areas to prevent air-borne disease (J. Wiley, personal communication, 2012).
1.4 Sound and Vibration

Consideration should be given to controlling sounds and vibrations that can be heard by animals in the care of AZA-accredited zoos and aquariums. Exposure to loud noises should be avoided. Stress levels should be monitored if loud sounds and vibrations cannot be prevented or controlled. Noises that average >885 dB for more than eight hours a day will cause damage to human hearing; it is recommended to avoid similar noise levels in primate enclosures (OSHA, 1984). Potential sources of problematic noises and vibrations may arise from nearby construction, loud air handling systems, cleaning machines, etc. Behavior of the animals should be closely monitored during these times to determine if modifications need to be made (J. Wiley, personal communication, 2012).
Chapter 2. Habitat Design and Containment

2.1 Space and Complexity

Careful consideration should be given to exhibit design so that all areas meet the physical, social, behavioral, and psychological needs of the species. Animals should be presented in a manner reflecting modern zoological practices in exhibit design (AZA Accreditation Standard 1.5.1). All animals must be housed in enclosures and in appropriate groupings that meet their physical, psychological, and social needs. (AZA Accreditation Standard 1.5.2).

Hamadryas baboons are very adept at climbing rock facings, so proper exhibit design is critical in housing this species. Rock walls or outcroppings with multiple ledges are recommended for hamadryas baboons to allow species-appropriate resting and sleeping (AZA Old World Monkey TAG recommendation, 2006). However, containment should also be considered because they are excellent climbers.

Additional vertical space may be added to exhibits by constructing interior rock walls or outcroppings to promote climbing and physical activity. These structures also create complexity that can help diffuse social tensions. Climbing structures made from deadfall also increase vertical space and will allow the baboons to forage for bugs under the bark of the wood. If the group is multi-male, several climbing areas are suggested. Careful consideration should be given to the size and placement of these structures so that they do not become a vehicle for escape.

Figure 2. Example of climbing structure and deadfall in hamadryas baboon exhibit
Photo courtesy of J. Wiley
Space will dictate group size, but for hamadryas baboons, space will also dictate group complexity. A group consisting of two males and four females will need more space than a group consisting of one-male and five females. This is caused by the formation of one-male units by hamadryas baboons (Kummer, 1971). These one-male units need to be able to break apart and be out of visual contact with one another. This will lead to fewer tense responses by the male leader because there will not be a constant presence of a rival male attempting to interact (steal) the leader’s females.

Due to a male’s natural tendency to herd their females, male unit leaders become stressed when they are in visual, but out of tactile, contact with their females. Temporary isolation of conspecifics is best accomplished by ensuring that animals are out of visual contact with the remaining troop. The minimum distance between females and males in a closely bonded one-male group is as little as 61–91 cm (2–3 ft). Minimum male/male distances should be 3 m (10 ft) or more. The minimum distance that an exhibit should allow between two one-male units is 6 m (20 ft) or more.

Substrate for hamadryas baboons can vary. Hamadryas baboons do not nest, but they will forage through straw/hay. The straw will aid in fecal and urine absorption in holding areas. Mulch and grass can be used as substrate in outdoor areas. Unlike other primates, baboons will utilize large water sources and are able to swim. Careful consideration should be used if moats are used for containment, and external moat walls should be included.

The same careful consideration regarding exhibit size and complexity and its relationship to the hamadryas baboons’ overall well-being must be given to the design and size of all enclosures, including those used in exhibits, holding areas, hospital, and quarantine/isolation (AZA Accreditation Standard 10.3.3). Sufficient shade must be provided by natural or artificial means when sunlight is likely to cause overheating or discomfort to the animals (AZA Accreditation Standard 10.3.4).

Clean, fresh water should always be accessible, unless otherwise advised by veterinarian staff. Multiple sources are recommended, each accessible to all troop members. Size, age, and injuries or disabilities should be considered when choosing placement of water bowls or Lixit® spouts.

Holding areas should contain climbing structures that offer additional vertical space as well as visual barriers. Fire hose can be used to increase vertical space, and items can be hung from the fire hose to increase visual barriers in the holding area. Benches of various sizes will serve as sleeping sites. Hamadryas baboons do not nest, but will forage through straw/hay for seed heads. Straw and hay are also beneficial for urine and fecal absorption and should be offered daily. Change and variation within the environment can be achieved by moving or changing out exhibit/holding furniture, the provision of daily environmental enrichment and browse, as well as changing substrates in interior exhibits.
It is recommended that the off-exhibit enclosures have the several connecting rooms in the event that individuals or OMUs need to be separated from the rest of the troop. Having smaller connecting rooms will also aid in separating individuals or OMUs for operant conditioning training. Having training portals designed into the mesh will be beneficial for training blood draw, ultrasound, hand injection, and other such behaviors (J. Wiley, personal communications, 2008). It is also recommended to have several elevated sleeping shelves in the off-exhibit enclosures to promote species-appropriate behaviors.

It is preferable to have a separate holding yard also attached to the exhibit to allow for introductions or for separating out OMUs if necessary. While hamadryas baboons do live in very large groups in the wild, a holding yard is recommended to have the flexibility to run two groups as needed for medical reasons or introductions. It is also recommended that smaller areas such as night quarters have doors located in multiple locations, preferably creating a “roundabout” to prevent an animal from becoming trapped by a more dominant animal.

2.2 Safety and Containment

Animals housed in free-ranging environments should be carefully selected, monitored and treated humanely so that the safety of these animals and persons viewing them is ensured (AZA Accreditation Standard 11.3.3). The Old World Monkey Taxon Advisory Group does not advise keeping baboons or other Old World monkeys in this setting.

Animal exhibits and holding areas in all AZA-accredited institutions must be secured to prevent unintentional animal egress (AZA Accreditation Standard 11.3.1). Pest control methods must be administered so there is no threat to the animals, staff, and public (AZA Accreditation Standard 2.8.1). Exhibit design must be considered carefully to ensure that all areas are secure and particular attention must be given to shift doors, gates, keeper access doors, locking mechanisms and exhibit barrier dimensions and construction.

A variety of barriers can be used to safely house hamadryas baboons including glass, hotwire, wire mesh, and dry moats (however, water moats are not recommended for primary containment due to a baboon’s ability to swim). Mesh openings for hamadryas baboons should not be greater than 5 x 5 cm (2 x 2 in.) and should be a relatively heavy gauge wire. Training portals can be installed with larger mesh openings but should be closed off when not in use to prevent infants from fitting through the openings. Baboons can jump great distances, especially when running. It is estimated that the jump distance is approximately 3–3.7 m (10–12 ft) horizontally and 2.4 m (8 ft) vertically (J. Wiley, personal communication, 2012).

Exhibits must have a guardrail/barrier that separates the visiting public from the animals (AZA Accreditation Standard 11.3.6).

All emergency safety procedures must be clearly written, provided to appropriate staff and volunteers, and readily available for reference in the event of an actual emergency (AZA Accreditation Standard 11.2.4). Depending on the personality of the baboons, they could be herded or baited back into enclosures, or darted if necessary. If animals are reliably trained for recall, this would be an option for recapture. Each institution will develop emergency response protocols best suited to their institution,
animals, and staff. If hamadryas baboons are living in areas prone to hurricanes, tornadoes, floods, or other such natural disasters, provisions to evacuate the animals to a safe location should be in place. For animals living in outdoor enclosures in these severe weather prone environments, crate or recall training is essential for quick and stress free evacuation. If indoor holding areas provide sufficient protection from severe weather patterns, animals should be trained to enter and be locked into these spaces.

Staff training for emergencies must be undertaken and records of such training maintained. Security personnel must be trained to handle all emergencies in full accordance with the policies and procedures of the institution and in some cases, may be in charge of the respective emergency (AZA Accreditation Standard 11.6.2).

Emergency drills should be conducted at least once annually for each basic type of emergency to ensure all staff is aware of emergency procedures and to identify potential problematic areas that may require adjustment. These drills should be recorded and evaluated to ensure that procedures are being followed, that staff training is effective and that what is learned is used to correct and/or improve the emergency procedures. Records of these drills should be maintained and improvements in the procedures duly noted whenever such are identified (AZA Accreditation Standard 11.2.5). AZA-accredited institutions must have a communication system that can be quickly accessed in case of an emergency (AZA Accreditation Standard 11.2.6).

AZA-accredited institutions must also ensure that written protocols define how and when local police or other emergency agencies are contacted and specify response times to emergencies (AZA Accreditation Standard 11.2.7).

AZA-accredited institutions that care for potentially dangerous animals must have appropriate safety procedures in place to prevent attacks and injuries by these animals (AZA Accreditation Standards 11.5.2 and 11.5.3). Staff should be properly inoculated for transmissible diseases, (e.g., rabies, flu, measles, hepatitis, etc.).

Each institution should have established protocols for treating staff scratch or bite wounds from primates. If bitten, the wound should be thoroughly washed with soap and water immediately. Medical attention should be sought as soon as possible to avoid infection.

Animal attack emergency response procedures must be defined and personnel must be trained for these protocols (AZA Accreditation Standard 11.5.3).

Animal attack emergency drills should be conducted at least once annually to ensure that the institution’s staff know their duties and responsibilities and know how to handle emergencies properly when they occur. All drills need to be recorded and evaluated to ensure that procedures are being followed, that staff training is effective, and that what is learned is used to correct and/or improve the emergency procedures. Records of these drills must be maintained and improvements in the procedures duly noted whenever such are identified (AZA Accreditation Standard 11.5.3; AZA Accreditation Standard 11.5.2).
If an animal attack occurs and injuries result from the incident, a written account outlining the cause of the incident, how the injury was handled, and a description of any resulting changes to either the safety procedures or the physical facility must be prepared and maintained for five years from the date of the incident (AZA Accreditation Standard 11.5.3).
Chapter 3. Records

3.1 Definitions

In the zoo and aquarium world, animal records are defined as “data, regardless of physical form or medium, providing information about individual animals, samples or parts thereof, or groups of animals” (AZA Accreditation Standard 1.4.4). Most animals in zoo and aquarium collections are recorded as (referred to as) individuals, though some types of animals are recorded as (referred to as) groups or colonies of animals, particularly with invertebrates and in aquariums. The decision about how to record its animals usually resides with each institution, but in certain cases, the AZA Animal Program Leader (i.e., TAG Chair, SSP Coordinator, or Studbook Keeper) may request that animals be recorded in a certain manner, whether as individuals or as groups.

Hamadryas baboons in AZA populations should be referred to as individuals, and daily assessments of each individual should be made. Keepers should note their observations and major events in the animal’s life history for inclusion in their record. When used in the context of records, a group of multiple individuals should be referred to as a troop. Thus, the record for an individual animal contains information on only that one particular animal, but a troop record contains information on a number of animals as a whole. This type of troop is to be distinguished from a social group, in which several individually identifiable animals live together, e.g. a gorilla troop or an addax herd.

The animal should be accessioned as an individual, but the decision about how to record data usually resides with each institution. In certain cases, the AZA Animal Program Leader (i.e., TAG Chair, SSP Coordinator, or Studbook Keeper) may request that data in records of individuals or troops of individual animals be recorded in a certain manner to manage a population.

3.2 Types of Records

There are many types of records kept for the animals in our care, including but not limited to, veterinary, husbandry, behavior, enrichment, nutrition and collection management. These types of records may be kept as separate records as logs in separate locations or as part of the collection records and some may be required by regulatory agencies (e.g., primate enrichment records) or per AZA Accreditation Standards (e.g., emergency drill records).

Recordkeeping is an important element of animal care and ensures that information about individual animals or groups of animals is always available. The institution must show evidence of having a zoological records management program for managing animal records, veterinary records, and other relevant information (AZA Accreditation Standard 1.4.0). These records contain important information about an individual animal or group of animals, including but not limited to taxonomic name, transaction history, parentage, identifiers, gender, weights, enclosure locations and moves, and reproductive status (see Appendix C for Guidelines for Creating and Sharing Animal and Collection Records).

A designated staff member should be responsible for maintaining the animal recordkeeping system and for conveying relevant laws and regulations to the animal care staff (AZA Accreditation Standard 1.4.6). Recordkeeping must be accurate and current (AZA Accreditation Standard 1.4.7). Complete and up-to-date animal records must be duplicated and stored at a separate location (AZA Accreditation Standard 1.4.4) and

AZA Accreditation Standard
1.4.0 The institution must show evidence of having a zoological records management program for managing animal records, veterinary records, and other relevant information.

AZA Accreditation Standard
1.4.6 A staff member must be designated as being responsible for the institution’s animal recordkeeping system. That person must be charged with establishing and maintaining the institution’s animal records, as well as with keeping all animal care staff members apprised of relevant laws and regulations regarding the institution’s animals.

AZA Accreditation Standard
1.4.7 Animal and veterinary records must be kept current.

AZA Accreditation Standard
1.4.4 Zoological records, whether in electronic or paper form, must be duplicated and stored in a separate location. Animal records are defined as data, regardless of physical form or medium, providing information about individual animals, or samples or parts thereof, or groups of animals.

AZA Accreditation Standard
1.4.5 At least one set of the institution’s historical animal records must be stored and protected. Those records should include permits, titles, declaration forms, and other pertinent information.
historical records safely stored (AZA Accreditation Standard 1.4.5).

AZA member institutions must inventory their hamadryas baboon population at least annually and document all hamadryas baboon acquisitions, transfers, and transitions (AZA Accreditation Standard 1.4.1). All hamadryas baboons owned by an AZA institution must be listed on the inventory, including those animals on loan to and from the institution (AZA Accreditation Standard 1.4.2). All AZA-accredited institutions must abide by the AZA Policy on Responsible Population Management (Appendix D) and the long-term welfare of animals should be considered in all acquisition, transfer, and transition decisions.

For an example of a recordkeeping form used to keep track of baboon inventory, refer to Appendix F. When transferring hamadryas baboons to other institutions, it is recommended to include an Animal Data Transfer Form which can be found in Appendix G. It is recommended to provide background information on the individual (behavioral traits, social issues, etc.) as well as diet information and any safety concerns. Enrichment items and operant conditioning history should also be included.

3.3 Permit Considerations

The hamadryas baboon is regulated by federal and/or state governments. Therefore, possession and/or specific activities involving these species usually require a permit(s) issued by the regulating agency, granting permission for possession and/or the specific activities. Depending on the agency involved, the application and approval process may take a few days to many months. These permits must be received by the applicant before the proposed possession or activity can occur.

Hamadryas baboons are listed as IUCN Red List status is Least Concern and are listed as CITES Appendix II. Institutions should consult with the receiving institution for required export permits to be legally shipped out of the country of export or contact the CITES office. Nonhuman primates imported after 1975 (Foreign Quarantine Ref 42-CFR-Part 71.53(c)) and their offspring are not allowed to be used for any purpose other than research, breeding for research, or educational purposes (university level). Be sure to check all regulations (USDA, CDC, USD) prior to transfer of nonhuman primates.

It can take several months for a CITES Permit to be processed for international shipments. The U.S. Fish and Wildlife eDECS (Declaration form 3-177) is required for inspection of the shipment, a health certificate is required from the exporting institution, and shipping containers should follow IATA container and shipping requirements. It is also recommended that the medical history of the colony is provided to the receiving institutions prior to shipment. For international import or export, an animal broker is always recommended to assist with transit, documentation, in-transit care of animals during layovers, and other logistics required. There are many companies that perform these functions and it is recommended to contact other AZA institutions for recommendations.

3.4 Identification

Ensuring that hamadryas baboons are identifiable through various means increases the ability to care for individuals more effectively. All animals held at AZA facilities must be individually identifiable whenever practical, and have corresponding identification (ID) numbers. For animals maintained in colonies or groups, or other animals not considered readily identifiable, institutions must have a procedure for identification of and recording information about these groups or colonies. (AZA Accreditation Standard 1.4.3). These IDs should be included in specimen, collection and/or transaction records and veterinary records. Types of identifiers include:

<table>
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<th>AZA Accreditation Standard</th>
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<td>1.4.3) Animals must be identifiable, whenever practical, and have corresponding ID numbers. For animals maintained in colonies/groups or other animals not considered readily identifiable, the institution must provide a statement explaining how record keeping is maintained.</td>
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Physical identifier: These include, but are not limited to, ear tags, tattoos, microchips/transponder and RFID devices, elastomers, ear and toe clips. Permanent physical identifiers are often required when a species is regulated by a government agency and to distinguish separate animals in studbooks. Hamadryas baboons are typically easy to distinguish from one another, and therefore, tags and tattoos.
are not typically necessary. It is recommended to implant microchips/transponders in individuals. Baboons should receive the microchip during their first physical exam if they are older than six months. Microchips should be checked periodically to ensure they are still functioning. If placed properly, microchips are rarely groomed out, but are occasionally damaged during playing or fighting. Appropriate periodic checks of implants include annually via operant conditioning or during all medical procedures.

Tattoos placed on the inside of the pelvic limbs or abdomen can also be useful in the identification of hamadryas baboons due to good visibility because of the sparse hair covering those regions and how the animals tend to sit. Individual animals have specific phenotypic characteristics that make them easy for keepers to visually identify (J. Wiley, personal communication, 2008).

Intangible identifiers (called ‘logical identifiers’ in the Zoological Information Management System [ZIMS]): These include, but are not limited to, institutional accession number, house name, public name, studbook number, and ZIMS Global Accession Number.

The regional Studbook Keeper for hamadryas baboons should be notified after the birth, import, or other acquisition outside AZA, and a studbook number will be assigned to the individual. Likewise, the Studbook Keeper should be notified about deaths, transfers, or exports to keep the studbook current.
4.1 Preparations

Animal transportation must be conducted in a manner that adheres to all laws, is safe, and minimizes risk to the animal(s), employees, and general public (AZA Accreditation Standard 1.5.11). All temporary, seasonal, and traveling live animal exhibits must meet the same accreditation standards as the institution’s permanent resident animals (AZA Accreditation Standard 1.5.10). Safe animal transport requires the use of appropriate conveyance and equipment that is in good working order. Include copies of appropriate permits and authorizations in transport documentation. If the animal is not owned by the shipping institution, permission is to be obtained from the owner well in advance of the move.

The equipment must provide for the adequate containment, life support, comfort, temperature control, food/water, and safety of the animal(s). Containers are required to be built such that animals cannot reach out, or that shielding/disease barrier and quarantine procedures may be required before, during, and after transport. For air transport that is domestic or international, the IATA container requirement 34 should be used for sub-adult/young, adult male, and adult female baboons (IATA, 2013). Sexual dimorphism of the species allows for smaller crate dimensions to be used for females and young animals. Dimensions for adult male baboons are about 91 cm x 91 cm x 81 cm (36 in. x 36 in. x 32 in.), and for adult females and sub-adult/young animals, they are 76 cm x 81 cm x 51 cm (30 in. x 32 in. x 20 in.). Three quarters of an inch CDX plywood or metal can be used for construction, and 3.8 cm x 3.8 cm x 0.3 cm (1.5 in. x 1.5 in. x 0.13 in.) aluminum angle can be used for framing and support. No solid/hardwoods should be used in construction of containers due to agricultural export/import regulations. A guillotine door is required. Installation of steel bars spaced 2.5 cm (1 in.) apart, inset 7.6 cm (3 in.) at one end behind the guillotine door with steel mesh between the bars are also recommended. Forklift space for extrusions on the bottom of the crate and handles for carrying the crate are needed. Wire mesh bottom with removable fecal and urine catch tray should be in place to ensure no waste spills from the crate during transport (IATA, 2013).

Ventilation openings should be present on the ends, top, and sides. They need to be about 2.5 cm (1 in.) in diameter with mesh over them on the outside of the crate, and ventilation openings should be on 100% of the surface area of top and ends and about 65% of the surface area of the sides. A muslin curtain should be attached to the outside of the crate on the sides and ends to provide privacy for the animal. The bedding in the crate should be shredded paper or another non-natural material due to agriculture restrictions and regulations for domestic and international shipments. All crates should be secured with locks or hardware that prevent accidental opening. Keys for locks should be labeled and attached to crates, and it is recommended that keys be sent to the receiving institution in advance (T. Webb, personal communication, 2011).

Food and water containers that can be accessed from the outside of the crate should be present. Dry food/chow and bottled water should be in a clear zip lock bag attached to the top of each crate, and there should be enough food and water included for at least a 24 hour period. Produce should not be included because of agriculture restrictions and regulations for domestic and international shipments. Food and water should be placed in the crate prior to departure. Feeding and watering instructions should be attached to each crate. All crates should have individual identifiers on them, emergency contact information for shipping and receiving institutions, live animal labels on all surfaces, up arrow labels on all sides, feeding and watering instructions, acclimation documents, and food and water ports labeled (T. Webb, personal communication, 2011).

Chapter 7, Section 7.2 outlines the information on recommended medical tests to be performed on hamadryas baboons prior to shipment. A ‘certificate of veterinary inspection,’ medical records, and appropriate permits should accompany the hamadryas baboon in transit. For international shipments, containers should be approved and reviewed in advance of shipping date by a USFWS official in person or via photographs. This is essential to ensure that cargo is not turned away at the airport at time of departure. If animals are being imported, it is recommended to have crates fabricated in the U.S., have
them approved by USFWS, and then ship them to the country of export. Container doors and locking mechanisms should be designed in a manner that allows the USFWS officials to place an official seal on all openings. This seal should be intact from point of departure to the point of export. This seal cannot be cut, tampered with, or removed. If this seal is not intact upon arrival, there is a risk that the cargo will be returned to the point of origin. Staff should carry a copy of all permits, a copy of the health certificate, a flashlight, a roll of duct tape, extra crate labels, a set of keys for the crates. Staff should also have all emergency contact numbers and extra food for the animals in transit (T. Webb, personal communication, 2011).

Safe transport also requires the assignment of an adequate number of appropriately trained personnel (by institution or contractor) who are equipped and prepared to handle contingencies and/or emergencies that may occur in the course of transport. Planning and coordination for animal transport requires good communication among all affected parties, plans for a variety of emergencies and contingencies that may arise, and timely execution of the transport. At no time should the animal(s) or people be subjected to unnecessary risk or danger (AZA Accreditation Standard 1.5.11).

It is recommended that at least (2) staff members that are trained and familiar with the care and behavior of baboons accompany the animals during transport from the institution to the point of departure, meet with officials to ensure that animals are kept in a safe and quiet area, conduct any necessary inspections with officials, and ensure that the animals depart as scheduled. A curator, manager, and/or veterinarian should be one of the staff members, and a keeper should be the other staff member accompanying the animals to the point of departure and beyond if staff does travel with the animals.

In cases where a non-commercial air carrier is used, such as Fed Ex or Cargo Lux, grooms can attend and accompany the animals on the airplane. There are background checks and TSA requirements for this to occur, and these should be completed a minimum of 30 days prior to departure. For international import or export, a reputable animal broker is always recommended to assist with documentation, in transit care of animals during layovers, and other logistics required. If a layover is for an extended period of time, an animal care center is advised, if available. This can be facilitated through an animal broker.

When baboons are transported via ground or have layovers, contingency plans should be in place prior to departure with institutions on or the near the route in case of an emergency. These institutions or facilities should be contacted in advance to ensure that they are able and willing to assist if needed. During this hold, transport crates should be placed in a presentation that allows familiar animals to see each other because this may ease the stress of separation. When possible, it is important to crate train animals prior to shipment so that animals do not need to be immobilized on or near the time of departure. This also allows the animals to adjust to the environment that they will be housed in during transit (T. Webb, personal communication, 2011).

4.2 Protocols

Transport protocols should be well defined and clear to all animal care staff. All attempts should be made not to immobilize the animals the day of transport. This can be done by crate training baboons prior to departure. In the event that the baboon needs to be immobilized the day of departure, the baboon should be evaluated by a veterinarian after recovery from anesthesia and prior to being cleared for shipment. A veterinarian is not required but may be recommended in some cases to accompany animals during transport. If needed, medication for relaxation during transport should be under the guidance and recommendation of a veterinarian. Baboons should be shipped individually; animals that are pregnant or caring for young are not recommended for transport. Maximum transport time before reaching normal housing location should be about 48 hours. Food and water should be placed in the crate prior to departure. Food and water for at least another 24 hour period should be attached to the top of the crate. Feeding and watering instructions should be attached to each crate (T. Webb, personal communication, 2011).

Bedding should be made of shredded paper. Natural substrates may not be allowed due to agriculture restrictions
domestically and internationally. A wire mesh bottom should be placed in each crate to allow urine and feces to pass, and a catch tray should be in the bottom of the crate to prevent waste from spilling during transport. Recommended temperatures are no less than 7.22 °C (45 °F) and no more than 29.44 °C (85 °F) for extended periods of time. Every effort should be made to keep the baboons in a quiet, safe location during transport and during transit layovers (IATA, 2013).

Hamadryas baboons cannot be safely handled during transport without immobilization. A thorough visual check of the baboon prior to departure and immediately upon arrival should be sufficient. Ensure that feeding and watering protocols are followed. This should be done safely from outside of the shipping container. In the event of an emergency, non-zoo personnel should administer the food and water. Animals should be evaluated upon arrival to ensure that they are behaviorally and physically normal prior to release. Animals should be unloaded individually and evaluated again prior to introductions. Enrichment, shelving height, and cage furniture should be limited to prevent injury in a new environment (J. Wiley, personal communication, 2008). Figure 4 depicts an example of baboons in transit.
Chapter 5. Social Environment

5.1 Group Structure and Size

Careful consideration should be given to ensure that animal group structures and sizes meet the social, physical, and psychological well-being of those animals and facilitate species-appropriate behaviors. Hamadryas baboons are highly social monkeys like other species of baboons (Stammbach, 1987). However unlike other baboons, hamadryas baboons are not matrilineal, and males are the absolute leaders over their females. Hamadryas baboons are a fusion-fission species with a unique four leveled social structure. This is an ecological adaptation that allows them to form suitable groups for various resource concentrations (Kummer, 1995). The one-male unit (OMU), consisting of one adult male, several females, and their dependent offspring, is the core of the hamadryas baboon society. Male leaders of the OMU will aggressively maintain the loyalty of their females. These threats towards the female range from a stare with a raised brow (mild), to pinning the female down and biting the nape of her neck (severe) (Kummer, 1968).

In the wild, the OMU grouping allows individuals to utilize food resources such as a single bush or tree with little competition. Several OMUs come together to form a clan. OMU leaders in the clan are related to each other. Males will stay in their natal clan while females will emigrate to other clans or bands. The clan grouping forms to utilize small feeding sights. Several clans form a band and can be found at permanent watering holes, which are scarce in the desert environment. A troop, consisting of well over 100 individuals is formed at night at the sleeping cliffs. This large number in combination with the steep cliffs acts as protection from predators (Kummer, 1995).

Typically in ex situ environments, hamadryas baboons form the species-specific OMU. Given this and their natural history, multi-male, multi-generational groupings of hamadryas baboons most closely resemble wild populations. Ideally, hamadryas baboon groups housed in zoos would resemble the clan level of their social structure. Therefore, space becomes a consideration because breeding groups can become very large. A clan would consist of, at the very least, 6 individuals (two to three males and three to four females), but 10–20 individuals is a more realistic representation. This composition should consist of two to four OMUs. Institutions with space limitations could house a single OMU or a pair of OMUs that contain only two to three females per OMU.

It is very important that there are more females in the group than adult males. Male competition for a limited number of females jeopardizes the physical and mental well-being of both the males and females. Zuckerman’s (1932) chronicle of Monkey Hill is an example of what can happen when males have to compete for such a limited female resource. Follower males, young males who “follow” an established OMU, should also be considered when housing hamadryas baboons (Abegglen, 1984). These follower males will form their own OMUs as they mature and will replace aged males. Juvenile females in the group will be adopted or kidnapped by an adult male and will become part of his OMU. Females will transfer from one OMU to another only a few times in their lifetime.

Multigenerational groups are beneficial to all individuals in the troop. Housing multigenerational groups in managed environments best replicates their natural social organization. Older OMU leaders often determine the direction of the daily march for food and water resources. Elderly males who have lost their females spend time playing with infants in the troop (Kummer, 1995).

There have been no reports of all male groups in the wild; in fact, this is opposite from the way the hamadryas baboons’ social structure is designed. While males in the troop may not have females of their own, they are still part of the troop as either a follower male (young male) or a peripheral animal (old male) who still interacts with some group members. In zoos, males have been housed in all male groups for extended periods of time, but success is greater if the males have grown up together. Once bachelor groups are established, they are typically fairly stable and can be housed together for years. Bachelor groupings are common in some research centers in the United States, and these bachelor troops are commonly comprised of between 15–30 males. Juvenile groups of males (up to three years of age) are typically the larger groups of 30, and the adult all-male groups are between 15–20 animals (C. Lutz, personal communication, 2009).

Patterns of social affiliation will vary based on group composition. Adult females will remain in close contact with their OMU leader. Infants and juveniles will be observed interacting with most members of the troop, even outside of their mother’s OMU. Older females may find themselves no longer rigidly bound to an OMU and may be observed moving more freely among the troop than a younger female. In
groups with more than one adult male, enough space should be provided to allow male groups to separate from each other. This will help reduce male stress by alleviating the constant need to watch females carefully for defection or kidnapping. Visual barriers and vertical space will assist this.

Group size is dependent on space. Hamadryas baboons have been housed in groups as small as two and as large as twenty or more in AZA institutions. However, it is recommended to have a space that can hold more than five individuals because hamadryas baboons are a social species. Europe has successfully housed very large troops of more than 100 individuals (N. Bemment, personal communication, 2013).

### 5.2 Influence of Others and Conspecifics

Animals cared for by AZA-accredited institutions are often found residing with conspecifics, but may also be found residing with animals of other species. There has been little success mixing hamadryas baboons with different species. Proper exhibit size and complexity is significantly important when determining whether to attempt a mixed species exhibit with hamadryas baboons. Individual temperament, age, and the stability of a group will also play a role in achieving success. An examination of the AZA Old World Monkey Taxon Advisory Group’s *Mixed Species Manual* is advisable, and consultation with experienced individuals and institutions is warranted.

In any mixed species exhibit, the space occupied by both species will require more complexity than one occupied by a single species. Adding another species to an exhibit will require that staff practice well-coordinated introductions, manage mixed species co-existence on a daily basis, and provide safe methods of separation. These practices are specific for mixed species maintenance and are necessary for the maintenance of more than one species in the same space (J. Wiley, personal communication, 2008). The following questions should be considered when developing a mixed-species plan:

- How many species will be mixed, and how many individuals within each species will be put into the space?
- Where will the niche of each species most likely be in the space, and is this space furnished appropriately for the needs of the specific species? Care should be taken to avoid competition for niches.
- Are there enough visual barriers so that animals can be out of sight from the public, from conspecifics, and from the species they are being mixed with? Where and when are these appropriate?
- Are different shift doors provided for each species or are there at least two shift doors to/from the exhibit?
- Are there separate off-exhibit/night-house spaces for each species?
- Are there multiple feeding and watering stations provided for each species?

Hamadryas baboons will show interest (affiliative or aggressive) in adjacently housed conspecifics. This will especially be the case if males have visual access to females, but not direct contact. In these cases, expect males to be tense and anxious. Even when separating individuals or groups for short periods (hours to a few days), consider removing visual access. If a male has been separated from a female member of his OMU and can still see her, he will try to get her to follow him despite it not being physically possible (J. Wiley, personal communication, 2008).

It is important when interacting with hamadryas baboons that an individual (human) does not interfere with the bonds and social dynamics of the species. For example: cooperative feeds and individual training are successful in many species, including hamadryas baboons. However, when asking a female to participate, one should keep in mind that she will likely receive punishment from her male for accepting the treat or will feel so socially inhibited by the male that her accepting treats from a trainer may take a considerable amount of time and trust. Males are very protective, and one should take care when interacting with females and infants. A slight scream from an infant will bring a male running and threatening a keeper (J. Wiley, personal communication, 2008).

Hamadryas baboons can be difficult animals to house in a mixed species group; however, this is also dependent on individuals and individual troops. The most successful species to mix with hamadryas baboons are ibex, but further research would need to be done to determine if other species would be compatible. A good resource to refer to is the AZA Old World Monkey Taxon Advisory Group Mixed Species Manual (J. Wiley, personal communication, 2008).
5.3 Introductions and Reintroductions

Managed care for and reproduction of animals housed in AZA-accredited institutions are dynamic processes. Animals born in or moved between and within institutions require introduction and sometimes reintroductions to other animals. It is important that all introductions are conducted in a manner that is safe for all animals and humans involved.

Hamadryas baboons should not be separated and housed singly for any reason other than medical concerns. Any separation, especially in multi-male groups, can affect the OMU groupings. Separating a male allows companion males to gain control of his females. Separating a female subjects her to possible severe punishment from her male upon reintroduction. This is especially a concern when a female is near parturition or has a black infant (normal pelage of an infant up to five months of age). A male takeover of the female at this time may result in infanticide (Swedell & Tesfaye, 2003; J. Ireland, personal communication, 2004).

Infanticide in hamadryas baboons has been observed in both the wild and in ex situ environments (Swedell & Tesfaye, 2003). It can occur when a female transfers OMUs during pregnancy or shortly after giving birth. The new OMU leader will sometimes kill the black infant so that the female will come back into estrus. A study by Zinner and Deschner (2000) has shown that hamadryas baboon females with nursing infants that have been taken over by a new male will develop a “deceptive” sexual swelling. This anovulatory swelling allows the new male to mate with her without the risk of conception. The female therefore avoids the cost of being pregnant and lactating at the same time, while decreasing the risk of infanticide.

If there have been unexplained cases of infanticide or high male aggression, caregivers may consider forming a female group around the pregnant female prior to parturition. This allows the female to give birth in a safer environment, but does not exclude (and may even increase) the risk of infanticide upon reintroduction. Each situation is different, and caregivers should carefully consider the personalities of all their animals and the options they present.

Genetic testing is the only guaranteed way to determine an individual’s sire and dam. When reconstructing the parentage of a managed hamadryas baboon band through genetic testing, Smith et al. (1999) noted that a high instance of extra OMU copulations that resulted in pregnancy was observed. More surprisingly, they have shown that females from the same or other OMUs will kidnap an infant shortly after birth and raise it as their own. Understandably, the success rate is higher when the kidnapping female is lactating. It is therefore important for caregivers to closely monitor pregnant females and those who have just given birth. It is important to note that in hamadryas baboons, males have a keen interest in infants and juveniles. It is not uncommon to see an adult male holding or carrying infants and juveniles of either sex (Kummer, 1995).

Careful planning and consideration should go into each animal introduction because of the complex, multi-layered social structure of the hamadryas baboon. While zoos may vary in their introduction methods and philosophies, animal welfare should remain the primary goal. Several things should be considered when establishing an introduction plan:

- Current group size, dynamics, and composition
- Individual personalities of group members
- Breeding recommendations
- Desired group outcome
- Space, time, and resources available for the introduction process
- Wounding criteria- maximum injury sustained by an individual before introduction is terminated
- Acclimation time to others (typically through mesh)
- Desired observed behaviors at each step of introduction process

Planning introductions can be relatively easy or very complicated. Some introductions will present caretakers with a multitude of options for forming the new grouping, others will have very few. Group size and social complexity will determine options. While planning introductions, caretakers should consider each individual and their role in the social group. In socially complex groups (i.e., multi-male groups) each individual’s relationship with each other should be considered. It is important to deliberate how manipulating the group in a certain way will impact the current stability of the group.

These careful considerations are most important in a multi-male hamadryas baboon group. If a female is to be introduced to the group, caretakers may choose to introduce her first to the smallest OMU
or the OMU in which the male is least genetically represented (this would be based on the AZA Hamadryas Baboon SSP recommendation determining the genetic representation). The female is recommended to be introduced to the leader of the OMU first. It is suggested that, if possible, this introduction begin out of visual contact with a rival male. The female then will be more likely to focus on the male that she is being introduced to rather than showing a preference for the rival, making it easier for the rival to take her upon that introduction. In these cases, the female is likely to stay with the lead male during the next stages of introductions, and the male is less likely to have her taken by a rival male. It is recommended that the established OMU is given visual access to rival males after this initial introduction. Experiments have shown that a rival male will respect the bond of a possessor male and his female when he has been in visual contact with this group (Kummer, 1995). These strategies can assist in making female introductions successful.

Male introductions are more complicated and need careful consideration. Most existing multi-male groups in managed environments were formed when the males were all juveniles, or the younger males were born into the group. When introducing adult males, caregivers are faced with limited options. Males can be introduced to each other in the absence of females, then females can be added to establish OMUs. Alternatively, OMUs can be formed with the individual males; the OMUs can then be introduced to each other.

From time to time, it may be necessary to separate an ill individual for medical treatment. It is extremely important that the individual be returned to their group as soon as it is safe to do so. Hamadryas baboons form close family ties in the wild and a single individual is extremely vulnerable (Kummer, 1995). A female without her male is lost, unsure, and defenseless. A male that is separated from his female(s) risks losing her and possibly his place in the hierarchy. This type of stress can slow the recovery process (Kummer, 1995). If the individual is not able to be completely returned to the group, allowing them to maintain visual and auditory access to their OMU will reduce stress on both the individual and the rest of their OMU. If at all possible, the OMU with the ill individual should be separated from the other groups until the ill individual is able to be fully integrated with their group again. The OMU as a whole may then be reintegrated with the rest of the group once the individual has recovered.

When planning a complicated introduction, it is beneficial to an institution to seek advice from other institutions. It is recommended that institutions preparing for introductions should contact the AZA Hamadryas Baboon SSP Coordinator for guidance.
Chapter 6. Nutrition

6.1 Nutritional Requirements

A formal nutrition program is required to meet the nutritional and behavioral needs of all species (AZA Accreditation Standard 2.6.2). Diets should be developed using the recommendations of nutritionists, the AZA Nutrition Scientific Advisory Group (NAG) feeding guidelines: (http://nagonline.net/guidelines-aza-institutions/feeding-guidelines/), and veterinarians as well as AZA Taxon Advisory Groups (TAGs), and Species Survival Plan® (SSP) Programs. Diet formulation criteria should address the animal’s nutritional needs, feeding ecology, as well as individual and natural histories to ensure that species-specific feeding patterns and behaviors are stimulated.

Feeding Ecology

Baboon foraging is broad, highly flexible and adaptable (Whiten et al., 1991). Although broad, two thirds of the diet consumed by free-ranging baboons is comprised of a relatively small number (8-13) of food types (Whiten et al., 1991). More than half (54.8%) of the annual feeding budget of hamadryas baboons was comprised of three plant species: *Hyphaene thebaica*, *Acacia senegal* and *Tribulus cistoides* (Schreier, 2010). Similarly, male hamadryas baboons invested 59% of their total annual feeding time to two plant species: *H. thebaica* and *A. senegal*. In both studies, the remaining observed annual feeding time was distributed over 30-40 plant species with no more than 6-8% of total feeding time devoted to any one plant species (Sweedell et al., 2008; Schreier, 2010). During dry season months, total feeding time was almost entirely comprised isolated to four plant species (Sweedell et al., 2008). Dietary flexibility in a smaller portion of the total diet allows baboons to employ differing dietary profiles in response to changes of food resource availability (e.g., seasonal, habitat) (Whiten et al., 1991). It should be noted that baboons living in managed environments are not subjected to such restrictions of resource or nutrient availability.

Over a 12-mo period, male hamadryas baboons spent 25.6% (range 18-34%) of their time feeding (Sweedell et al., 2008). Across habitats and species, baboons were observed to spend 3-74% of time feeding on fruiting bodies, 1-53% of time feeding on subterranean items and 8-53% if time feeding on leaves (Whiten et al., 1991). However, plant parts selected by free-ranging animals differ significantly in their nutrient composition when compared with analogous parts of cultivated plants (in general, cultivated plants are much higher in sugar and starch and lower in fat, fiber and protein, Henry et al., 2017, NRC, 2003). Therefore, the nutrient composition of plant foods, not descriptions of their botanical structure, should be used in selecting foods used in feeding programs for baboons in managed environments. Species in this foraging category may opportunistically and incidentally consume invertebrate (e.g., 0.254% total feeding time of free-living male hamadryas) and vertebrate prey; however, this does not support the inclusion of animal-based ingredients in the diets of hamadryas baboons in managed environments (Sweedell et al., 2008; Schreier et al., 2019).

The gastrointestinal tract of the baboon reflects their flexible feeding ecology, with a both a simple stomach that allows for faster passage of more readily digestible items (fruit bodies) and a larger caecum that allows for longer retention (and microbial fermentation) of more fibrous food items (immature leaves and grasses) (Stevens, pers. comm.).

AZA Accreditation Standard

(2.6.2) The institution must follow a written nutrition program that meets the behavioral and nutritional needs of all species, individuals, and colonies/groups in the institution. Animal diets must be of a quality and quantity suitable for each animal’s nutritional and psychological needs.
in Demment 1983). This represents a compromise digestively to exploit both types of food items to some degree. Readers should note that the gastrointestinal tract presented is that of an olive baboon (*Papio anubis*), so not precisely, but expected to be representative of, hamadryas baboons.

In summary, hamadryas baboons demonstrate characteristics of the “Frugivore/Herbivore” foraging category - “a species that eats fleshy fruiting bodies, perhaps some seeds, the fleshy roots of certain plants, and some green leafy material (Eisenberg, 1981).

**Energy and nutrient recommendations**

Exact nutrient requirements of Hamadryas baboons are unknown: Nutrient recommendations for non-human primates can be used as a guide. All animals should have unrestricted access to potable drinking water. Adequate nutrient concentrations for post-weaning adult nonhuman primates are provided in Tables 6.1.1 and 6.2.2 (NRC, 2003). Data for Hamadryas baboons are consistent with protein concentration recommendations for nonhuman primates (Bourgoignie et al., 1994). Excess sugars and fat should be avoided as they can cause metabolic abnormalities consistent with developing cardiometabolic syndrome (Higgins et al., 2010). Diets higher in insoluble carbohydrates and lower in soluble carbohydrates have been attributed to improved body and coat condition in hamadryas baboons (Cabana et al., 2018). Excess salt (NaCl) should be avoided as it can cause high blood pressure in hamadryas baboons (Cherchovich et al., 1976).

Offered diets should be formulated and measured to support the energy requirements of the animal. Observations of feeding time or number of feeding bouts are not directly related to actual food or caloric intake in either free-living or captive hamadryas baboons (Zinner, 1999; Swedell et al., 2008). Therefore, predicted food intake using observations of feeding should be carefully scrutinized, particularly if those data are used manage the diets of animals in managed environments (Zinner, 1999). The estimated daily metabolizable energy (ME) requirement of adult captive baboons can be calculated using the equation 109(BW<sub>kg</sub>)<sup>0.75</sup> (NRC, 2003). Actual energy needs vary, so estimated needs should be used as guide. Adjustments to diet should be based on routine assessments of body mass and condition (Leigh, 1994). Growth, gestation and lactation may require additional energy above maintenance (NRC, 2003), though specific equations for those estimations have yet to be determined.

Table 6.1.1. Estimated adequate nutrient concentrations (dry matter basis) in diets containing conventional feed ingredients offered to post-weaning non-human primates (NRC, 2003).

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Unit</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proximate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>%</td>
<td>15-22</td>
</tr>
<tr>
<td>n-3 fatty acids</td>
<td>%</td>
<td>0.5</td>
</tr>
<tr>
<td>n-6 fatty acids</td>
<td>%</td>
<td>3.0</td>
</tr>
<tr>
<td>ADF</td>
<td>%</td>
<td>10</td>
</tr>
<tr>
<td>NDF</td>
<td>%</td>
<td>5</td>
</tr>
<tr>
<td><strong>Minerals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>%</td>
<td>0.8</td>
</tr>
<tr>
<td>Total Phosphorus</td>
<td>%</td>
<td>0.6</td>
</tr>
<tr>
<td>Magnesium</td>
<td>%</td>
<td>0.08</td>
</tr>
<tr>
<td>Potassium</td>
<td>%</td>
<td>0.4</td>
</tr>
<tr>
<td>Sodium</td>
<td>%</td>
<td>0.2</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/kg</td>
<td>100</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/kg</td>
<td>20</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/kg</td>
<td>20</td>
</tr>
<tr>
<td>Iodine</td>
<td>mg/kg</td>
<td>0.35</td>
</tr>
<tr>
<td>Selenium</td>
<td>mg/kg</td>
<td>0.3</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/kg</td>
<td>100</td>
</tr>
<tr>
<td><strong>Vitamins</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A</td>
<td>IU/kg</td>
<td>8000</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>IU/kg</td>
<td>2500</td>
</tr>
<tr>
<td>Vitamin E</td>
<td>mg/kg</td>
<td>100</td>
</tr>
</tbody>
</table>
6.2 Diets

The formulation, preparation, and delivery of all diets must be of a quality and quantity suitable to meet the animal’s psychological and behavioral needs (AZA Accreditation Standard 2.6.2). Food should be purchased from reliable, sustainable and well-managed sources. The nutritional analysis of the food should be regularly tested and recorded.

A suitable diet consists of commercially available, cultivated produce balanced by an appropriately formulated primate feed (e.g., biscuits). Additional items, offered in controlled quantities, can be safely included as part of the diet without resulting in nutrient and/or energy imbalance. Within each diet component (i.e., produce, formulated feeds, additional items) there is the potential to introduce variability. This variation, enhanced with methods of food preparation, diet delivery, and feeding frequency can be employed to promote natural feeding behavior, reinforcing behavior and delivery of medication. Table 6.2.1 lists nutrient composition ranges of seven formulated feeds for primates. Table 6.2.2 illustrates sample diets that would meet the nutrient recommendations discussed above (and in Table 6.1.1), when using a formulated diet with similar composition to those in Table 6.2.1.

Table 6.2.1. Nutrient concentration ranges (dry matter basis) of several formulated feeds (n=7) for use in hamadryas baboon diets. See Table 6.2.2 for inclusion rate as part of a balanced diet.

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Unit</th>
<th>Concentration</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Proximate</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protein</td>
<td>%</td>
<td>15-25</td>
</tr>
<tr>
<td>n-3 fatty acids</td>
<td>%</td>
<td>0.5-1.0</td>
</tr>
<tr>
<td>n-6 fatty acids</td>
<td>%</td>
<td>2.2-2.5</td>
</tr>
<tr>
<td>ADF</td>
<td>%</td>
<td>12-25</td>
</tr>
<tr>
<td>NDF</td>
<td>%</td>
<td>20-35</td>
</tr>
<tr>
<td><strong>Minerals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Calcium</td>
<td>%</td>
<td>1-1.5</td>
</tr>
<tr>
<td>Phosphorus</td>
<td>%</td>
<td>0.5-0.8</td>
</tr>
<tr>
<td>Magnesium</td>
<td>%</td>
<td>0.15-0.25</td>
</tr>
<tr>
<td>Potassium</td>
<td>%</td>
<td>0.8-1.7</td>
</tr>
<tr>
<td>Sodium</td>
<td>%</td>
<td>0.2-0.5</td>
</tr>
<tr>
<td>Chloride</td>
<td>%</td>
<td>0.3-0.6</td>
</tr>
<tr>
<td>Iron</td>
<td>mg/kg</td>
<td>250-500</td>
</tr>
<tr>
<td>Copper</td>
<td>mg/kg</td>
<td>20-40</td>
</tr>
<tr>
<td>Manganese</td>
<td>mg/kg</td>
<td>70-150</td>
</tr>
<tr>
<td>Zinc</td>
<td>mg/kg</td>
<td>120-180</td>
</tr>
<tr>
<td>Iodine</td>
<td>mg/kg</td>
<td>0.8-2.5</td>
</tr>
<tr>
<td>Selenium</td>
<td>mg/kg</td>
<td>0.1-0.4</td>
</tr>
<tr>
<td>Chromium</td>
<td>mg/kg</td>
<td>0.01</td>
</tr>
<tr>
<td><strong>Vitamins</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vitamin A</td>
<td>IU/kg</td>
<td>9000-30000</td>
</tr>
<tr>
<td>Vitamin D</td>
<td>IU/kg</td>
<td>3200-4800</td>
</tr>
</tbody>
</table>
Hamadryas Baboon (Papio hamadryas) Care Manual

Using this information and target weights based on free-living specimens (Table 3, Introduction), example diets for a single adult male and female (Table 6.2.2) hamadryas baboon are provided. Sample diets to meet the estimated daily metabolizable energy and nutrient requirements of post-weaning male and female hamadryas baboons have been prepared to empower users to adjust total dietary energy based on the desired target body mass. Recommendations on distribution of food groups (e.g., formulated feeds, greens, root vegetables) as a percent of the metabolizable energy requirement allows users the maximum flexibility to adjust diet components based on their goals, without compromising nutrient and energy of the consumed diet. Animal care providers are always advised to seek the guidance from a nutrition consultant to ensure proper formulation of animal diets.

It is commonly known that cultivated plant materials are not nutritionally similar to plant parts that animals consume under free-living conditions (NRC, 2003). Comprehensive, typical nutrient details for cultivated produce items available in the US food supply chain are easily accessible on the USDA FoodData Central website (https://fdc.nal.usda.gov/). The example diet allows maximum flexibility within designated groups (e.g., formulated feeds, greens, root vegetables, vegetables, fruits, and other foods). Within these groups, animal care providers can rotate a wide range of ingredients to emulate intake diversity typical of the species in the wild. As such, with careful planning the rotation of items, the entire diet is an integrated part of the overall animal enrichment program, not a separate entity.

Table 6.2.2. Example quantities (as-fed basis) and distribution of ingredients to deliver the estimate daily metabolizable energy (ME) requirement of a single adult male and a single adult female hamadryas baboon. Calculated nutrient composition of this example diet and estimated adequate nutrient concentrations are shown. All nutrient concentrations expressed on a dry matter basis (nd = not determined) (NRC, 2003).

<table>
<thead>
<tr>
<th>Food Type</th>
<th>Adult Male (BW: 19 kg)</th>
<th>Adult Female (BW: 10 kg)</th>
<th>Amount, g</th>
<th>Amount, %</th>
<th>ME, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Formulated primate feed, minimum inclusion²</td>
<td>165</td>
<td>100</td>
<td>11.7</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Greens, variable³</td>
<td>200</td>
<td>125</td>
<td>14.4</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>Roots, variable⁴</td>
<td>425</td>
<td>260</td>
<td>30.2</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Vegetables, variable⁵</td>
<td>500</td>
<td>315</td>
<td>36.4</td>
<td>17.5</td>
<td></td>
</tr>
<tr>
<td>Fruits, variable, suggested maximum inclusion⁶</td>
<td>100</td>
<td>60</td>
<td>6.8</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Other, variable⁷</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>Leafy plants, fresh, variable⁸</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Diet Adequate</th>
<th>Nutrient</th>
<th>Diet Adequate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Proximate</td>
<td></td>
<td>Vitamins</td>
<td></td>
</tr>
<tr>
<td>Crude Protein, %</td>
<td>19.1</td>
<td>15-22</td>
<td>Vitamin A, IU/kg</td>
</tr>
<tr>
<td>Essential n – 3 fatty acids, %</td>
<td>nd</td>
<td>0.5</td>
<td>Vitamin D, IU/kg³</td>
</tr>
<tr>
<td>Essential n – 6 fatty acids, %</td>
<td>nd</td>
<td>3.0</td>
<td>Vitamin E, mg/kg</td>
</tr>
</tbody>
</table>

Association of Zoos and Aquariums
Formulated feeds deliver animals a consistent and dependable nutrient package to balance the inadequacies and variability of cultivated plant materials. The example diets shown in Table 6.2.2 includes the minimum quantities (45% of required metabolizable energy intake, or 11.7% of overall diet) of formulated feeds a singly housed hamadryas baboon should consume daily to satisfy most of the adequate nutrient concentrations (NRC, 2003). Systems should be in place to ensure these minimum intake levels are maintained among socially grouped animals to minimize marginal intake of key nutrients (Schlabritz-Loulsevitch et al., 2004). While the example diet shows it should not contain less than 11.7% formulated feeds, an increase in that amount will still allow the overall diet to meet the recommended nutrient levels for this species. The distribution of the remaining food types (greens, roots, vegetables, fruits), would need to be adjusted.

As discussed previously, hamadryas baboons are herbivorous animals with wild fruits and foliage composing the bulk of their diet, supplemented by flowers, seeds, and roots or tubers. The majority of the example diets consist of cultivated plant materials (i.e., commercially available produce) as substitutes for these wild-type items. The distribution of the groups under this broad category is intended to allow variability while delivering a nutrient package comparable to that consumed by free-living hamadryas baboons and/or estimated adequate nutrient concentrations. Though, it would be reasonable to alter the distribution of the diet between ‘greens’, ‘roots’, ‘vegetables’ and ‘fruits’ to suit the management needs of a particular animal or group. However, it should be recognized that nutrient composition of wild-type fruits differs greatly from cultivated fruits, most notably in their sugar content (Henry et al., 2017). As such, it is suggested that commercially available fruits be limited in the diet, if included at all. If they are offered, we suggest energy from fruits be limited to 5% overall. In the diet examples in Table 6.2.2, this becomes 6-7% of the overall diet. Cultivated plant parts should be offered whole where possible to promote dietary diversity, time spent feeding and overall food consumption (Smith et al. 1989).

### Minerals

<table>
<thead>
<tr>
<th>Nutrient</th>
<th>Requirement</th>
<th>Formulated Feed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcium, %</td>
<td>0.9</td>
<td>0.8</td>
</tr>
<tr>
<td>Total Phosphorus, %</td>
<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Magnesium, %</td>
<td>0.17</td>
<td>0.08</td>
</tr>
<tr>
<td>Potassium, %</td>
<td>1.8</td>
<td>0.4</td>
</tr>
<tr>
<td>Sodium, %</td>
<td>0.4</td>
<td>0.2</td>
</tr>
<tr>
<td>Iron, mg/kg</td>
<td>233</td>
<td>100</td>
</tr>
<tr>
<td>Copper, mg/kg</td>
<td>30</td>
<td>20</td>
</tr>
<tr>
<td>Manganese, mg/kg</td>
<td>72</td>
<td>20</td>
</tr>
<tr>
<td>Iodine, mg/kg</td>
<td>1.18</td>
<td>0.35</td>
</tr>
<tr>
<td>Selenium, mg/kg</td>
<td>0.2</td>
<td>0.3</td>
</tr>
<tr>
<td>Zinc, mg/kg</td>
<td>103</td>
<td>100</td>
</tr>
</tbody>
</table>

1. Calculated daily ME (kcal) requirement of adult, captive baboons is 109*(BW)^0.75 (NRC, 2003).
2. Formulated primate diets are nutritionally complete, provide consistent and reliable nutrient concentrations and may constitute up to 100% of the animal’s daily metabolizable energy intake. Multiple formulations may be offered to this species and can be used to promote diet complexity (see Table 6.2.1).
3. Variable greens may include, but are not limited to: kale, collard, romaine lettuce, dandelion.
4. Variable roots may include, but are not limited to: beets, carrot, parsnip, sweet potato, turnip.
5. Variable vegetables may include, but are not limited to: broccoli, cucumber, squash, tomato.
6. Variable fruits may include, but are not limited to: apple, banana, grape, mango, orange, papaya.
7. Other variable foods are included in the offered diet based on metabolizable energy content. Amounts offered will vary. These include scatter foods and other items offered to promote diet complexity and foraging activity.
8. Non-injurious fresh, leafy plant material is not recommended or required as a food item but may be included as an object for manipulation.
9. When formulated primate diets constitute 45% or less of the animal’s daily metabolizable energy consumption, the intake of several nutrients achieves marginal and possibly deficient levels. Allowing the consumed quantities of formulated primate foods to constitute less than 45% of an individual animal’s daily metabolizable energy intake is not recommended.
All edible and ingested materials should be accounted in the animal’s daily intake, regardless of the goal or intent associated with feeding the food. With the understanding that some foods are reserved for purposes of “enrichment” or “training reinforcement”, a portion (5%) of the animal’s daily metabolizable energy requirement is allocated to “other variable foods.” The consumption of these foods (e.g., seeds, nuts, grains, medication vectors) should not negatively impact intake of the remainder of the diet.

Fresh, leafy plant material (i.e., browse) is not a critical dietary component for this species. As browse is often a limited commodity, this resource should be reserved for specialized leaf-eating primates (e.g., sifaka, howlers, colobines) and other high browse priority species. If adequate quantities of non-injurious leafy plant materials are available, this ingredient group could be added as an object for manipulation and environmental complexity. Consumption of this food group should not negatively impact the minimum level of formulated food intake.

A major consideration for determining the appropriate amount to offer an animal, or group, is to first recognize that the diet offered does not necessarily equal the diet consumed. An animal or group that disproportionately leaves behind a certain part of the diet, particularly the formulated feed, indicates the diet should be reviewed and reformulated to ensure consumption of all components in the intended proportions. In the case of the formulated diet, a reduction of only this component (to reduce apparent waste) may still meet energy requirements but can negatively impact the balance of the diet overall if the proportions of other items are not also adjusted.

Ultimately, once a diet is balanced, the amount to offer should depend on an individual’s (or overall group’s) body condition and status. The decision to increase or decrease a diet overall should be based upon evidence of it’s need; weight trends, body condition, and behavior (group dynamics, ravenous consumption or regularly leaving more than 10% of diet, food aggression or low food motivation for shifting and training, etc.). Diet adjustments intended to elicit weight changes should be done so weight is not gained or lost too quickly. Both can predispose to deleterious conditions such as increasing fatty tissue over muscle if gains are too fast, or muscle loss and nutritional deficiencies if losses are too fast. A general rule of thumb is to make 5-15% changes, no more often than once per week. On rare occasions, a larger increase (20-25%) can be made if previous increases have not produced a gain in weight. If repeated increases do not produce a gain in weight, other factors need to be considered, and a veterinarian should likely be consulted. If an animal is consistently gaining or losing 2-3% BW or more per week, changes should be slowed by making smaller, or less frequent diet adjustments. Given the great sexual dimorphism seen in this species, caretakers should expect to feed a greater amount to adult males than adult females (see Table 6.2.2). Until maturation (and therefore difference in size) can be appreciated, juvenile males and females should have similar requirements. If in appropriate condition, a pregnant female should not need a diet increase simply because pregnancy is confirmed. Particular attention should be paid during the third trimester and lactation however as these times have a higher energetic cost. Though care should be taken to ensure that animals are reduced back to maintenance amounts after the period of increased demand (lactation) ends.

Food preparation must be performed in accordance with all relevant federal, state, or local laws and/or regulations (AZA Accreditation Standard 2.6.1). Meat processed on site must be processed following all USDA standards. The appropriate hazard analysis and critical control points (HACCP) food safety protocols for the diet ingredients, diet preparation, and diet administration should be established for species. Diet preparation staff should remain current on food recalls, updates, and regulations per USDA/FDA. Remove food within a maximum of 24 hours of being offered unless state or federal regulations specify otherwise and dispose of per USDA guidelines.

Studies of baboon activity budgets show that troops spend 21-33% of their day engaged in feeding (Boug et al. 1994, Joseph 2016). If a feeding program is designed to meet both nutritional needs, and simulate natural behaviors, one that allows for ~25% of time spent feeding seems appropriate for baboons in captivity. It is suggested that the diet be split between at least two feeds daily. Additional feedings can be considered to obtain management goals for each institution’s circumstances. However, feeding schedules, as well as food types, should be routinely evaluated. A change in feeding frequency from once to twice daily, as well as the addition of a scatter feeding “grain” actually increased the incidence of stereotypic behavior in a troop of hamadryas baboons (Nevill and Lutz, 2015). Nevill and Lutz (2015) further suggested that the item chosen for scatter (grain) did not require enough effort to forage and occupy time. Furthermore, hamadryas baboons employ food storage in strategic response to
foraging competition (Gore, 1993), which could impact a caretaker’s assessment of overall diet consumption. These outcomes are examples of the need to employ an understanding of baboon behavior and troop dynamics to avoid, or mitigate, unintended consequences of an otherwise logical approach to feeding schedules. Presenting food items in a way that encourages foraging can maximize the enriching impact of the diet if aligned with the natural behavior of the species.

While consumption in the wild is anecdotally reported, the inclusion of meat or whole prey items is not recommended for baboon captive diets.

If browse plants are used within the animal’s diet or for enrichment, all plants must be identified and assessed for safety prior to use (AZA Accreditation Standard 2.6.3). The responsibility for approval of plants and oversight of the program must be assigned to at least one qualified individual (AZA Accreditation Standard 2.6.3.1). The program should identify if the plants have been treated with any chemicals or near any point sources of pollution and if the plants are safe for the species. The institution’s animal care program must address the potential risks of animals being exposed to toxic plants growing around or near their exhibit space, and exhibits should be checked regularly during the growing season (AZA Accreditation Standard 2.6.3.2).

Browse which is known to have been sprayed with herbicides or pesticides is not recommended for use as animal feed. Also, plants from areas close to major roads or industrial areas are not recommended for food as these plants may accumulate potentially harmful pollutants. When accepting plant material from outside sources, verify that no noxious chemicals have been used on or around the plants. Furthermore, staff responsible for harvesting, dispensing, and feeding browse should be able to identify species to ensure potentially toxic plants are not fed out.

Given the large range of plant species available across regions, a singular list of approved plants is not practical. Facilities are encouraged to build and maintain their own list of approved (and non-approved) browse species specific to their region and available forage.

Several websites and references are available to determine the safety of a plant species and are listed below. In addition to maintaining and approved browse list, it would be prudent to also document plants known to be toxic which should not be offered. It is important to keep in mind that items that are safe for one species may still be toxic to others. Facilities may also make use of local extension offices for assistance.

ASPCA Toxic and Non-Toxic Plants
http://www.aspca.org/pet-care/poison-control/plants/

Cornell University Poisonous Plants Index
http://www.anisci.cornell.edu/plants/index.html


While some can be made available for enrichment, Hamadryas baboons are not considered a species requiring a regular source of browse material as part of the diet. Regionally available plant species previously identified as non-injurious for other primate species would be acceptable for this application.

6.3 Nutritional Evaluations

Biological Nutrient Norms

Target serological levels of nutrients have not been specifically established for hamadryas baboons. It seems reasonable that parameters established for humans would be sufficient.
Free-ranging hamadryas baboons have vitamin D metabolites in the same range as humans described as having adequate levels of vitamin D (Ziegler et al., 2018).

**Body Weight Monitoring and Body Condition Scoring**

As in humans, there is a strong correlation between body fat (%) and waist circumference (i.e., abdominal adiposity) and the occurrence of type 2 diabetes mellitus in hamadryas baboons (Comuzzie et al., 2003; Chavez et al., 2007). When adjusted for differences in body fat (%), there were no differences in fasting insulin and triglyceride levels between male and female hamadryas baboons (Higgins et al., 2014).

It is valuable to monitor weight and body condition of baboons regularly to ensure the diet is meeting their energetic needs. This can be accomplished via scale training for monthly weights on individuals, and the coordinated use of a species appropriate body condition scoring system. Body condition scoring is a semi-objective tool to evaluate body fat and muscle, either visually or by physical palpation. Usually on a 1-5 or 1-9 scale, each score reflects a detectable and describable difference in ‘fatness’ when examining the body overall. Additionally, in validated systems, a change in score reflects a determined % change in total body fat.

When used in combination, a target body weight range can be established (the range of body weight that corresponds to the animal scoring within the ideal BCS range), allowing monitoring through body weights if body condition scoring is not always possible.

Body condition scoring in most primates can be challenging to assess, unless during an anesthesia event. Typical positions (hunched or sitting) or haircoat can mask assessment points on the body, and physical palpation while awake may not be possible, or prevent complete assessment. A system has been developed and validated for nonhuman primates using rhesus macaques as a model (Appendix H). For a complete review, including instruction for how to assess via direct palpation, see Clingerman and Summers (2005) (also available at the AZA NAG Body Condition Scoring Resource Center), Clingerman and Summers (2012), and Summers et al (2012). While not species specific to hamadryas baboons, the body type between both species is similar enough to make this a reasonable system.
Chapter 7. Veterinary Care

7.1 Veterinary Services

Veterinary services are a vital component of excellent animal care practices. A full-time staff veterinarian is recommended, however, in cases where this is not practical, a consulting/part-time veterinarian must be under contract to make at least twice monthly inspections of the animal collection and to any emergencies (AZA Accreditation Standard 2.1.1). Veterinary coverage must also be available at all times so that any indications of disease, injury, or stress may be responded to in a timely manner (AZA Accreditation Standard 2.1.2). The AZA Accreditation Standards recommend that AZA-accredited institutions adopt the guidelines for medical programs developed by the American Association of Zoo Veterinarians (AAZV) (http://aazv.affiniscape.com/associations/6442/files/veterinary_standards_2009_final.docx). The following guidelines are adapted from the Guidelines for Comprehensive Old World Primate Health Monitoring Program (http://www.AAZV.org), but the final medical decisions should be determined by veterinarian and animal care staff at each institution. It is recommended that veterinary staff perform annual visual examinations of all baboons to discuss their health with animal care staff, and perform examinations under anesthesia every 1-3 years to facilitate a thorough physical examination and evaluation of routine blood work and imaging.

Veterinary advisors for the AZA Hamadryas Baboon SSP and the AZA Old World Monkey TAG can be found by visiting the AZA Animal Program page.

Protocols for the use and security of drugs used for veterinary purposes must be formally written and available to animal care staff (AZA Accreditation Standard 2.2.1). Procedures should include, but are not limited to: a list of persons authorized to administer animal drugs, situations in which they are to be utilized, location of animal drugs and those persons with access to them, and emergency procedures in the event of accidental human exposure. Euthanasia of this species should be performed only in sedated animals, and then by the use of an injectable barbiturate, as recommended by the American Veterinary Medical Association. See section 7.5 for drugs used for anesthesia and sedation.

Drugs commonly used in hamadryas baboons include a variety of antibiotics such as amoxicillin/clavulanic acid, trimethoprim/sulfa combinations, enrofloxacin and cephalaxin. Also frequently used are anti-inflammatory and analgesic medications such as tramadol and meloxicam. All drugs should be stored and administered according to their labels. Hamadryas baboons tolerate most medications very well and do not seem to be prone to antibiotic-induced dysbiosis/diarrhea or the gastrointestinal side effects of non-steroidal anti-inflammatory medications. Some individual baboons are extremely difficult to medicate as they can be very savvy about detecting and refusing medications in food and treats. Training for routine acceptance of injectable medications is well within the realm of possibility for most hamadryas baboons (J. Wiley, personal communication, 2008).

Veterinary recordkeeping is an important element of animal care and ensures that information about individual animals and their treatment is always available. A designated staff member should be responsible for maintaining accurate animal veterinary record keeping. Medical records should include animal medical history, medical issues and treatments, vaccinations, laboratory results, anesthetic and nutritional records.

AZA Accreditation Standard

(2.1.1) A full-time staff veterinarian is recommended. In cases where such is not practical, a consulting/part-time veterinarian must be under written contract to make at least twice monthly inspections of the animals and to respond as soon as possible to any emergencies.

AZA Accreditation Standard

(2.1.2) So that indications of disease, injury, or stress may be dealt with promptly, veterinary coverage must be available to the animals 24 hours a day, 7 days a week.

AZA Accreditation Standard

(2.2.1) Written, formal procedures must be available to the animal care staff for the use of animal drugs for veterinary purposes, and appropriate security of the drugs must be provided.

7.2 Transfer Examination and Diagnostic Testing Recommendations

The transfer of animals between AZA-accredited institutions or certified related facilities due to AZA Animal Program recommendations occurs often as part of a concerted effort to preserve these species. These transfers should be done altruistically as possible and the costs associated with specific examination and diagnostic testing for determining the health of these animals should be considered. The
following details the minimum data to be collected and recorded during annual or regular examinations, pre-shipment examinations, and quarantine examinations.

- **Signalement:** Age, sex, origin, studbook number, ISIS number, and verification of ID (e.g., transponder, tattoo, etc.)
- **Medical History:** Summary of information regarding health screens, medical problems, diagnostic test results, and treatment over the previous year
- **Physical exam:** Conduct a complete physical examination including a review of all systems. Special attention to dental and orthopedic condition is warranted, especially in older animals. Body weight should be recorded.
- **Contraception:** Any contraception methods should be verified if applicable (e.g., surgical, melengestrol acetate implant, medroxyprogesterone injections, deslorelin implants, etc.).
- **Blood collection:** Blood is recommended to be collected for complete blood cell count (CBC), serum chemistry panel, serology/PCR (testing is available for hepatitis A, B, C, herpes simplex, herpes B, influenza virus A, G, measles, SRV, SIV, STLV, foamy virus, SA8, SA6, EBV, and others). Specific testing should be based on the animal’s history and intended disposition. Additional serum should be banked in a -70 ºC (-94 ºF) ultra-low freezer.
- **Tuberculin test:** 0.1 mL of mammalian tuberculin, human isolate, or TB MOT (Colorado Serum Co., Symbiotics Corp) is injected intradermally into the upper eyelid using an insulin syringe or 27-gauge needle. Concurrent testing with avian tuberculin (injected into the opposite upper eyelid or the skin on another accessible region of the body) may be useful depending on the institution’s history. The injection site will be evaluated at 24, 48, and 72 hours after injection by qualified veterinary staff. It is recommended that the animal is tested twice approximately 30 days apart, once during pre-shipment examination and once during quarantine examination. If the pre-shipment examination has been performed longer than 30 days before the arrival of the animal at the new institution, an entry and exit quarantine examination and TB testing should be performed. In case of a questionable or positive TB test, the animal should be kept in quarantine or its established group until follow-up testing can be performed. Follow-up testing should consist of repeating the intradermal testing with mammalian and avian tuberculin, thoracic radiographs and blood testing with an acceptable methodology (Gamma interferon, Lymphocyte stimulation, STAT-PAK, etc.). Gastric lavage may also be performed, and the samples obtained are submitted for mycobacterial culture and PCR (NIH, 2017).
- **Aerobic culture of feces for enteric pathogens like Salmonella sp., Shigella, Campylobacter, and Yersinia** may be warranted depending on history and the specific situation.
- **Fecal screening for parasites:** Fecal samples are recommended to be collected at least annually, though semi-annually is preferred. The sampling schedule should be based on the specific needs of the troop/institutions. Direct smear, flotation, and sedimentation should be performed to characterize parasite carriage by the baboons. Many institutions treat prophylactically for parasites at regular intervals, while others only treat in response to positive fecal samples. Both approaches are considered acceptable.
- **Radiographs:** Baseline radiographs of the thorax and abdomen are recommended when the baboons reach adult size. Routine radiographs of the lumbar spine and peripheral joints are recommended with geriatric animals.
- **Vaccinations:** Regular vaccination for tetanus toxoid is recommended. Please note that these vaccination recommendations are empirically derived because no optimal vaccination protocol or protective titers have been established in hamadryas baboons. Options for vaccination of hamadryas baboons are:
  - 0.5 mL IM at 5–7 and 13–15 months of age, then booster every five years
  - 0.5 mL IM at 3, 6, and 9 months of age, then booster every three to five years
  - 1.0 mL IM at 2, 4, 6, and 18 months of age, then booster every five to ten years

A rabies vaccination every one to three years with a commercial killed virus product should be considered in endemic areas, especially where baboons have outdoor access. Titers can be measured as well, but adequate protective vaccine doses and titers have not been determined in this species. Recommendations are:
  - Prophylaxis: 1 ml IM at 6–12 months of age, then booster every one to three years.
7.3 Quarantine

AZA institutions must have holding facilities or procedures for the quarantine of newly arrived animals and isolation facilities or procedures for the treatment of sick/injured animals (AZA Accreditation Standard 2.7.1). All quarantine, hospital, and isolation areas should be in compliance with AZA standards/guidelines (AZA Accreditation Standard 2.7.3; Appendix E). All quarantine procedures should be supervised by a veterinarian, formally written and available to staff working with quarantined animals (AZA Accreditation Standard 2.7.2). If a specific quarantine facility is not present, then newly acquired animals should be kept separate from the established collection to prohibit physical contact, prevent disease transmission, and avoid aerosol and drainage contamination. If the receiving institution lacks appropriate facilities for quarantine, pre-shipment quarantine at an AZA or American Association for Laboratory Animal Science (AALAS) accredited institution may be applicable. Local, state, or federal regulations that are more stringent than AZA Standards and recommendation have precedence. A CDC quarantine is usually mandatory upon international import.

Food provided by the sending institution for the baboon may be different from what will be fed at the receiving institution. Diets from the sending institution should accompany the animal during shipment and be used initially by the receiving institution. Baboons are not particularly finicky or sensitive to dietary changes, but novel foods can cause gastrointestinal upset. The baboons’ diet should be slowly transitioned from the old diet to the new diet to avoid gastrointestinal disturbances that may occur with any dietary change. Most diet changes can be completed during the quarantine period.

AZA institutions must have zoonotic disease prevention procedures and training protocols established to minimize the risk of transferable diseases (AZA Accreditation Standard 11.1.2) with all animals, including those newly acquired in quarantine. Keepers should be designated to care only for quarantined animals if possible. If keepers must care for both quarantined and resident animals of the same class, they should care for the quarantined animals only after caring for the resident animals. Care should be taken to ensure that these keepers are “decontaminated” before caring for the healthy resident animals again. Equipment used to feed, care for, and enrich animals in quarantine should be used only with these animals. If this is not possible, then all items must be appropriately disinfected, as designated by the veterinarian supervising quarantine before use with resident animals. Disinfectants such as a diluted bleach solution, sodium hypochlorite or other broad-spectrum disinfectant (effective against mycobacteria and viruses) can be used (Occupational Primate Safety Guidelines, 2013).

Proper protective equipment should be available for personnel attending to quarantined primates. This should include rubber boots, disposable quarantine coveralls, facial masks, and gloves. The disposable gloves should be disposed of after each use, while coveralls and masks can be reused throughout the quarantine period if they remain in good condition. The rubber boots should be cleaned as they become soiled and properly disinfected at the end of the quarantine period. Each institution should develop a PPE protocol to ensure quarantine guidelines are met.

At least 30 days is the recommended quarantine length for hamadryas baboons. This time period is suggested in order to accomplish quarantine goals while minimizing stress in housing that is usually not

### AZA Accreditation Standard

(2.7.1) The institution must have holding facilities or procedures for the quarantine of newly arrived animals and isolation facilities or procedures for the treatment of sick/injured animals.

(2.7.3) Quarantine, hospital, and isolation areas should be in compliance with standards/guidelines contained within the Guidelines for Zoo and Aquarium Veterinary Medical Programs and Veterinary Hospitals developed by the American Association of Zoo Veterinarians (AAZV), which can be obtained at: http://www.aazv.org/associations/6442/file s/veterinary_standards_2009_final.docx.

(2.7.2) Written, formal procedures for quarantine must be available and familiar to all staff working with quarantined animals.

(11.1.2) Training and procedures must be in place regarding zoonotic diseases.
appropriate for long-term periods. If the medical history of an animal is unknown, an extended period may be warranted. Should a new primate arrive in the quarantine facility, the minimum quarantine period of 30 days will start over.

During the quarantine period, specific diagnostic tests should be conducted with each animal if possible or from a representative sample of a larger population (e.g., birds in an aviary or frogs in a terrarium) (see Appendix E). A complete physical, including a dental examination if applicable, should be performed. Animals should be evaluated for ectoparasites and treated accordingly. Blood should be collected, analyzed and the sera banked in either a -70 °C (-94 °F) freezer or a frost-free -20 °C (-4 °F) freezer for retrospective evaluation. Fecal samples should be collected and analyzed for gastrointestinal parasites and the animals should be treated accordingly. Vaccinations should be updated as appropriate, and if the vaccination history is not known, the animal should be treated as immunologically naive and given the appropriate series of vaccinations. Tuberculosis testing should be performed on all animals while they are in quarantine, see above section for details.

Depending on the disease and history of the animals, testing protocols for animals may vary from an initial quarantine test to yearly repetitions of diagnostic tests as determined by the veterinarian. Animals should be permanently identified by their natural markings or, if necessary, marked when anesthetized or restrained (e.g., tattoo, ear notch, ear tag, etc.). Release from quarantine should be contingent upon normal results from diagnostic testing and two negative fecal tests that are spaced a minimum of two weeks apart. Medical records for each animal should be accurately maintained and easily available during the quarantine period.

Prolonged isolation from other hamadryas baboons is not recommended. Hamadryas baboons in isolation can suffer from depression-like symptoms and develop behavioral problems. Anorexia, stereotypical behavior, and over-grooming/self-mutilation are all possible. The minimum quarantine period is 30 days; however, if the medical history of the animal is unknown, an extended period may be warranted. If a baboon requires an extended stay in quarantine/isolation, steps should be taken to minimize the potential for the aforementioned issues. Increased amounts of enrichment and keeper interactions/training sessions may help alleviate some of the stress of isolation. If an animal from the existing group requires hospitalization, provision of a companion animal from the group should be considered. Housing an animal in an adjacent enclosure is a viable option, as it will allow the animals to have continual visual, olfactory, and possibly tactile contact with one another. Return of an animal to the group can be difficult if it is kept in isolation for an extended period of time (J. Wiley, personal communication, 2008).

If an animal should die in quarantine, a necropsy should be performed on it and the subsequent disposal of the body must be done in accordance with any local or federal laws (AZA Accreditation Standard 2.5.1). If the animal is on loan from another facility, the loan agreement should be consulted as to the owner’s wishes for disposition of the carcass; if nothing is stated, the owner should be consulted. Necropsies should include a detailed external and internal gross morphological examination and representative tissue samples from the body organs should be submitted for histopathological examination (see Chapter 7.6).

### 7.4 Preventive Medicine

AZA-accredited institutions should have an extensive veterinary program that must emphasize disease prevention (AZA Accreditation Standard 2.4.1). The American Association of Zoo Veterinarians (AAZV) has developed an outline of an effective preventative veterinary medicine program that should be implemented to ensure proactive veterinary care for all animals: (https://cdn.ymaws.com/www.aazv.org/resource/resmgr/files/aazvveterinaryguidelines2016.pdf). When applicable, the diagnostics listed in Chapter 7.2: Transfer Examination and Diagnostic Testing Recommendations should be performed annually as part of an institution’s preventative medicine program for baboons.

Care should be taken to ensure proper protection and to avoid any transmission of potential zoonotic pathogens to humans or to other animals in the collection. Properly maintained footbaths with
disinfectants can be helpful in preventing transmission of pathogens and should be placed at the entrance/exit of the area housing baboons. Shoes should be mechanically cleaned prior to stepping into the footbath because organic material inactivates most disinfectants. Organic matter in footbaths neutralizes the disinfectants, and the disinfectant should be replaced frequently (Occupational Primate Safety Guidelines, 2013).

Proper personal protective equipment including designated rubber boots, disposable gloves, long sleeves/pants, facial masks, and eye protection are recommended during the cleaning of any primate enclosure. Proper protective clothing should be available for personnel attending to any ill baboons as well. This includes rubber boots or shoe covers, disposable coveralls with long sleeves, face masks and disposable gloves. This equipment should not leave the animal area prior to cleaning and disinfection (Occupational Primate Safety Guidelines, 2013).

Primates are susceptible to many diseases commonly carried by humans including influenza A, hepatitis viruses, herpesviruses, and tuberculosis. Therefore, proper care should be taken to protect the baboons from infection through human contact. Humans feeling ill and/or showing symptoms of illness should not work with primates. If possible, this should include personnel with sick family members, especially children, at home. If it is not possible for sick individuals to avoid caring for baboons, masks and gloves should be worn at all times and special care should be paid to hand-washing (Occupational Primate Safety Guidelines, 2013).

Animals that are taken off zoo grounds for any purpose have the potential to be exposed to infectious agents that could spread to the rest of the institution’s healthy population. AZA-accredited institutions must have adequate protocols in place to avoid this (AZA Accreditation Standard 1.5.5). Baboons that are taken to human hospitals for medical procedures should be isolated from the rest of the group for 10-14 days after returning, to protect against introducing human pathogens into the troop. A tuberculin testing and surveillance program must be established for animal care staff, as appropriate, to protect the health of both staff and animals (AZA Accreditation Standard 11.1.3). Depending on the disease and history of the animals, testing protocols for animals may vary from an initial quarantine test, to annual repetitions of diagnostic tests as determined by the veterinarian. To prevent specific disease transmission, vaccinations should be updated as appropriate for the species.

Any zoo employee working in the primate building (including keepers, maintenance department, veterinarians, etc.) should be tested annually for tuberculosis. This is recommended for the protection of the personnel and of the animal collection.

7.5 Capture, Restraint, and Immobilization

The need for capturing, restraining and/or immobilizing an animal for normal or emergency husbandry procedures may be required. All capture equipment must be in good working order and available to authorized and trained animal care staff at all times (AZA Accreditation Standard 2.3.1).

Possible capture methods are crate/squeeze training, netting (young or female hamadryas baboons), or via chemical immobilization. Catching a hamadryas baboon with a net is a very difficult and is a potentially dangerous activity for both the handler and the animal. It is recommended that netting be avoided if possible. Training baboons via positive reinforcement techniques to enter a squeeze cage is a much better option and is easily accomplished with most individual animals. Newly built facilities are encouraged to include a squeeze cage area within the holding area.

Baboons can be immobilized via inhalant and injectable anesthetics. Injectable anesthetics are used most frequently. Baboons can be readily trained to enter a squeeze cage for delivery of injectable anesthetics, though many will willingly offer a body part for injection through a mesh barrier. The more accustomed the animal is to entering a squeeze cage and/or accepting an anesthetic injection, the less stressful the immobilization will be. A variety of anesthetic medications can be safe and effective with baboons including ketamine (6–10 mg/kg IM, IV), midazolam (0.2–0.5 mg/kg IM, IV), medetomidine

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(0.01–0.05 mg/kg IM, IV), and butorphanol (0.2–0.5 mg/kg IM, IV). Inhalant anesthetics such as isoflurane and sevoflurane can be delivered via mask or endotracheal tube as needed. Other anesthetics can be used effectively at the discretion of the attending veterinarian. Appropriate monitoring of parameters such as heart rate, respiratory rate, blood pressure, oxygen saturation, and end-tidal carbon dioxide is recommended for safe maintenance of anesthesia (Calle and Joslin, 2015; Ølberg and Sinclair, 2014).

Weakened or very young animals may be manually restrained by grasping the upper arms between the elbows and shoulders and pulling the arms slightly behind the baboon’s back. Care should be taken to ensure the arms are not being pulled beyond their normal range of motion and that the baboon can easily breathe. The lower body should be supported by a second person. Baboons can be extremely strong and have large, sharp canine teeth that can inflict serious bite wounds. The decision to manually restrain a baboon should be critically evaluated for safety (for both handler and animal); manual restraint should not be attempted with healthy, mature male baboons.

7.6 Management of Diseases, Disorders, Injuries and/or Isolation

AZA-accredited institutions should have an extensive veterinary program that manages animal diseases, disorders, or injuries and has the ability to isolate these animals in a hospital setting for treatment if necessary. The owner of an animal on loan at a facility is to be consulted prior to any elective invasive procedures, including permanent contraception.

Hamadyras baboon keepers should be trained for meeting the animal’s dietary, husbandry, and enrichment needs, as well as in restraint techniques, and recognizing behavioral indicators animals may display if their health becomes compromised (AZA Accreditation Standard 2.4.2). Protocols should be established for reporting these observations to the veterinary department.

Hospital facilities for hamadyras baboons should have radiographic equipment or access to radiographic services (AZA Accreditation Standard 2.3.2), contain appropriate equipment and supplies on hand for treatment of diseases, disorders or injuries, and have staff available that are trained to address health issues, manage short and long term medical treatments and control for zoonotic disease transmission.

Hamadyras baboons are incredibly stoic animals and rarely show signs of discomfort or illness until the situation is grave. Therefore, keepers and veterinarians should be able to interpret subtle changes in behavior in order to catch problems early enough for effective intervention. Signs of illness are similar to what is seen in other taxa and varies according to the exact diagnosis. Severity of disease/injury/etc, can be evaluated by the baboon’s ability to maintain its status in the social group. Severely ill or traumatized animals are often ostracized or lose the ability to stay with the group and effectively maintain their social position. Ill animals can become the targets of aggression and often are not defended by their (previous) allies.

Veterinary staff should always be alerted if any changes are noted that may indicate a health problem. In cases of mild to moderate disease, all efforts should be made to maintain the ill animal in its normal social group. If severe disease occurs, veterinarians may have no choice but to isolate the baboon for effective therapy. If a health problem necessitates removal of a baboon from its social group, efforts should be made to provide some level of companionship from other baboons. This may be accomplished by pulling another individual from the group that is unlikely to behave aggressively towards the patient and whose removal would not have an adverse effect to the troop. Alternatively, the ill baboon can be kept in an area that allows visual, olfactory, and vocal, but no direct contact with other animals from the group.

If hospitalization and isolation of a baboon is necessary, an enclosure with a squeeze cage to restrict movement is considered optimal. Squeeze cages allow for repeated delivery of injectable medications via subcutaneous or intramuscular administration. Occasionally a baboon’s medical condition requires placement of an intravenous catheter and a constant infusion of intravenous fluids or medications. Maintenance of an intravenous catheter in a baboon is difficult, but not impossible. Placement of the
Hamadryas baboons are generally very healthy and resilient animals in managed environments. Commonly encountered medical problems include con-specific wounding (including injury to dental structures) and age-related degenerative joint disease/osteoarthritis. Hamadryas baboons are quite aggressive and violent when interacting with one another. Both male and female baboons will fight amongst one another to jockey for social position, and males may be extremely aggressive when interacting with the females in their harem (especially when the females are cycling). Luckily, traumatic soft tissue injuries rarely require veterinary intervention in hamadryas baboons because they are extremely adept at keeping wounds clean and typically heal quickly. It is important to understand that when con-specific wounding occurs, it usually indicates some type of social stress. Removing an animal from the group can result in ongoing problems. Therefore, careful evaluation is necessary to determine if intervention is necessary. Intervention is always indicated if wounds result in damage to or exposure of vital structures, persistent hemorrhage, evidence of infection (or infection is considered likely due to the nature of the wound), and/or damage to dental structures resulting in exposure of the pulp cavity.

When injuries to the dental structures occur, efforts to preserve teeth are indicated. If the pulp cavity is exposed and enough of the crown remains, a vital pulpotomy or root canal procedure can be performed to salvage the tooth. Artificial crowns are not typically installed, but they can be considered. If cracks in the crown extend below the gum line, there is damage to the root, or there are obvious signs of infection, extraction may be indicated. Dental radiographs are essential in the evaluation of these cases.

Orthopedic fractures are occasionally encountered, typically in younger animals. Closed fractures and reasonably well-aligned fractures of the metacarpals and phalanges rarely require intervention and usually heal without incident. Long bone fractures are usually addressed surgically, employing internal fixation techniques with good results.

Age-related, degenerative joint disease occurs with high frequency in older animals. Degenerative disc disease of the spinal column is particularly well documented in geriatric baboons, and can cause decreased spinal flexibility. A variety of medications are used in treatment of the pain and inflammation associated with joint disease. Tramadol, meloxicam, gabapentin, and polysulfated glycosaminoglycans at doses extrapolated from those published for domestic animals are frequently used with apparent good results and no complications. Other age related conditions should be considered when choosing such medications, particularly kidney and liver function. If impairment is considered severe and unresponsive to medications, euthanasia should be considered (Adkesson and Rubin, 2012).

Many baboons harbor a host-adapted herpesvirus, *Herpesvirus papio* 2 (*Papiine Herpesvirus 2*). Like most herpesviruses, this virus rarely causes significant problems in baboons, but it has been reported to cause fatal pneumonia in a single hand-reared infant baboon (Wolf et al., 2006). This disease can potentially cause severe disease in non-baboon species. There is at least one report of transmission of *herpesvirus papio* 2 to a young black and white colobus monkey resulting in fatal encephalitis (Troan et al., 2007). Herpesviruses are not hardy in the environment and are deactivated by most commonly used disinfectants and cleaning techniques. Therefore, the risk of cross-species transmission in institutions holding other species in close proximity to hamadryas baboons can be easily minimized. Specific testing via serology and PCR is occasionally available through research laboratories. At the time of this writing (2017) antibody testing for herpesvirus papio 2 is available through VRL Animal Health Services laboratory (www.vrlsat.com). It is impossible to predict the susceptibility of non-baboon species to infection with *herpesvirus papio* 2, so mixed-species exhibits including hamadryas baboons should be carefully considered.

Occasionally, evidence of exposure to various viral pathogens is discovered in managed hamadryas baboons. This information should be carefully weighed in reference to the particular virus, the specific animals and their circumstances, and the importance of the animals to the population as a whole. Having a positive antibody titer to a particular virus does not absolutely mean a baboon should be culled or isolated from the population, and in most cases it is of little apparent concern. Should issues arise related to infectious disease screening, attending veterinarians are encouraged to contact the appropriate TAG and SSP veterinarians to discuss the matter.

AZA-accredited institutions must have a clear process for identifying and addressing hamadryas baboon animal welfare issues (1.5.8) The institution must develop a clear process for identifying, communicating, and addressing animal welfare concerns within the institution in a timely manner, and without retribution.
concerns within the institution (AZA Accreditation Standard 1.5.8) and should have an established Institutional Animal Welfare Committee. This process should identify the protocols needed for animal care staff members to communicate animal welfare questions or concerns to their supervisors, their Institutional Animal Welfare Committee or if necessary, the AZA Animal Welfare Committee. Protocols should be in place to document the training of staff about animal welfare issues, identification of any animal welfare issues, coordination and implementation of appropriate responses to these issues, evaluation (and adjustment of these responses if necessary) of the outcome of these responses, and the dissemination of the knowledge gained from these issues.

AZA-accredited zoos and aquariums provide superior daily care and husbandry routines, high quality diets, and regular veterinary care, to support hamadryas baboon longevity. In the occurrence of death however, information obtained from necropsies is added to a database of information that assists researchers and veterinarians in zoos and aquariums to enhance the lives of hamadryas baboons both in their care and in the wild. As stated earlier, necropsies should be conducted on deceased hamadryas baboons to determine their cause of death, and the subsequent disposal of the body must be done in accordance with local, state, or federal laws (AZA Accreditation Standard 2.5.1). If the animal is on loan from another facility, the loan agreement should be consulted as to the owner's wishes for disposition of the carcass; if nothing is stated, the owner should be consulted. Necropsies should include a detailed external and internal gross morphological examination and representative tissue samples from the body organs should be submitted for histopathological examination. Many institutions utilize private labs, partner with Universities or have their own in-house pathology department to analyze these samples. The AZA and American Association of Zoo Veterinarians (AAZV) website should be checked for any AZA Hamadryas Baboon SSP Program approved active research requests that could be filled from a necropsy.

The AZA Old World Monkey Taxon Advisory Group has established a necropsy protocol for monkeys that can be accessed on the AZA and AAZV websites. The institutions should also contact the AZA Hamadryas Baboon SSP Coordinator for any potential ongoing research projects requiring tissues collected during the post-mortem examination. All gross and histopathological findings should be recorded in a necropsy report, and the report should be sent to the AZA Hamadryas Baboon SSP Veterinary Advisor (preferably an electronic copy via email).

If possible, three samples should be collected from all organs; two samples should be placed in formalin and one should be placed in whirl-pak or zip-lock freezer bags for freezing at -59.4 ºC (-75 ºF). One sample of the formalin-fixed tissue as well as the frozen tissue should be kept at the institution for potential further investigation. One sample of the formalin-fixed tissue should be submitted to a qualified pathology laboratory for evaluation. Please contact the AZA Hamadryas Baboon SSP Coordinator for laboratory recommendations if assistance is needed.
Chapter 8. Reproduction

8.1 Reproductive Physiology and Behavior

It is important to have a comprehensive understanding of the reproductive physiology and behaviors of the animals in our care. This knowledge facilitates all aspects of reproduction, artificial insemination, birthing, rearing, and even contraception efforts that AZA-accredited zoos and aquariums strive to achieve.

Wild populations of hamadryas baboons exhibit some seasonality in reproduction; however, ex situ reproduction is based on female estrous cycles. Females in the wild reach sexual maturity at four years of age and will typically give birth every second year after reaching sexual maturity. Females' estrous cycles are approximately 30 days, and, during ovulation, females will have a pronounced genital swelling. Males reach sexual maturity at four to six years of age. In ex situ situations, animals may reach sexual maturity at a younger age.

The female's reproductive cycle averages 30 days. The perineal swelling develops to full tumescence in five to seven days, and remains at this full tumescence for about one week (Kummer, 1968). It is during this time that ovulation and conception occur. Deflation of the swollen perineal skin generally takes only one to two days. Menses occurs during the "flat" stage of the cycle, approximately seven to ten days after deflation. Females in the tumescent stage of their reproductive cycle will elicit the attention of their male. During this time, the female also is likely to receive increased aggression and wounding from the male (Zinner et al., 1994). This is due to the male's increased desire to keep this female close and under his control. It is not suggested that the female be separated from the male during this time. Reintroduction while a female is in tumescence may result in severe wounding. Staff should monitor wounding and the stress level of the female. Females may develop deceptive perineal swelling to avoid infanticide when a new male takes over the group (J. Wiley, personal communication, 2017).

It is recommended that caretakers monitor and chart female estrus swellings (AZA Old World Monkey TAG, 2006) to predict pregnancy and parturition. Gestation for hamadryas baboons is six months (180 days) from the last day of full tumescence (Polo and Colmenares, 2016). Hormone patterns can be determined through the analysis of urine. The analysis of complete cycles can identify cycle length and regularity in addition to potential days of ovulation. Urine analysis can also assess hormonal activity in younger females for the purpose of contraception. Ovarian and estrous synchronization is still undergoing investigation in this species, but has been documented in some populations. Baboons are not seasonal breeders as reproductive events occur year-round, but studies have shown that they may show "moderate seasonal clustering" of reproductive events (Polo and Colmenares, 2016; Zinner et al., 1994; Tobler et al., 2010). A 30 year retrospective study of a colony in Spain showed that conceptions were clustered from March through July, births from September through February, resumptions of ovarian activity from February through June, and menarches from March through September (Polo and Colmenares, 2016).

If conjugal visits with an outside male are the planned method for reproduction, females should be separated from their groups and introduced to breeding males during times of receptivity. Females may be fertile several days before their fullest physical swelling. It is preferable that the females be returned to their social groups as soon as possible (preferably within the same day) to reduce social upheaval within the group. The behavior of the animals once paired provides a good indication of the females' receptivity. If upon introduction, the male exhibits behaviors such as smiling at the female, slowly pursuing her or inspecting her genitals with his hands or mouth, he is more likely to mount her than if he ignores her upon introduction. If the conjugal visit is conducted in the visual or auditory presence of the social group's dominant male and the female is quickly reunited with the group, the chances for conception may be reduced because it is likely that the dominant male will immediately copulate with the female thus removing the copulatory plug left by the breeding male.

8.2 Assisted Reproductive Technology

The practical use of artificial insemination (AI) with animals was developed during the early 1900s to replicate desirable livestock characteristics to more progeny. Over the last decade or so, AZA-accredited zoos and aquariums have begun using AI processes more often with many of the animals residing in their care. AZA Studbooks are designed to help manage animal populations by providing detailed genetic and demographic analyses to promote genetic diversity with breeding pair decisions within and between our
institutions. While these decisions are based upon sound biological reasoning, the efforts needed to ensure that transports and introductions are done properly to facilitate breeding between the animals are often quite complex, exhaustive, and expensive, and conception is not guaranteed.

AI has become an increasingly popular technology that is being used to meet the needs identified in the AZA Studbooks without having to re-locate animals. Males are trained to voluntarily produce semen samples and females are being trained for voluntary insemination and pregnancy monitoring procedures such as blood and urine hormone measurements and ultrasound evaluations. Techniques used to preserve, and freeze semen have been achieved with a variety, but not all, species and should be investigated further.

Besides physical issues, AI procedures also bring issues of ownership of semen and/or the animal being inseminated. Very often, semen from multiple animals may be used. As with any natural (physical) breeding, the rights of the owners of all materials and animals involved must be considered. Appropriate transaction documents (and loan agreements, if appropriate) must be fully completed before AI is attempted.

Despite the ability to achieve AI, hamadryas baboons breed well in zoos, and AI is not needed at this time. However, semen collection is currently being trained via operant conditioning for this species in preparation of possible future AI research. To date, AI for hamadryas baboons has not been used in AZA-accredited facilities, but it may be used in the future to assist with the genetic needs in the managed population (J. Wiley, personal communication, 2014).

8.3 Pregnancy and Parturition

It is extremely important to understand the physiological and behavioral changes that occur throughout an animal’s pregnancy. The average gestation for hamadryas baboons is 180 days. As parturition nears, it is recommended to offer more bedding where the female is likely to give birth. The female will often show some physical or behavioral signs that birth is approaching. In some cases, the perineum will have a slight swelling and the male will show increased attention and possible breeding with the female. There may be a bloody or clear discharge from the vaginal area. Sometimes abdominal contractions can also be observed.

No special management changes are required for pregnant hamadryas baboon females, and females should be left with their groups for parturition and rearing of the infant. It is recommended to avoid separating a pregnant female baboon from the troop due to possible complications. Stress caused by separation can cause a pregnant female to go into premature labor. Separating a female also increases the chance of infanticide to occur if another male reclaims her into his OMU. A careful re-introduction plan is necessary to lessen the danger in the separation process. If separation is deemed necessary, the steps below should be followed (J. Wiley, personal communication, 2008).

- Once the female is separated from the troop, the female should be closely monitored for premature labor and/or miscarriage (vaginal bleeding, straining, or distress).
- The pregnant baboon’s OMU can remain together along with the rest of the troop during the separation period.
- When it’s time to re-introduce the female back to the troop, the female’s entire OMU (sire of the fetus) should be separated from the troop.
- The pregnant female is recommended to be introduced to her OMU and remain with only her OMU until the unit appears to be stable and the male appears to have reclaimed her into his unit (mounting, tail sweep, excessive herding, etc.). This usually takes only a few minutes; in some instances, more time might be necessary.
- During the initial introduction of the pregnant baboon into the OMU, the remaining troop should have visual access to the OMU so that the other adult males will respect the bond between the pregnant female and her corresponding male.
- Once the female has been accepted back into her OMU, the remaining troop can be introduced.
- Careful observation of this introduction is necessary to ensure that the pregnant baboon stays with her OMU.
- After the re-introduction has occurred, the pregnant female should be closely monitored for premature labor and/or miscarriage (vaginal bleeding, straining, or distress).

See Section 5.3 for more information on introductions.
8.4 Birthing Facilities

As parturition approaches, animal care staff should ensure that the mother is comfortable in the area where the birth will take place. Birth management plans can be very useful in preparing for a birth. Written when a breeding recommendation is given, these plans outline the individuals’ reproductive and medical history as well as the institutional plan for all aspects of management of the pregnancy, birth, and resulting rearing.

Institutions should inspect their facilities prior to a birth to look for any issues that may cause harm to a baby. These may include gaps where an infant’s head can get stuck, ropes that can loop around a neck, hard enrichment items that may be thrown, etc.

8.5 Assisted Rearing

Although mothers may successfully give birth, there are times when they are not able to properly care for their offspring, both in the wild and in ex situ populations. Fortunately, animal care staff in AZA-accredited institutions are able to assist with the rearing of these offspring when deemed necessary. Infants should not be removed from their mothers’ care unless the health of the mother or the infant is severely compromised. If the mother needs to be removed from the group for medical treatment, the infant should be returned to its mother at the earliest possible time. Medications can be used to encourage the production of milk upon the mother’s recovery. If the infant demonstrates a weak grip or poor nursing response, it should be monitored carefully and only removed from the mother in cases of severe health issues. If the infant needs to be hand-reared for any length of time, it is recommended to be cared for within sight of the baboon group instead of being removed to a hospital or nursery. This may ease its transition back into the group upon recovery. Prior to parturition, it is important to be prepared and have a hand rearing protocol in place if it is needed. See Appendix I for an example hand rearing protocol.

Once an infant is born, the following questions should be addressed before pulling the infant from the mother:

- Does the infant appear deserted?
- Are there any other baboons nearby?
- Who is holding the infant?
- Is it getting back to its mother or nurse?
- Is the infant nursing from another lactating female?
- Is there any injury to infant?
- Is there anything requiring veterinary care or that requires pulling?
- Is the infant weak?
- Have its cries diminished in intensity throughout the day?

Cries will intensify if the infant is hungry, but they will diminish as it gets weaker. Additionally, it is recommended to not rush to pull an infant if it is being handled roughly, but to give the mom a chance to prove herself. The first 24–72 hours are critical nursing times. It is recommended to observe closely for nursing during this time.

In cases where the infant remains out of the group for an extended period of time, the infant should be encouraged to develop skills that will be necessary for reintroduction to the group, such as a strong grip, the ability to climb, and the ability to soothe itself when stressed. The infant should be started on solid foods as soon as is feasible. The infant should be trained to come to the caregiver for its nutritional support so that it can be supplemented by care staff upon reintroduction. The infant should be familiarized with all forms of behavioral enrichment used with the group and the group’s enclosure and climbing structures prior to being integrated with the group. Husbandry training with the group members can also ease the transition. Individuals can be trained to separate, feed cooperatively, and allow an infant bottle to be placed through the mesh without bothering it.

Once the infant is self-sufficient enough to be returned to the group, it is advisable to limit the initial phase to a small number of individuals (i.e., mother and sibling). It is recommended that the infant be introduced first to a female that caregivers feel will protect it. Common primate introduction techniques involve a period of tactile contact through a panel of mesh before the full physical introduction. Once the infant has been successfully integrated with a few group members, begin introducing other members,
being mindful of dominance hierarchies. Always ensure that the infant has a protector when reintroducing adult males, as infanticide has been documented with baboons (Swedell & Tesfaye, 2003).

8.6 Contraception

Many animals cared for in AZA-accredited institutions breed so successfully that contraception techniques are implemented to ensure that the population remains at a healthy size. In the case of an animal on loan from another facility, consult the loan agreement or owner regarding authority to contraccept. In the case of permanent contraception, prior permission of the animal’s owner must be obtained.

The recommendation for long-term contraception by the AZA Contraception Advisory Group (CAG) for all AZA Old World Monkeys is a MGA (melengesterol acetate) implant. MGA implants need to be administered every two years and, to this point, have shown no serious deleterious effects. These implants should be inserted between the scapulae, intra-muscularly if possible. There has also been good success in implanting the MGA between the muscles of the upper thigh. Suturing the implant in place at the time of insertion may control migration of the implant. It is possible for the implants to be groomed out by conspecifics in certain situations. It is highly recommended that the implant be fitted with a microchip or transponder for easier location (AZA Old World Monkey TAG, 2006). This will also ease the retrieval of the implant and will allow confirmation of placement via operant conditioning. The implant’s presence should be confirmed each time the animal is handled (AZA, 2004). Individuals who have become pregnant while on the implant (due to lack of proper separation during the initial stages of the implant) have had normal pregnancies and given birth to normally developed infants (C. Ketz-Riley, personal communication, 2010; J. Wiley, personal communication, 2010). Since female hamadryas baboons implanted with MGA implants do not exhibit sexual swellings, these implants can aid in decreased aggression within the troop. Females in full estrus can create social strife and increased aggression in a troop, especially if only one female is cycling at a time. By eliminating the sexual swelling through contraception, male aggression towards females should be reduced, which will have a stabilizing effect on the social dynamics of the group.

Hamadryas baboon females have been given Depo-Provera® (medroxyprogesterone acetate) injections as a means of contraception after a birth if they are not recommended to breed again. These intramuscular injections can usually be administered through training and do not require anesthesia or sedation to accomplish. This temporary measure typically lasts 90 days, and is used until the staff veterinarian feels it is safe to immobilize the female and offspring in order to place an implant. Depo-Provera® is a progesterone-based drug that supports lactation and will not affect milk production, but should not be used in pregnant females. Dosing and usage recommendations are made based on information from the AZA Reproductive Management Center and can be found at the following website: https://www.stlzoo.org/animals/scienceresearch/reproductivemanagementcenter/contraceptionrecommenda tion/contraceptionmethods/depo-provera. Contraception effects of Depo-Provera® can take several days to begin, and it is recommended that females be separated for 1-2 weeks before they are considered safe from becoming pregnant (AZA Reproductive Management Center, 2017). Depo-Provera® should suppress estrous swellings in the females. Institutions will need to continue administering injections until surgery for an implant can be performed. More permanent methods of sterilization in females should be avoided unless they are specifically recommended by the AZA Hamadryas Baboon SSP or are necessary to preserve the life of the animal. An ovariohysterectomy is a standard procedure that can be performed by most veterinarians.

Contraception in males is most often achieved through vasectomy or castration. However, vasectomy will not alleviate issues of conspecific aggression due to testosterone, so should only be used as a means of birth control, not behavioral modification. Hamadryas baboon males are not recommended for castration because they lose their secondary male characteristics, and there is typically a behavioral change in the males. Temporary separation is acceptable if groups of more than one are maintained. Single separation is acceptable for short periods of time.

Recently, at the recommendation of the AZA CAG (as part of a research study), several institutions have used Suprelorin®, which contains the GnRH agonist deslorelin, as a contraception technique for hamadryas baboons (S. Boutelle, personal communication, 2010). Deslorelin functions by stopping the production of sex hormones. Deslorelin is an option for contraception in males as well as females, but its use in hamadryas baboons needs further study to determine efficacy and reversibility. Deslorelin placement is followed by a two to three week stimulation for males and females (either testosterone or
estrogen), which can lead to heightened fertility. Separation during this time is important to prevent conception or increased aggression in males. An alternative to separation is an oral progestin regimen that requires dosing for seven days prior to and eight days following deslorelin placement. Unfortunately, the longevity of the contraception is still being tested.

There were no confirmed pregnancies in animals that had previously received Suprelorin® until recently. There have been two successful births in two hamadryas baboons after receiving the deslorelin implant. The implant (which could not be removed) suppressed ovulation for four years in both animals, but both females were impregnated after two full estrous cycles once they began to cycle again. Both infants appear to be in good health. Information on how deslorelin has affected the future reproduction of hamadryas baboons is still being gathered, and further research is needed to determine if this is a form of contraception that is appropriate for this species (J. Wiley, personal communication, 2012).

Each institution will need to decide the methods of contraception based on their needs. Please consult the AZA Hamadryas Baboon SSP Coordinator for permanent forms of contraception. It is also recommended that zoos contact the AZA Reproductive Management Center (https://www.stlzoo.org/animals/scienceresearch/reproductivemanagementcenter/) for the most current information on suggested contraception and dosing for hamadryas baboons.
Chapter 9. Behavior Management

9.1 Animal Training

Classical and operant conditioning techniques have been used to train animals for over a century. Classical conditioning is a form of associative learning demonstrated by Ivan Pavlov. Classical conditioning involves the presentation of a neutral stimulus that will be conditioned (CS) along with an unconditioned stimulus (US) that evokes an innate, often reflexive, response. If the CS and the US are repeatedly paired, eventually the two stimuli become associated and the animal will begin to produce a conditioned behavioral response to the CS.

Operant conditioning uses the consequences of a behavior to modify the occurrence and form of that behavior. Reinforcement and punishment are the core tools of operant conditioning. Positive reinforcement occurs when a behavior is followed by a favorable stimulus to increase the frequency of that behavior. Negative reinforcement occurs when a behavior is followed by the removal of an aversive stimulus to also increase the frequency of that behavior. Positive punishment occurs when a behavior is followed by an aversive stimulus to decrease the frequency of that behavior. Negative punishment occurs when a behavior is followed by the removal of a favorable stimulus also to decrease the frequency of that behavior.

AZA-accredited institutions are expected to utilize reinforcing conditioning techniques to facilitate husbandry procedures and behavioral research investigations. Operant conditioning is very commonly used with hamadryas baboons and is essential for day to day management and useful for reducing stress during medical procedures. Hamadryas baboons have been successfully trained for both simple behaviors like stationing, shifting, and obtaining weights as well as more complex behaviors like voluntary injections, blood draws, and ultrasounds. For a complete list of commonly trained behaviors and signals, refer to Appendix J and Appendix K. A structured training program utilizing positive reinforcement techniques is not only warranted, but it is critical to good husbandry practices. Training encourages the animal to tolerate close proximity to caregivers and provides general observational opportunities (e.g., inspection of animal's physical appearance, identify nature/extent of injury or illness, determine changes in appetite, etc.).

It is preferable to train each animal individually, but, due to the social structure of this species, it is often difficult to separate out individual animals. In very large groups, if the facility allows, it is often possible to train animals within their OMUs by separating out each OMU instead of each individual. If multiple trainers are available, one can focus on the male while other trainer(s) can focus on female and juvenile baboons. Depending on the relationships within the groups, it is often possible for one trainer to work with the male and one or more females. The key to this type of training is a strong stationing behavior with all the animals and very high rate of reinforcement for the male along with gradually decreasing rates of reinforcement for the females in descending order of rank. It is also possible to train the male to separate from his females during training as long as visual access is maintained for all members of the group. The male should be the first and last animal to be reinforced in this situation, and it is a good practice to occasionally reinforce him for calm behavior while the focus of the session is on the females.

The key to being successful with training a group of animals is to begin with cooperative feeding within the group. This practice ideally begins after a bridge has already been conditioned. Sessions including two trainers are the easiest way to start, but cooperative feeding can be accomplished with one trainer. The goal of the session is to bridge and reinforce the dominant animal for allowing the subordinate animal to take reinforcement. Depending on the relationship of the individuals, it may be easier to begin the process with two trainers who work together and communicate well. Station or call the dominant animal to his trainer; once he is settled into his designated spot, the subordinate animal may be called to his spot. Each time the subordinate animal is offered food, the dominant animal should be bridged and reinforced. The first few sessions may result in some splitting of the dominant animal, but continuing to call him back to his spot and moving on with the sessions with a high rate of reinforcement for appropriate behavior will quickly cause him to lose interest in leaving his trainer. When the dominant animal becomes comfortable in his spot and rarely breaks station, move the subordinate animal closer and continue to approximate in this way until both animals may be fed by one trainer. It is recommended...
Ultrasounds are certainly a consideration because the ability to lock all animals inside their night quarters during an emergency can mean the difference between life and death during a natural disaster or an animal escape. In choosing a recall sound, consideration should be given to the range of hearing of the species in question. It is assumed that hamadryas baboons have a similar range of hearing to other Old World primates. To set the baboons up for success, be sure that the recall stimulus is easily heard from anywhere in the exhibit. The sound can be anything from an electronic doorbell to a simple cowbell as long as it can be heard from anyplace the baboons may be. All OMUs should respond to the recall. Begin this training by sounding the recall at a time that you can be reasonably sure that the baboons will shift inside and provide a primary reinforcer. Once the recall stimulus has been paired regularly and the baboons seem to be responding, begin to shift the time of the recall gradually until you can get a solid recall no matter the time of day. Always provide a primary reinforcer to maintain the strength of this behavior. Periodically practice at different times of day to maintain the recall.

More complex behaviors such as voluntary injections or ultrasounds are certainly easier if the facility provides a chute or other small area with which to work with an individual. However, it is possible to train complex behaviors within the group as long as the schedule of reinforcement remains high for stationing behaviors with the rest of the group. Hamadryas baboons have been successfully trained to present body parts such as hands, feet, and bellies for manipulation. Ultrasounds is a particularly useful behavior for females in a breeding situation. The belly present may be gradually approximated using a target. Once the manual manipulation portion of the training begins, the male may become very protective. Allow the male to observe the training and reinforce him heavily for remaining on station. Always remember that it is the male’s job to protect his females, and approximate slowly. If the female feels threatened, the male will intervene. If the trainers have taken the time to build trust between themselves and the baboons through positive reinforcement, the training sessions will be smoother, and more progress will happen in a shorter amount of time.

When training behaviors for medical exams, meet with the veterinary staff in advance. It is important to know as much about the procedure as possible before beginning training. Some sample questions to ask the veterinary staff are:

- What tools or machinery will need to be brought into the animal area?
- How many veterinary staff are required and which members? Can it be limited to the minimum number needed for the procedure?
- Can veterinary staff participate in the training?
- How does the animal need to be positioned? How long does the animal need to maintain this position?
- How much of this procedure can be done by keepers?
- Can the animal have food/liquid during the procedure for reinforcement? What type/amount of reinforcement is acceptable (juice, soft foods)?
- Can the keeper/trainer give the injection/draw blood?
  - Is the injection intramuscular or subcutaneous?
  - Where on the animal’s body is the best place for the injection? What is the best place to draw blood? (Female baboons often have very small veins in the arm; the back of the leg is often easier to access in this case).
  - What is the volume of the injection? What is the volume of blood needed?
  - What size syringe and needle will be used?
  - Does the injectable medication sting?
  - A maximum number of needle sticks (two to three) should be agreed upon in advance before the procedure is rescheduled for another day in order to prevent the behavior from breaking down.
- How much of an ultrasound or radiograph can the keepers do?
  - Can the keepers apply the ultrasound gel?
  - Can the gel be heated before being applied?
  - Can keepers work the transducer while vets monitor the screen?
  - What position does the animal need to be in and for how long?
9.2 Environmental Enrichment

Environmental enrichment, also called behavioral enrichment, refers to the practice of providing a variety of stimuli to the animal’s environment, or changing the environment itself to increase physical activity, stimulate cognition, and promote natural behaviors. Stimuli, including natural and artificial objects, scents, and sounds are presented in a safe way for the hamadryas baboons to interact with. Some suggestions include providing food in a variety of ways (i.e., frozen in ice or in a manner that requires an animal to solve simple puzzles to obtain it), using the presence or scent/sounds of other animals of the same or different species, and incorporating an animal training (husbandry or behavioral research) regime in the daily schedule.

Enrichment programs for hamadryas baboons should take into account the natural history of the species, individual needs of the animals, and facility constraints. The hamadryas baboon enrichment plan should include the following elements: goal setting, planning and approval process, implementation, documentation/record-keeping, evaluation, and subsequent program refinement. The hamadryas baboon enrichment program should ensure that all environmental enrichment devices (EEDs) are “hamadryas baboon” safe and are presented on a variable schedule to prevent habituation. AZA-accredited institutions must have a formal written enrichment program that promotes hamadryas baboon-appropriate behavioral opportunities (AZA Accreditation Standard 1.6.1).

Hamadryas baboon enrichment programs should be integrated with veterinary care, nutrition, and animal training programs to maximize the effectiveness and quality of animal care provided. AZA-accredited institutions must have specific staff members assigned to oversee, implement, train, and coordinate interdepartmental enrichment programs (AZA Accreditation Standard 1.6.2).

Hamadryas baboons are inquisitive animals, and all five categories of enrichment (social, sensory, food/forage, manipulative, environmental) should be offered. Encouraging natural behaviors as well as amelioration and prevention of stereotypies should be the top goals of the enrichment program. In the wild, hamadryas baboon social units travel eight or more kilometers daily between their sleeping cliff and their forage spots (Kummer, 1995); therefore, socialization, exercise, and activity are critical components of an enrichment program particularly for young, healthy baboons. Exhibits should be designed and built with large enough areas to allow travel for enrichment and forage. Food is often scarce in the wild, and the baboons are required to dig for water or edible roots (Kummer, 1995), so digging areas are strongly suggested. Even with designated digging pits, hamadryas baboons have been known to destroy exhibits with their need to dig. They are also exquisite climbers, often scaling sheer rock cliffs in the wild (Kummer, 1995) to find safe sleeping spots, and climbing structures and/or trees should be provided and vertical space maximized within the exhibit.

A great number of enrichment devices can be used with hamadryas baboons (see Appendix O). Boomer or Jolly balls with or without holes for foodstuffs are popular. PVC puzzle feeders consisting of a length of PVC 15–46 cm (6–18 in.) in length with end caps and holes drilled in them for seed mixtures or food stuffs are quite excellent for extending foraging times, particularly for animals that tend to stuff cheek pouches. The PVC feeders can be extended further by adding another piece of PVC with a slightly larger diameter, but a shorter length and layering the two pipes to increase the difficulty of the puzzle.
Alternatively, 10–15 cm (4–6 in.) long PVC caps may be strung together with food stuffs hidden in the stacking cups. All varieties of edible browse are excellent enrichment, particularly when left in large pieces that the OMU may forage on together. Food items or even juices may be frozen into popsicles. Pits dug into the exhibit or even child pools filled with sand, soil, wood chips, or straw are all excellent forage devices and allow the natural digging behavior that hamadryas baboons crave. Digging pits also encourage activity to more closely approximate the activity level of wild hamadryas baboons (see Figure 5). Simple cardboard boxes may be used, and shredded paper is also an acceptable form of enrichment. Forage boards or logs with holes drilled in them may also be used to extend feeding times. Hamadryas baboons have been known to utilize toys designed for toddlers, likely due to the colorful, cognitive, and manipulative nature of the toys. Cutting food into small pieces and spreading it throughout the exhibit will also extend forage time and increase travel. Fabricated climbing structures, simple piles of large logs that are secured in place, or even full grown trees are popular. It is very important that the structure be large enough for all members of the OMU to sit on it simultaneously, though not necessarily at the same height.

Having evolved in the harsh environment of the desert, hamadryas baboons are natural problem solvers. Providing them opportunities for husbandry training will stimulate those natural problem solving skills in addition to making daily management easier for keepers and caretakers. It is important to note that the training of new behaviors is enriching due to the problem solving process but maintaining established behaviors should not be considered enrichment. For a socially and cognitively complex species such as hamadryas baboons, the learning process keeps them actively engaged in their environment, which can prevent the development of stereotypies based on boredom.

Stereotypies typical of hamadryas baboons are similar to those of other primates and include hair plucking, eye poking, head rolling and floating limbs etc. Stereotypies are easier to prevent than to fix, so complex environments and active goal setting enrichment programs are critical for this species. Animals with severe stereotypies do not make good exhibit animals and may compromise the “respect for wildlife” message for which the modern zoo strives (Jones et al., 2001).

Enrichment devices should be assessed for safety of all members of the group prior to being offered to any of them. Enrichment devices should be offered in sufficient numbers as to allow each juvenile and adult animal to access at least one device. Questions to assist in the planning process include:

- Can the animal become tangled up in the device?
- Is the device a choking hazard or could it cause gut impaction?
- Are there any toxic materials?
- Are there sharp edges or splinters that could cause an injury?
- Are the holes of a size that will prevent an animal from getting a head or limb stuck in them?

Enrichment should be provided on a variable schedule, not only so that the baboons get a variety of enrichment categories, but so that the categories are evenly distributed throughout the week. One way to encourage a variety of enrichment without stifling keeper creativity is to create a calendar of enrichment categories, and allow keepers and caretakers to choose items from within the designated category for each day (J. Wiley, personal communication, 2012).

Enrichment foodstuffs are commonly used to encourage hamadryas baboons to interact with devices or new items. It is strongly recommended that these food stuffs be factored in as part of the baboons’ diets. It is important to prevent obesity in baboons to avoid common diseases such as diabetes or arthritis. It is also important to encourage movement as much as possible for the group, as hamadryas baboons are known to travel long distances in the wild. More movement will also allow for more calories...
and more enrichment food so long as the baboons can be weighed and are able to maintain a healthy weight for all individuals in the group (J. Wiley, personal communication, 2012).

9.3 Staff and Animal Interactions

Animal training and environmental enrichment protocols and techniques should be based on interactions that promote safety for all involved. Hamadryas baboon facilities should be designed to maximize keeper safety while still allowing access to animals as needed for good husbandry. Protected contact allows keepers and animals to remain in separate spaces while still allowing keepers the flexibility to train animals through fencing. Fencing openings should be large enough to allow training tools through as needed, but should be small enough to prevent baboons from reaching out to grab keepers.

Keepers should also be able to shift baboons between spaces to allow for cleaning and exhibit maintenance. Baboon facilities should be designed in such a way as to be flexible enough to separate OMUs as needed. Ideally a training chute should be incorporated into the design. Chutes that run between stalls allow staff to filter animals one at a time to facilitate training or separations of ill individuals. A training chute can also be used to separate individual animals for training sessions. Chutes may have larger grade openings in the fencing than the rest of the exhibit or even hatches to facilitate training for ultrasound, injection, or blood draws. A blood sleeve built into the chute is useful for adult male baboons, but females and juveniles often have better veins in the back of the legs. Training sessions and day to day maintenance of animals should occur in a protected contact setting. Gloves, long sleeves, and masks can prevent zoonotic disease transmission, and staff who are ill should not work in the area. If keeper or veterinary staff need to enter the enclosure with adult animals, it is recommended that the animal is anesthetized first through trained voluntary injection. Darting the animal may be a possibility if the individual is able to be separated from their OMU. If the individual is not able to be separated, it is extremely dangerous to dart as the group will rally to protect the targeted individual. If it is absolutely necessary to enter the enclosure without anesthetizing the animal, staff should use leather gloves, nets and face shields to enter and restrain the animal. A meeting should occur just prior to the capture and restraint to ensure that everyone knows his/her role in the procedure. This will minimize the amount of time needed for the procedure and create a smoother process which will reduce the stress on the baboons.

Hamadryas baboons should be managed in a protected contact situation at all times during daily maintenance. Baboons should be shifted off exhibit and secured for cleaning and set up. There should be a lockout mechanism to prevent another keeper from accidentally opening a door and allowing baboons access to an area where people are working. Doors and their remote mechanisms should be clearly marked to prevent the opening of the wrong door accidentally. Doors should also be able to be operated in such a way to allow keepers to stop the door if an animal stops in a doorway to prevent injury to the baboon. If several OMUs are housed at the facility, there should be enough space to separate out each OMU as needed, particularly in small spaces such as holding or night quarters.

9.4 Staff Skills and Training

Hamadryas baboon staff members should be trained in all areas of hamadryas baboon behavior management. Funding should be provided for AZA continuing education courses, related meetings, conference participation, and other professional opportunities. A reference library appropriate to the size and complexity of the institution should be available to all staff and volunteers to provide them with accurate information on the behavioral needs of the animals with which they work.

Staff is encouraged to be thoroughly informed and comfortable with using positive reinforcement training. While these skills can take time to develop, there are countless books on the subject that should be made available to keepers. Keepers should also be encouraged and supported to attend conferences and workshops on the topic. Other resources include newsletters from professional organizations such as Animal Behavior Management Alliance’s (ABMA) Wellspring and American Association of Zookeepers’ (AAZK) Animal Keeper’s Forum. New staff members may also be paired with more experienced staff or offered the opportunity to observe training sessions in other areas to increase their knowledge. Staff should also have the opportunity to communicate with staff at other facilities working with the same or similar species to share ideas and advice. This can be done through AZA’s online networks -operator conditioning or enrichment as well as the Old World monkey network.
Enrichment is encouraged to go through an approval process before being implemented, and staff should have access to lists of approved items from other facilities. There are also many books and workshops available on the subject of enrichment and a library should be kept for keepers to access as needed. Newsletters from *The Shape of Enrichment* and ABMA’s *Wellspring* are also excellent resources for keepers on the subject of enrichment.

Keepers are encouraged to be trained in enrichment goal setting and should be able to list and recognize goal behaviors in the hamadryas baboon activity budget. Keepers should also be able to recognize common stereotypies and ways to prevent them. Training keepers in behavioral observation techniques and maintaining an ethogram (Appendices N and O) for reference are critical to evaluating the success of the enrichment plan. Enrichment plans should be adjusted as needed to achieve the goals of the program.
10.1 Known Methodologies

AZA believes that contemporary hamadryas baboon management, husbandry, veterinary care and conservation practices should be based in science, and that a commitment to scientific research, both basic and applied, is a trademark of the modern zoological park and aquarium. AZA-accredited institutions have the invaluable opportunity, and are expected, to conduct or facilitate research both in *in situ* and *ex situ* settings to advance scientific knowledge of the animals in our care and enhance the conservation of wild populations. Participating in AZA Taxon Advisory Group (TAG) or Species Survival Plan® (SSP) Program sponsored research when applicable, conducting original research projects, affiliated with local universities, and/or employing staff with scientific credentials could help achieve this (AZA Accreditation Standard 5.3).

All record-keeping requirements noted previously apply to most research animals, especially those which are part of the exhibit collection. When an animal on loan to a facility is subject to an invasive research procedure, including when done as part of a routine health exam, the owner’s prior permission is to be obtained.

Research investigations, whether observational, behavioral, physiological, or genetically based, should have a clear scientific purpose with the reasonable expectation that they will increase our understanding of the species being investigated and may provide results which benefit the health or welfare of animals in wild populations. Many AZA-accredited institutions incorporate superior positive reinforcement training programs into their routine schedules to facilitate sensory, cognitive, and physiological research investigations and these types of programs are strongly encouraged by the AZA.

There have been several AZA Hamadryas Baboon SSP solicited research programs in the past. Those research projects have included tissue samples, banked serum, hair, and fecal collection, as well as some cognitive studies. Most of the research projects have centered on taxonomic classification, diets, diseases, genetics, and cognition. It is recommended for institutions to bank serum and tissue samples for future use in research requests. This can be facilitated through routine physical exams. It has also been requested through the AZA Old World Monkey TAG that body measurements be taken during physical exams to be contributed to a primate database. Data sheets can be requested from the AZA Hamadryas Baboon SSP coordinator or TAG chair. Institutions conducting research are encouraged to communicate with the AZA Hamadryas Baboon SSP to share the design and results of any studies.

There has been great success to facilitate cognitive studies with hamadryas baboons via operant conditioning. These studies have been quite successful and appear to be enriching to the subjects.

Data from a yearlong hamadryas baboon wounding study was collected in 2012 which evaluated the severity and frequency of wounds based on troop compositions housed in AZA institutions. Information from this study is in the process of being evaluated and will be a good reference for determining social groupings of hamadryas baboons in the future (Wiley JN, et al, 2018).

AZA-accredited institutions are required to have a clearly written research policy that identifies the types of research being conducted, methods used, staff involved, evaluations of the projects, the animals included, and guidelines for the reporting or publication of any findings (AZA Accreditation Standard 5.2). Institutions must designate a qualified individual to oversee and direct its research program (AZA Accreditation Standard 5.1).

An Institutional Animal Care and Use Committee (IACUC) should be established within the institution if animals are included in research or instructional programs. The IACUC should be responsible for reviewing all research protocols and conducting evaluations of the institution’s animal care and use.

If institutions are not able to conduct in-house research...
investigations, they are strongly encouraged to provide financial, personnel, logistical, and other support for priority research and conservation initiatives identified by Taxon Advisory Groups (TAGs) or Species Survival Plans® (SSP) Programs.

10.2 Future Research Needs

This Animal Care Manual is a dynamic document that will need to be updated as new information is acquired. Knowledge gaps have been identified throughout the Manual and are included in this section to promote future research investigations. Knowledge gained from these areas will maximize AZA-accredited institutions’ capacity for excellence in animal care and welfare as well as enhance conservation initiatives for the species.

Sound and Vibration: It may be possible that sound and vibrations may lead to increased stress (over grooming/ stereotypies/ aggression) in baboons; however, there is little data to confirm this speculation.

Social Groupings: As of 2014, there are only two AZA institutions that currently house bachelor troops of hamadryas baboons. It is important to collect information from these institutions on space needs of housing such troops, introduction methods, exhibit design, etc.

Contraception: MGAs contraception implants frequently migrate out of place, but it would be beneficial to be able to implant these for longer periods of time. Long term studies on deslorelin reversals and duration is needed. Information on how deslorelin has affected the future reproduction of hamadryas baboons is still being gathered, and further research is needed to determine if this is a form of contraception that is appropriate for this species.

Mixed Species Exhibits: The most successful species to mix with hamadryas baboons are ibex, but further research would need to be done to determine if other species would be compatible.
Chapter 11. Other Considerations

11.1 Surplus Animals

All SSP species held by institutions should be reported to the SSP Program Leaders. The SSP Program Leader should be responsible for making the decision as to whether or not specific animals are to be included in the managed population (e.g., over-represented animals or animals beyond reproductive age). Those animals not included in the managed population should be considered surplus to the managed population, but records still must be maintained on them to the same degree as those in the managed population.

Hamadryas baboons are managed by the SSP if they are housed in an AZA-accredited institution. There have been multiple occasions that baboons have been moved from unaccredited institutions to AZA institutions, and, at that time, those individuals become part of the managed population. It is not recommended that hamadryas baboons are moved from AZA institutions to non-AZA institutions, and the SSP Program leader will make every effort to relocate those animals to another AZA institution by contacting institutions that house hamadryas baboons and by contacting the AZA Old World Monkey TAG. If there is no other choice than for the baboon to be moved to an unaccredited institution, then that individual would still be part of the managed population.
Acknowledgements

The AZA Hamadryas Baboon SSP would like to acknowledge all the members of the management group over the last 10 years for their contributions to the first draft of the Hamadryas Baboon Care Manual. We would also like to thank the managers of the other AZA Old World Monkey TAG Species Survival Plan® Programs, particularly the Colobus SSP, who provided many references for information found in this manual.
References


OSHA. Regulations (Occupational Safety & Health Administration) (1984). Standard 1910.95 (c) (1) Appendix F.


**Personal Communications**

Photo Credits
Jodi Wiley, Hamadryas Baboon SSP Coordinator, North Carolina Zoological Park
Terry Webb, Curator of Mammals, Zoo Miami
Margaret Rousser, Zoological Manager, Oakland Zoo
Appendix A: Accreditation Standards by Chapter

The following specific standards of care relevant to hamadryas baboons are taken from the AZA Accreditation Standards and Related Policies (AZA, 2011) and are referenced fully within the chapters of this animal care manual:

General Information

(1.1.1) The institution must comply with all relevant local, state/provincial, and federal wildlife laws and regulations. It is understood that, in some cases, AZA accreditation standards are more stringent than existing laws and regulations. In these cases the AZA standard must be met.

Chapter 1

(1.5.7) The animals must be protected from weather or other environmental conditions clearly known to be detrimental to their health.

(10.2.1) Critical life-support systems for the animals, including but not limited to plumbing, heating, cooling, aeration, and filtration, must be equipped with a warning mechanism, and emergency backup systems must be available. All mechanical equipment must be kept in working order and should be under a preventative maintenance program as evidenced through a record-keeping system. Special equipment should be maintained under a maintenance agreement, or a training record should show that staff members are trained for specified maintenance of special equipment.

(1.5.9) The institution must have a regular program of monitoring water quality for fish, pinnipeds, cetaceans, and other aquatic animals. A written record must be maintained to document long-term water quality results and chemical additions.

Chapter 2

(1.5.1) Animals should be presented in a manner reflecting modern zoological practices in exhibit design, balancing animals’ functional welfare requirements with aesthetic and educational considerations.

(1.5.2) All animals must be housed in enclosures and in appropriate groupings which meet their physical, psychological, and social needs. Wherever possible and appropriate, animals should be provided the opportunity to choose among a variety of conditions within their environment. Display of single animals should be avoided unless biologically correct for the species.

(10.3.3) All animal enclosures (exhibits, holding areas, hospital, and quarantine/isolation) must be of a size and complexity sufficient to provide for the animal’s physical, social, and psychological well-being; and exhibit enclosures must include provisions for the behavioral enrichment of the animals. AZA housing guidelines outlined in the Animal Care Manuals should be followed.

(10.3.4) When sunlight is likely to cause overheating of or discomfort to the animals, sufficient shade (in addition to shelter structures) must be provided by natural or artificial means to allow all animals kept outdoors to protect themselves from direct sunlight.

(11.3.3) Special attention must be given to free-ranging animals so that no undue threat is posed to either the institution’s animals, the free-ranging animals, or the visiting public. Animals maintained where they will be in contact with the visiting public must be carefully monitored, and treated humanely at all times.

(11.3.1) All animal exhibits and holding areas must be secured to prevent unintentional animal egress.

(2.8.1) Pest control management programs must be administered in such a manner that the animals, staff, and public are not threatened by the pests, contamination from pests, or the control methods used.

(11.3.6) In areas where the public is not intended to have contact with animals, some means of deterring public contact with animals (e.g., guardrails/barriers) must be in place.
(11.2.4) All emergency procedures must be written and provided to staff and, where appropriate, to volunteers. Appropriate emergency procedures must be readily available for reference in the event of an actual emergency.

(11.2.5) Live-action emergency drills must be conducted at least once annually for each of the four basic types of emergency (fire; weather/environment appropriate to the region; injury to staff or a visitor; animal escape). Four separate drills are required. These drills must be recorded and evaluated to determine that procedures are being followed, that staff training is effective, and that what is learned is used to correct and/or improve the emergency procedures. Records of these drills must be maintained and improvements in the procedures documented whenever such are identified.

(11.6.2) Security personnel, whether staff of the institution, or a provided and/or contracted service, must be trained to handle all emergencies in full accordance with the policies and procedures of the institution. In some cases, it is recognized that Security personnel may be in charge of the respective emergency (i.e. shooting teams).

(11.2.6) The institution must have a communication system that can be quickly accessed in case of an emergency.

(11.2.7) A written protocol should be developed involving local police or other emergency agencies and include response times to emergencies.

(11.5.3) Institutions maintaining potentially dangerous animals (e.g. large carnivores, large reptiles, medium to large primates, large hoofstock, killer whales, sharks, venomous animals, and others, etc.) must have appropriate safety procedures in place to prevent attacks and injuries by these animals. Appropriate response procedures must also be in place to deal with an attack resulting in an injury. These procedures must be practiced routinely per the emergency drill requirements contained in these standards. Whenever injuries result from these incidents, a written account outlining the cause of the incident, how the injury was handled, and a description of any resulting changes to either the safety procedures or the physical facility must be prepared and maintained for five years from the date of the incident.

(11.5.2) All areas housing venomous animals, or animals which pose a serious threat of catastrophic injury and/or death (e.g. large carnivores, large reptiles, medium to large primates, large hoofstock, killer whales, sharks, venomous animals, and others, etc.) must be equipped with appropriate alarm systems, and/or have protocols and procedures in place which will notify staff in the event of a bite injury, attack, or escape from the enclosure. These systems and/or protocols and procedures must be routinely checked to insure proper functionality, and periodic drills must be conducted to insure that appropriate staff members are notified.

Chapter 3

(1.4.0) The institution must show evidence of having a zoological records management program for managing animal records, veterinary records, and other relevant information.

(1.4.6) A staff member must be designated as being responsible for the institution's animal recordkeeping system. That person must be charged with establishing and maintaining the institution's animal records, as well as with keeping all animal care staff members apprised of relevant laws and regulations regarding the institution's animals.

(1.4.7) Animal and veterinary records must be kept current.

(1.4.4) Zoological records, whether in electronic or paper form, must be duplicated and stored in a separate location. Animal records are defined as data, regardless of physical form or medium, providing information about individual animals, or samples or parts thereof, or groups of animals.

(1.4.5) At least one set of the institution's historical animal records must be stored and protected. Those records should include permits, titles, declaration forms, and other pertinent information.

(1.4.1) An animal inventory must be compiled at least once a year and include data regarding acquisition, transfer, euthanasia, release, and reintroduction.

(1.4.2) All species owned by the institution must be listed on the inventory, including those animals on loan to and from the institution. In both cases, notations should be made on the inventory.
(1.4.3) Animals must be identifiable, whenever practical, and have corresponding ID numbers. For animals maintained in colonies/groups or other animals not considered readily identifiable, the institution must provide a statement explaining how record keeping is maintained.

Chapter 4
(1.5.11) Animal transportation must be conducted in a manner that is safe, well-planned and coordinated, and minimizes risk to the animal(s), employees, and general public. All applicable laws and/or regulations must be adhered to.

(1.5.10) Temporary, seasonal and traveling live animal exhibits (regardless of ownership or contractual arrangements) must meet the same accreditation standards as the institution's permanent resident animals.

Chapter 6
(2.6.2) The institution should have a written nutrition program that meets the behavioral and nutritional needs of all species, individuals, and colonies/groups in the institution. Animal diets must be of a quality and quantity suitable for each animal's nutritional and psychological needs.

(2.6.1) Animal food preparation and storage must meet all applicable laws and/or regulations.

(2.6.3) The institution should assign at least one person to oversee appropriate browse material for the animals.

Chapter 7
(2.1.1) A full-time staff veterinarian is recommended. In cases where such is not practical, a consulting/part-time veterinarian must be under written contract to make at least twice monthly inspections of the animals and to respond as soon as possible to any emergencies.

(2.1.2) So that indications of disease, injury, or stress may be dealt with promptly, veterinary coverage must be available to the animals 24 hours a day, 7 days a week.

(2.2.1) Written, formal procedures must be available to the animal care staff for the use of animal drugs for veterinary purposes, and appropriate security of the drugs must be provided.

(2.7.1) The institution must have holding facilities or procedures for the quarantine of newly arrived animals and isolation facilities or procedures for the treatment of sick/injured animals.

(2.7.3) Quarantine, hospital, and isolation areas should be in compliance with standards/guidelines contained within the Guidelines for Zoo and Aquarium Veterinary Medical Programs and Veterinary Hospitals developed by the American Association of Zoo Veterinarians (AAZV), which can be obtained at: http://www.aazv.org/associations/6442/files/veterinary_standards_2009_final.docx.

(2.7.2) Written, formal procedures for quarantine must be available and familiar to all staff working with quarantined animals.

(11.1.2) Training and procedures must be in place regarding zoonotic diseases.

(11.1.3) A tuberculin (TB) testing/surveillance program must be established for appropriate staff in order to ensure the health of both the employees and the animals. Each institution must have an employee occupational health and safety program.

(2.5.1) Deceased animals should be necropsied to determine the cause of death. Cadavers must be stored in a dedicated storage area. Disposal after necropsy must be done in accordance with local/federal laws.

(2.4.1) The veterinary care program must emphasize disease prevention.

(1.5.5) For animals used in offsite programs and for educational purposes, the institution must have adequate protocols in place to protect the rest of the animals at the institution from exposure to infectious agents.

(11.1.3) A tuberculin (TB) testing/surveillance program must be established for appropriate staff in order to ensure the health of both the employees and the animals. Each institution must have an employee occupational health and safety program.
(2.3.1) Capture equipment must be in good working order and available to authorized, trained personnel at all times.

(2.4.2) Keepers should be trained to recognize abnormal behavior and clinical signs of illness and have knowledge of the diets, husbandry (including enrichment items and strategies), and restraint procedures required for the animals under their care. However, keepers should not diagnose illnesses nor prescribe treatment.

(2.3.2) Institution facilities should have radiographic equipment or have access to radiographic services.

(1.5.8) The institution must develop a clear process for identifying, communicating, and addressing animal welfare concerns within the institution in a timely manner, and without retribution.

Chapter 9

(1.6.1) The institution must have a formal written enrichment and training program that promotes species-appropriate behavioral opportunities, and a training program that facilitates husbandry and veterinary procedures where appropriate.

(1.6.2) The institution must have specific staff member(s) or committee assigned for enrichment program oversight, implementation, training, and interdepartmental coordination of enrichment efforts.

Chapter 10

(5.3) The institution should maximize the generation of scientific knowledge gained from the animals. This might be achieved by participating in AZA TAG/SSP sponsored research when applicable, conducting original research projects, affiliating with local universities, and/or employing staff with scientific credentials.

(5.2) The institution must have a written policy that outlines the type of research that it conducts, methods, staff involvement, evaluations, animals to be involved, and guidelines for publication of findings.

(5.1) Research activities must be under the direction of a person qualified to make informed decisions regarding research.
Appendix B: Recordkeeping Guidelines for Group Accessions

Developed by the AZA Institutional Data Management Scientific Advisory Group
Published 23 May 2014
Edited to replace the document entitled “Updated Data Entry for Groups” published 16 December 2002

Animals can be accessioned into a collection as either individuals or as part of a group. The term “group” has many definitions when used in zoos and aquariums, and is usually defined by its application, such as a social group or animals grouped for husbandry purposes. To provide a consistent language that can be used throughout the Association of Zoos and Aquariums (AZA), the term “group accession”, as defined by the AZA Institutional Data Management Scientific Advisory Group (IDMAG),

- contains multiple animals of the same species or subspecies, which
- cannot be differentiated from one another, either physically (there are no scars or color pattern differences), artificially (they are not tagged or transpondered), or spatially (they are not held in separate enclosures), and
- are cared for as a whole.

Thus, no individually accessioned animals are included in a group accession and no individually identifiable animals are included in a group accession. As soon as an animal becomes individually identifiable, it is recommended that it be split from the group record and accessioned as an individual. For example, large clutches of amphibian tadpoles should first be accessioned as a group; then as individuals become identifiable, they should be removed from the group record and accessioned as individuals. Otherwise, information about an individual animal that could otherwise be tracked through the animal’s life will be lost in the group record. An exception to this occurs occasionally when a group member is removed and temporarily held separately for medical treatment, with the expectation that it will be returned to the group when treatment ends. In this case, the animal remains part of the group even though separated from it. As with individual records, group record accession numbers should not duplicate any other accession number, and once a group accession number has been assigned, it should not be changed.

Group accession provides less information on specific individuals than does individual accession. Group records make information less retrievable, and often need more clarifying comments than individual records. Whenever information applies to only part of the group, notes should be used to indicate which animal(s) the information applies to. It is of utmost importance that these notes be thorough and clear so future readers can easily understand them. Examples of information needing additional notations in group records include, but are not limited to, parentage when not every member of the group has the “the group. Thus, though it is preferable to accession animals as individuals, a group accession can capture considerable information when individual accession is not appropriate.

Although colonies are often confused with groups, the term “colony” should be used to designate truly colonial organisms: those that must live and function as an intact unit, such as corals and eusocial insects. Individuals within a colony are components of a single entity rather than separate members of a group. Also, colony members generally cannot be counted and true census data is not possible, so for the purposes of inventory, a colony is a singular unit while a group is composed of a number of individuals. However, for accessioning purposes, colonies are treated in the same manner as are groups.

Examples of Appropriate Group Accessions

- A group of animals that are not individually identifiable and are the same species or subspecies.
  
  Your institution receives 50 Puerto Rican crested toad tadpoles to rear. Unless each tadpole is raised in a separate numbered tank, there is no way to tell one tadpole from another. All tadpoles housed together are accessioned as one group.

- Colonial species, such as coral or eusocial insects (e.g., some species of bees or ants).
  
  Your institution receives a piece of coral. Since the coral is in one piece, you accession it as a group of one. You make a note of the dimensions or mass of the piece to give an estimate of colony size, since it is not possible to count individual animals in the colony. In the inventory,
the colony counts as one animal. When a section of the coral breaks off, you accession that new piece as a new colony.

- A self-sustaining, breeding group of small rodents or insects.

  Your institution has a large number of Cairo spiny mice. No daily count is made, though births and deaths increase and decrease the count. A census is taken periodically, and the new count is recorded by sex and life stage. Exact counts are made whenever possible – for example, when the group is moved to a new enclosure.

- Young born to several females of the same species or subspecies and raised together without means of identifying which offspring were born to which mother.

  A flock of 3.6 peafowl raise 25 chicks this year. Identity of the hens incubating each nest, hatch dates, and number of chicks hatched from each nest can be determined and recorded. However, unless the chicks are caught and banded at hatching, once the mothers and chicks join the main flock, it is no longer possible to tell which chicks belong to which females. All chicks in the flock have the same possible parents: all the peacocks and those peahens that incubated the nests. The chicks are accessioned as a group and are split out only when they are banded or tagged (and are thus individually identifiable).

- Historical records for a species or subspecies for which there is insufficient information to attribute events to specific individuals.

  Some of your historical records are found as simple lists of events. Though there are dates for all transactions, and maybe even specified vendors or recipients for those events, you cannot create individual records for any of these animals without additional information: there is nothing connecting any specific individual to both acquisition and disposition information. If additional information is uncovered that makes this connection, then that individual can be removed from the group accession and given an individual record.

Managing Group Records

Maintaining Group Records - As with individual records, group records should also be maintained and updated. Addition of animals through births or transactions such as loans, purchases, donations, or trades are entered as acquisitions. Subtraction of animals through deaths or transactions such as loans, sales, donations, or trades are entered as dispositions.

Weights and lengths can be entered into a group record even if that data cannot be attributed to a specific individual. This information is still useful in describing the overall condition of group members, although care should be given to describe the animal that the measurement came from. For example, is the animal a juvenile or a breeding adult? Is it healthy, or sickly? Alternatively, average and/or median measurements can be entered into the record to give an indication of what size a “normal” individual might be. In this case, notes should include the maximum and minimum measurements, and how many animals were measured to calculate the average or median.

Censuses - Groups should be censused at regular intervals - ideally, no longer than one inter-birth interval. Institutions should establish and follow a census schedule for each group. An inventory must be done at least once yearly (AZA Accreditation Standard 1.4.1) but the frequency at which a group is censused depends on species biology, husbandry protocols, and animal welfare. For species in which births/hatches and deaths tend to go undetected, or for species that have high fecundity and mortality (which makes counting every animal very difficult or impossible), census data should be obtained more frequently than for species with longer inter-birth intervals. These more frequent censuses should not be undertaken when intrusion on the group has a negative effect on the welfare of the group, e.g., disruption of maternal care.

Censuses should provide as much detail as possible by recording numbers in distinctive life stages (such as newborn, immature, adult) and/or sex ratio (such as male, female, unknown/undetermined). If the census count is estimated, the estimation method and (when possible) the accuracy of the estimate should be included. When updating the sex ratio, who sexed the animals and how they were sexed should also be recorded.

Splitting And Combining (Merging) Groups - Splitting animals from groups and combining groups together are realities of group management. Animals may be removed to create additional groups, or perhaps new
animals are received from another institution. When new groups are created, new group records also need to be created. However, if the entire group moves to a new location (such as a different tank), it retains the same accession number, and notation of the change in location is made.

When a single group is split into two or more groups, one of the new groups keeps the original accession number and the others are assigned new accession numbers. This is also true if a portion of a group is sent to another institution: the subgroup making the transfer must have an accession number distinct from that of the main group. The accession number(s) for the new group(s) should follow institutional procedures for the assignment of new accession numbers. Note of the new group accession number(s) should appear in the originating group record, and the new group accession record(s) should contain the originating group number. The reason for the split should be entered into both the originating and new group records.

When two or more groups combine to form a larger group, all but one of the groups are deaccessioned and their counts brought to zero. Notes in all the group records should indicate why the groups were merged, as well as the accession numbers of all groups involved – both the closed (empty) groups and the remaining group.

In all cases of splits and merges, the date of creation of the new record should be the same as the date of removal from the previous group or individual. Detailed notes should explain the reasons for all splits and merges.

**Merging Individuals Into Groups and Splitting Individuals From Groups** - Good husbandry dictates the use of identification methods that allow animals to be tracked as individuals whenever possible (AZA Accreditation Standard 1.4.3). Thus, most institutions initially accession newly-acquired animals as individual animals with individual identifiers.

Despite the best intentions, individual identification sometimes becomes impossible. For example, birds in large aviaries lose their bands; small frogs in a large terrarium die and decompose without being noticed. When individual identification of several of the animals in a group is lost and can't be resolved in a reasonable amount of time, it is best to move all potentially unidentifiable animals to a group record, by either creating a new group or merging them into an existing group. As with splitting and merging groups, the group record should contain the identities of the originating individuals and the individual records should show the new group identity. If the animals in the group ever become individually identifiable again, they can be split back to individual records to better capture demographic information. If this occurs, new accession numbers are generally needed for the new individual records since it is rarely possible to know which old individual record would apply to the newly identifiable group member.

Conversely, if one or more group members become identifiable, for example, the previously unbanded young of the year are caught up and banded, they should be split from the group record and given individual accessions. The group record should include the individual numbers assigned, and the records of all individuals should show the number of the originating group. In the case of new individual records, information particular to the animal being given the individual record (if known) should be transferred to the individual record. This includes birth date, origin, parent identification, etc. As in the cases of splitting and merging groups, the date of creation of the new record is the same as the date of removal from the previous group or individual, and detailed notes should explain the reasons for all changes in accession type.

**Transfers Between Institutions** - When accessioning a number of animals that were received from another institution, the new animals should be accessioned using the same type of record that the sending institution used, regardless of how the animals will ultimately be managed. If a group is received but the members will be managed as individuals, they should be accessioned as a group first, then split out as individuals. Similarly, if a number of individuals are received but the plan is to manage them as a group, they should be accessioned as individuals, then merged into a group. Although this is an extra step in the accession process, it allows the records from both institutions to more seamlessly link.

**Removing Individuals From Historical Group Records** - The decision of whether to use individual or group accession for historical records should be made thoughtfully and carefully. As detailed above, group accession should be used if there is insufficient information to create an accurate individual record. The
use of group accession is preferable to the inclusion of “best guess” information, i.e. fiction, to fill the information necessary to complete an individual record.

If additional information is later found that allows the creation of an individual record for one of the members of a historical group record, the procedure for removal from the group is different from that for current records. This situation is treated differently because the historical individual was not truly part of a group accession – the information necessary for a complete individual record was merely not known and the group accession was used “temporarily” until the required information was found or learned. For this reason, the individual should NOT be split from the group, but all reference to the individual should instead be deleted entirely from the group, as if it were never part of the group. This will allow the individual record to begin with the initial acquisition (instead of the date of removal from a group) and will include the animal's entire history in one record. It also prevents inflation of inventory numbers by eliminating the possible duplication of the same information in both the group and the individual records.
Appendix C: Guidelines for Creating and Sharing Animal and Collection Records

Developed by the AZA Institutional Data Management Scientific Advisory Group
Original Publication Date: 5 Sept 2007
Publication Revision Date: 23 June 2014

The goal of maintaining a centralized, compiled record for each animal cared for in a zoo or aquarium is ideal, however, oftentimes, information belonging in an animal record is spread across many departments and may originate with any member of the animal care staff. Therefore, it is important for zoos and aquariums to have a formal method for collecting or linking various pieces of information into the official records and that the roles and responsibilities for each named record type are clearly defined in written protocols for the reporting, recording, distribution, storage, and retrieval processes; there should also be a stated process of review for the accuracy and completeness of these records. For example, a recording/reporting protocol would state who reports births or deaths, to whom they are reported, in what manner and in what time frame they are reported, who officially records the information, and who reviews the resulting record for accuracy and completeness. Then, the maintenance and archiving protocol would state where the record is to be filed, who may have access, and how long the record is to be maintained before being archived or disposed of.

Information contained in animal records is essential not only to the immediate care of the individual animal but also as pooled data to manage larger concerns (e.g., providing norms for species-related veterinary and population management decisions, evidence of compliance with laws and regulations, showing trends in populations on every level from institutional to global, etc.). No matter what its use, it is critical for the information contained in an animal record to be factual, clear, complete, and documented. Because zoos and aquariums vary greatly in size and organizational structure, it is impossible to set defined procedures that would be applicable to all; therefore, the following guidelines for creating and sharing animal records have been developed to assist with the establishment of written policies that best fit their own internal structure and protocols.

Animal and Collection Records – Definitions and Examples
The AZA Institutional Data Management Scientific Advisory Group (IDMAG) defines an animal record as: “data, regardless of physical form or medium, providing information about individual animals, groups of animals, or samples or parts thereof.” An animal’s record may include, but is not limited to, information about its provenance, history, daily care, activities, and condition; some may originate in non-animal care departments. Some examples of animal records are:

- transaction documents (including proof of legal ownership, purchase contracts, etc.)
- identification information
- reports of collection changes (including in-house moves)
- pedigrees/lineages
- veterinary information, including images, test results, etc.
- nutrition and body condition information
- information on sampling and parts/products distribution

In addition, the IDMAG defines collection records as: “information, evidence, rationalizations about an animal collection as a whole that may supplement or explain information contained in an animal record.” Collection records may include, but are not limited to, documentation of collection decisions and changes, evidence of structural change at the institution, evidence of building name changes, and documentation of institution level or unit level husbandry protocols and changes. Some examples of collection records are:

- collection plans
- permits
- annual inventories (which include reconciliation with the previous year)
- area journals/notebooks (including information to/from/between other animal care staff)
- keeper reports
- animal management protocols (e.g., species hand-rearing protocols, special care or treatments, etc.)
• enclosure maps/trees
• enclosure/exhibit information (monitoring, maintenance, modifications, etc.)
• research plans and published papers

Animal and Collection Records - Development
It is recommended that each zoo and aquarium develop written policies and procedures, applicable to all staff involved with animal care, that:
• define the types of records that are required.
  For example, daily keeper reports might be required from the keeper staff and weekly summaries of activities might be required from the animal curator and senior veterinarian.
• define the information that is to be included in each type of record.
  Following the example above, the institution would state the specific types of information to be recorded on the daily keeper report and the weekly summaries.
• define the primary location where each record can be found.
  For example, if a zoo does not employ a nutritionist, the policy or procedures might state that animal diet information will be found in keeper daily reports, curator-developed daily diets, and/or veterinarian-prescribed treatment diets.
• assign responsibility for the generation of each record type and set time limits for the their creation.
  For example, keepers might be held responsible for producing daily reports by the start of the next day and curators might be held responsible for producing weekly summaries by the Tuesday of the following week.
• define a process to review the accuracy of each record type and assign responsibility for that review process.
  For example, the identity of who will review each type of record, the date of reviews, and the review/correction processes might be included in the policy.
• define a process to identify official records and assign responsibility for the recording of, or linking of, information into these records.
  For example, the identity of who will be responsible for placing information into the official records and the processes of how to identify official records might be included in the policy.
• ensure entries in official records are never erased or deleted.
  For example, if an entry is determined to be erroneous, rather than deleting it, the entry should be amended and an audit trail should be created that identifies what data was changed, who made the change, the date it was changed, and the reason for the change.
• ensure records relating to specific animals in the collection, including the records of non-animal care departments, are permanently archived as part of the animal's record.
  For example, if your zoo or aquarium's records retention schedules differ from this recommendation every attempt should be made to exempt these records from schedules requiring their destruction.

Animal and Collection Records – Sharing of Information
Each zoo and aquarium should assess the ownership of their animal and collection records and determine the rights of employees and outside entities to the information contained in them. It is recommended that each zoo and aquarium develop written policies and procedures for the distribution and/or availability of the animal and collection records that:
• identify who has access to animal and collection records and under what conditions.
  For example, animal care staff whose duties require a direct need for information about specific animals or collection of animals should be identified as individuals who are allowed access to any or specified records, regardless of who created them or when they were created.
• assign responsibility for the distribution, archiving and retrieval of each record type.
  For example, the recordkeeper or registrar might be held responsible for maintaining all past and current transaction documents and the curator might be held responsible for maintaining the daily keeper reports from his/her section.
• define a notification system that specifies what information will be provided in the notification, who will be notified, the date they will be notified by, and the mechanism that will be used to ensure the notification is communicated appropriately.
  For example, the shipment of an animal might require that written notice be made to the senior keeper in the animal’s area, the curator, and the veterinarian at least 30 days prior to the move, and identifies the animal by group or individual identification/accession number, sex, and tag/transponder number, etc.

• define where each record type (stored or archived) is available and what format (paper or digital) it is in.
  For example, all original animal transaction documents might be kept in the registrar’s office in fire-proof file cabinets but copies of the Animal Data Transfer Forms are kept in the appropriate keeper area.

• define a system for obtaining necessary information such that the information is available regardless of department and regardless of staffing issues
  For example, keeper daily reports might be maintained in an electronic database run on the institution’s network, to which all animal care staff members have at least read-only access.

Implementation of these Recommendations
Well-written, consistent data-recording protocols and clear lines of communication will increase the quality of animal records and should be implemented by all institutions, regardless of technical resources. While the best option for availability of information is an electronic database system run on a computer network (intranet) to which all animal care staff members have unrestricted access, the above recommendations may also be adopted by zoos and aquariums without full electronic connections.
Appendix D: AZA Policy on Responsible Population Management

PREAMBLE

The stringent requirements for AZA accreditation, and high ethical standards of professional conduct, are unmatched by similar organizations and far surpass the United States Department of Agriculture’s Animal and Plant Health Inspection Service’s requirements for licensed animal exhibitors. Every AZA member must abide by a Code of Professional Ethics (https://www.aza.org/Ethics/). In order to continue these high standards, AZA-accredited institutions and certified related facilities should make it a priority, when possible, to acquire animals from and transfer them to other AZA member institutions, or members of other regional zoo associations that have professionally recognized accreditation programs.

AZA-accredited institutions and certified related facilities cannot fulfill their important missions of conservation, education, and science without live animals. Responsible management and the long-term sustainability of living animal populations necessitates that some individuals be acquired and transferred, reintroduced or even humanely euthanized at certain times. The acquisition and transfer of animals should be prioritized by the long-term sustainability needs of the species and AZA-managed populations among AZA-accredited and certified related facilities, and between AZA member institutions and non-AZA entities with animal care and welfare standards aligned with AZA. AZA member institutions that acquire animals from the wild, directly or through commercial vendors, should perform due diligence to ensure that such activities do not have a negative impact on species in the wild. Animals should only be acquired from non-AZA entities that are known to operate legally and conduct their business in a manner that reflects and/or supports the spirit and intent of the AZA Code of Professional Ethics as well as this Policy.

I. INTRODUCTION

This AZA Policy on Responsible Population Management provides guidance to AZA members to:

1. Assure that animals from AZA member institutions and certified related facilities are not transferred to individuals or organizations that lack the appropriate expertise or facilities to care for them [see taxa specific appendices (in development)],

2. Assure that the health and conservation of wild populations and ecosystems are carefully considered as appropriate,

3. Maintain a proper standard of conduct for AZA members during acquisition and transfer/reintroduction activities, including adherence to all applicable laws and regulations,

4. Assure that the health and welfare of individual animals is a priority during acquisition and transfer/reintroduction activities, and

5. Support the goals of AZA’s cooperatively managed populations and associated Animal Programs [Species Survival Plans® (SSPs), Studbooks, and Taxon Advisory Groups (TAGs)].

This AZA Policy on Responsible Population Management will serve as the default policy for AZA member institutions. Institutions should develop their own Policy on Responsible Population Management in order to address specific local concerns. Any institutional policy must incorporate and not conflict with the AZA acquisition and transfer/transition standards.

II. LAWS, AUTHORITY, RECORD-KEEPING, IDENTIFICATION AND DOCUMENTATION

The following must be considered with regard to the acquisition or transfer/management of all living animals and specimens (their living and non-living parts, materials, and/or products):
1. Any acquisitions, transfers, euthanasia and reintroductions must meet the requirements of all applicable local, state, federal and international laws and regulations. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV’s Guidelines on the Euthanasia of Non-Domestic Animals. Ownership and any applicable chain-of-custody must be documented. If such information does not exist, an explanation must be provided regarding such animals and specimens. Any acquisition of free-ranging animals must be done in accordance with all local, state, federal, and international laws and regulations and must not be detrimental to the long-term viability of the species in the wild.

2. The Director/Chief Executive Officer of the institution must have final authority for all acquisitions, transfers, and euthanasia.

3. Acquisitions or transfers/euthanasia/reintroductions must be documented through institutional record keeping systems. The ability to identify which animal is being transferred is very important and the method of identifying each individual animal should be documented. Any existing documentation must accompany all transfers. Institutional animal records data, records guidelines have been developed for certain species to standardize the process (https://www.aza.org/AnimalCare/detail.aspx?id=3150).

4. For some colonial, group-living, or prolific species, it may be impossible or highly impractical to identify individual animals when these individuals are maintained in a group. These species can be maintained, acquired, transferred, and managed as a group or colony, or as part of a group or colony.

5. If the intended use of specimens from animals either living or non-living is to create live animal(s), their acquisition and transfer should follow the same guidelines. If germplasm is acquired or transferred with the intention of creating live animal(s), ownership of the offspring must be clearly defined in transaction documents (e.g., breeding loan agreements).

Institutions acquiring, transferring or otherwise managing specimens should consider current and possible future uses as new technologies become available. All specimens from which nuclear DNA could be recovered should be carefully considered for preservation as these basic DNA extraction technologies already exist.

6. AZA member institutions must maintain transaction documents (e.g., confirmation forms, breeding agreements) which provide the terms and conditions of animal acquisitions, transfers and loans, including documentation for animal parts, products and materials. These documents should require the potential recipient or provider to adhere to the AZA Policy on Responsible Population Management, and the AZA Code of Professional Ethics, and must require compliance with the applicable laws and regulations of local, state, federal, and international authorities.

7. In the case of animals (living or non-living) and their parts, materials, or products (living or non-living) held on loan, the owner’s written permission should be obtained prior to any transfer and documented in the institutional records.

8. AZA SSP and TAG necropsy and sampling protocols should be accommodated.

9. Some governments maintain ownership of the species naturally found within their borders. It is therefore incumbent on institutions to determine whether animals they are acquiring or transferring are owned by a government entity, foreign or domestic, and act accordingly by reviewing the government ownership policies available on the AZA website. In the case of government owned animals, proposals for and/or notifications of transfers must be sent to the species manager for the government owned species.

III. ACQUISITION REQUIREMENTS
A. General Acquisitions

1. Acquisitions must be consistent with the mission of the institution, as reflected in its Institutional Collection Plan, by addressing its exhibition/education, conservation, and/or scientific goals regarding the individual or species.

2. Animals (wild, feral, and domestic) may be held temporarily for reasons such as assisting governmental agencies or other institutions, rescue and/or rehabilitation, research, propagation or headstarting for reintroduction, or special exhibits.

3. Any receiving institution must have the necessary expertise and resources to support and provide for the professional care and management of the species, so that the physical, psychological, and social needs of individual animals and species are met.

4. If the acquisition involves a species managed by an AZA Animal Program, the institution should communicate with the Animal Program Leader and, in the case of Green SSP Programs, must adhere to the AZA Full Participation Policy (http://www.aza.org/full-participation-in-ssp-program-policy/).

5. AZA member institutions should consult AZA Wildlife Conservation and Management Committee (WCMC)-approved TAG Regional Collection Plans (RCPs), Animal Program Leaders, and AZA Animal Care Manuals (ACMs) when making acquisition decisions.

6. AZA member institutions that work with commercial vendors that acquire animals from the wild, must perform due diligence to assure the vendors’ collection of animals is legal and using ethical practices. Commercial vendors should have conservation and animal welfare goals similar to those of AZA institutions.

7. AZA member institutions may acquire animals through public donations and other non-AZA entities when it is in the best interest of the animal and/or species.

B. Acquisitions from the Wild

Maintaining wild animal populations for exhibition, education and wildlife conservation purposes is a core function of AZA-member institutions. AZA zoos and aquariums have saving species and conservation of wildlife and wildlands as a basic part of their public mission. As such, the AZA recognizes that there are circumstances where acquisitions from the wild are needed in order to maintain healthy, diverse animal populations. Healthy, sustainable populations support the objectives of managed species programs and the core mission of AZA members. In some cases, acquiring individuals from the wild may be a viable option in addition to, or instead of, relying on breeding programs with animals already in human care.

Acquiring animals from the wild can result in socioeconomic benefit and environmental protection and therefore the AZA supports environmentally sustainable/beneficial acquisition from the wild when conservation is a positive outcome.

1. Before acquiring animals from the wild, institutions are encouraged to examine alternative sources including other AZA institutions and other regional zoological associations or other non-AZA entities.

2. When acquiring animals from the wild, both the long-term health and welfare impacts on the wild population as well as on individual animals must be considered. In crisis situations, when the survival of a population is at risk, rescue decisions will be made on a case-by-case basis by the appropriate agency and institution.

3. AZA zoos and aquariums may assist wildlife agencies by providing homes for animals born in nature if they are incapable of surviving on their own (e.g., in case of orphaned or injured animals) or by euthanizing the animals because they pose a risk to humans or for humane reasons.
4. Institutions should only accept animals from the wild after a risk assessment determines the zoo/aquarium can mitigate any potential adverse impacts on the health, care and maintenance of the existing animals already being housed at the zoo or aquarium, and the new animals being acquired.

IV. TRANSFER, EUTHANASIA AND REINTRODUCTION REQUIREMENTS

A. Living Animals

Successful conservation and animal management relies on the cooperation of many entities, both AZA and non-AZA. While preference is given to placing animals with AZA-accredited institutions or certified related facilities, it is important to foster a cooperative culture among those who share AZA’s mission of saving species and excellence in animal care.

1. AZA members should assure that all animals in their care are transferred, humanely euthanized and/or reintroduced in a manner that meets the standards of AZA, and that animals are not transferred to those not qualified to care for them properly. Refer to IV.12, below, for further requirements regarding euthanasia.

2. If the transfer of animals or their specimens (parts, materials, and products) involves a species managed by an AZA Animal Program, the institution should communicate with that Animal Program Leader and, in the case of Green SSP Programs must adhere to the AZA Full Participation Policy (http://www.aza.org/full-participation-in-ssp-program-policy/).

3. AZA member institutions should consult WCMC-approved TAG Regional Collection Plans, Animal Program Leaders, and Animal Care Manuals when making transfer decisions.

4. Animals acquired solely as a food source for animals in the institution’s care are not typically accessioned. There may be occasions, however, when it is appropriate to use accessioned animals that exceed population carrying capacity as feeder animals to support other animals. In some cases, accessioned animals may have their status changed to “feeder animal” status by the institution as part of their program for long-term sustained population management of the species.

5. In transfers to non-AZA entities, AZA members must perform due diligence and should have documented validation, including one or more letters of reference, for example from an appropriate AZA Professional Fellow or other trusted source with expertise in animal care and welfare, who is familiar with the proposed recipient and their current practices, and that the recipient has the expertise and resources required to properly care for and maintain the animals. Any recipient must have the necessary expertise and resources to support and provide for the professional care and management of the species, so that the physical, psychological, and social needs of individual animals and species are met within the parameters of modern zoological philosophy and practice. Supporting documentation must be kept at the AZA member institution (see #IV.9 below).

6. Domestic animals should be transferred in accordance with locally acceptable humane farming practices, including auctions, and must be subject to all relevant laws and regulations.

7. AZA members must not send any non-domestic animal to auction or to any organization or individual that may display or sell the animal at an animal auction. See certain taxa-specific appendices to this Policy (in development) for information regarding exceptions.

8. Animals must not be sent to organizations or individuals that allow the hunting of these individual animals; that is, no individual animal transferred from an AZA institution may be hunted. For purposes of maintaining genetically healthy, sustainable zoo and aquarium populations, AZA-accredited institutions and certified related facilities may send animals to non-AZA organizations or individuals (refer to #IV.5 above). These non-AZA entities (for instance, ranching operations) should follow appropriate ranch management practices and other conservation minded practices to support population sustainability.
9. Every loaning institution must annually monitor and document the conditions of any loaned specimen(s) and the ability of the recipient(s) to provide proper care (refer to #IV.5 above). If the conditions and care of animals are in violation of the loan agreement, the loaning institution must recall the animal or assure prompt correction of the situation. Furthermore, an institution’s loaning policy must not be in conflict with this AZA Policy on Responsible Population Management.

10. If living animals are sent to a non-AZA entity for research purposes, it must be a registered research facility by the U.S. Department of Agriculture and accredited by the Association for the Assessment & Accreditation of Laboratory Animal Care, International (AAALAC), if eligible. For international transactions, the receiving facility must be registered by that country’s equivalent body having enforcement over animal welfare. In cases where research is conducted, but governmental oversight is not required, institutions should do due diligence to assure the welfare of the animals during the research.

11. Reintroductions and release of animals into the wild must meet all applicable local, state, and international laws and regulations. Any reintroduction requires adherence to best health and veterinary practices to ensure that non-native pathogens are not released into the environment exposing naive wild animals to danger. Reintroductions may be a part of a recovery program and must be compatible with the IUCN Reintroduction Specialist Group’s Reintroduction Guidelines (http://www.iucnsscrsg.org/index.php).

12. Humane euthanasia may be employed for medical reasons to address quality of life issues for animals or to prevent the transmission of disease. AZA also recognizes that humane euthanasia may be employed for managing the demographics, genetics, and diversity of animal populations. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV’s Guidelines on the Euthanasia of Non-Domestic Animals.

B. Non-Living Animals and Specimens

AZA members should optimize the use and recovery of animal remains. All transfers must meet the requirements of all applicable laws and regulations.

1. Optimal recovery of animal remains may include performing a complete necropsy including, if possible, histologic evaluation of tissues which should take priority over specimens’ use in education/exhibits. AZA SSP and TAG necropsy and sampling protocols should be accommodated. This information should be available to SSP Programs for population management.

2. The educational use of non-living animals, parts, materials, and products should be maximized, and their use in Animal Program sponsored projects and other scientific projects that provide data for species management and/or conservation must be considered.

3. Non-living animals, if handled properly to protect the health of the recipient animals, may be utilized as feeder animals to support other animals as deemed appropriate by the institution.

4. AZA members should consult with AZA Animal Program Leaders prior to transferring or disposing of remains/samples to determine if existing projects or protocols are in place to optimize use.

5. AZA member institutions should develop agreements for the transfer or donation of non-living animals, parts, materials, products, and specimens and associated documentation, to non-AZA entities such as universities and museums. These agreements should be made with entities that have appropriate long term curation/collections capacity and research protocols, or needs for educational programs and/or exhibits.
DEFINITIONS

Acquisition: Acquisition of animals can occur through breeding (births, hutchings, cloning, and division of marine invertebrates = “fragging”), trade, donation, lease, loan, transfer (inter- and intra-institution), purchase, collection, confiscation, appearing on zoo property, or rescue and/or rehabilitation for release.

Annual monitoring and Due diligence: Due diligence for the health of animals on loan is important. Examples of annual monitoring and documentation include and are not limited to inventory records, health records, photos of the recipient’s facilities, and direct inspections by AZA professionals with knowledge of animal care. The level of due diligence will depend on professional relationships.

AZA member institution: In this Policy “AZA member institutions” refers to AZA-accredited institutions and certified related facilities (zoological parks and aquariums). “AZA members” may refer to either institutions or individuals.

Data sharing: When specimens are transferred, the transferring and receiving institutions should agree on data that must be transferred with the specimen(s). Examples of associated documentation include provenance of the animal, original permits, tags and other metadata, life history data for the animal, how and when specimens were collected and conserved, etc.

Dispose: “Dispose/Disposing of” in this document is limited to complete and permanent removal of an individual via incineration, burying or other means of permanent destruction.

Documentation: Examples of documentation include ZIMS records, “Breeding Loan” agreements, chain-of-custody logs, letters of reference, transfer agreements, and transaction documents. This is documentation that maximizes data sharing.

Domestic animal: Examples of domestic animals may include certain camelids, cattle, cats, dogs, ferrets, goats, pigs, reindeer, rodents, sheep, budgerigars, chickens, doves, ducks, geese, pheasants, turkeys, and goldfish or koi.

Ethics of Acquisition/Transfer/Euthanasia: Attempts by members to circumvent AZA Animal Programs in the acquisition of animals can be detrimental to the Association and its Animal Programs. Such action may also be detrimental to the species involved and may be a violation of the Association’s Code of Professional Ethics. Attempts by members to circumvent AZA Animal Programs in the transfer, euthanasia or reintroduction of animals may be detrimental to the Association and its Animal Programs (unless the animal or animals are deemed extra in the Animal Program population by the Animal Program Coordinator). Such action may be detrimental to the species involved and may be a violation of the Association’s Code of Professional Ethics.

“Extra” or Surplus: AZA’s scientifically-managed Animal Programs, including SSPs, have successfully bred and reintroduced critically endangered species for the benefit of humankind. To accomplish these critical conservation goals, populations must be managed within “carrying capacity” limits. At times, the number of individual animals in a population exceeds carrying capacity, and while meaning no disrespect for these individual animals, we refer to these individual animals as “extra” within the managed population.

Euthanasia: Humane death. This act removes an animal from the managed population. Specimens can be maintained in museums or cryopreserved collections. Humane euthanasia must be performed in accordance with the established euthanasia policy of the institution and follow the recommendations of current AVMA Guidelines for the Euthanasia of Animals (2013 Edition, https://www.avma.org/KB/Policies/Documents/euthanasia.pdf) or the AAZV’s Guidelines on the Euthanasia of Non-Domestic Animals.

Feral: Feral animals are animals that have escaped from domestication or have been abandoned to the wild and have become wild, and the offspring of such animals. Feral animals may be acquired for temporary or permanent reasons.

Group: Examples of colonial, group-living, or prolific species include and are not limited to certain terrestrial and aquatic invertebrates, fish, sharks/rays, amphibians, reptiles, birds, rodents, bats, big herds, and other mammals.

Lacey act: The Lacey Act prohibits the importation, exportation, transportation, sale, receipt, acquisition or purchase of wildlife taken or possessed in violation of any law, treaty or regulation of the United States or any Indian tribal law of wildlife law. In cases when there is no documentation accompanying an acquisition, the animal(s) may not be transferred across state lines. If the animal was illegally acquired at any time then any movement across state or international borders would be a violation of the Lacey Act.

Museum: It is best practice for modern zoos and aquariums to establish relationships with nearby museums or other biorepositories, so that they can maximize the value of animals when they die (e.g., knowing who to call when they have an animal in necropsy, or specimens for cryopreservation). Natural history museums that are members of the Natural Science Collections Alliance (NSCA) and frozen biorepositories that are members of the International Society of Biological and Environmental Repositories (ISBER) are potential collaborators that could help zoos find appropriate repositories for biological specimens.

Non-AZA entity: Non – AZA entities includes facilities not accredited or certified by the AZA, facilities in other zoological regions, academic institutions, museums, research facilities, private individuals, etc.

Reintroduction: Examples of transfers outside of a living zoological population include movements of animals from zoo/aquarium populations to the wild through reintroductions or other legal means.
Specimen: Examples of specimens include animal parts, materials and products including bodily fluids, cell lines, clones, digestive content, DNA, feces, marine invertebrate (coral) fragments ("frags"), germplasm, and tissues.

Transaction documents: Transaction documents must be signed by the authorized representatives of both parties, and copies must be retained by both parties*. In the case of loans, the owner’s permission for appropriate activities should be documented in the institutional records. This document(s) should be completed prior to any transfer. In the case of rescue, confiscation, and evacuation due to natural disasters, it is understood that documents may not be available until after acceptance or shipping. In this case documentation (e.g., a log) must be kept to reconcile the inventory and chain of custody after the event occurs. (*In the case of government owned animals, notification of transfers must be sent to species manager for the government owned species).

Transfer: Transfer occurs when an animal leaves the institution for any reason. Reasons for transfer or euthanasia may include cooperative population management (genetic, demographic or behavioral management), animal welfare or behavior management reasons (including sexual maturation and individual management needs). Types of transfer include withdrawal through donation, trade, lease, loan, inter- and intra-institution transfers, sale, escape, theft. Reintroduction to the wild, humane euthanasia or natural death are other possible individual animal changes in a population.
RECIPIENT PROFILE EXAMPLE

Example questions for transfers to non-AZA entities (from AZA-member Recipient Profile documents):

Has your organization, or any of its officers, been indicted, convicted, or fined by a State or Federal agency for any statute or regulation involving the care or welfare of animals housed at your facility? (If yes, please explain on a separate sheet).

Recipients agree that the specimen(s) or their offspring will not be utilized, sold or traded for any purpose contrary to the Association of Zoos and Aquariums (AZA) Code of Ethics (enclosed)

References, other than (LOCAL ZOO/AQUARIUM) employees, 2 minimum (please provide additional references on separate sheet):

Reference Name
Facility
Address
City
Country
State
Zip
Phone
Fax
E-mail
AZA Member?

Reference Name
Facility
Address
City
Country
State
Zip
Phone
Fax
E-mail
AZA Member?

Veterinary Information:
Veterinarian
Clinic/Practice
Address
City
Country
State
Zip
Phone
Fax
E-mail
AZA Member?

How are animals identified at your facility? If animals are not identified at your facility, please provide an explanation about why they are not here:

Where do you acquire and send animals? (Select all that apply)

AZA Institutions
Non-AZA Institutions
Exotic Animal Auctions
Pet Stores
Hunting Ranches
Dealers
Private Breeders
Non-hunting Game Ranches
Entertainment Industry
Hobbyists
Research Labs
Wild
Other

What specific criteria are used to evaluate if a facility is appropriate to receive animals from you?

Please provide all of the documents listed below:

Required:
1. Please provide a brief statement of intent for the specimens requested.
2. Resumes of primary caretakers and those who will be responsible for the husbandry and management of animals.
3. Description (including photographs) of facilities and exhibits where animals will be housed.
4. Copy of your current animal inventory.

Only if Applicable:
5. Copies of your last two USDA inspection reports (if applicable).
7. Copy of your institutional acquisition/disposition policy.

(in-house use only) In-Person Inspection of this facility (Staff member/Date, attach notes):

(Local institution: provide Legal language certifying that the information contained herein is true and correct)

(Validity of this: This document and all materials associated will be valid for a period of 2 years from date of signature.)

Example agreement for Receiving institution (agrees to following condition upon signing):
RECIPIENT AGREES THAT THE ANIMAL(S) AND ITS (THEIR) OFFSPRING WILL NOT BE UTILIZED, SOLD OR TRADED FOR THE PURPOSE OF COMMERCE OR SPORT HUNTING, OR FOR USE IN ANY STRESSFUL OR TERMINAL RESEARCH OR SENT TO ANY ANIMAL AUCTION. RECIPIENT FURTHER AGREES THAT IN THE EVENT THE RECIPIENT INTENDS TO DISPOSE OF AN ANIMAL DONATED BY (INSITUTION), RECIPIENT WILL FIRST NOTIFY (INSITUTION) OF THE IDENTITY OF THE PROPOSED TRANSFEREE AND THE TERMS AND CONDITIONS OF SUCH DISPOSITION AND WILL PROVIDE (INSITUTION) THE OPPORTUNITY TO ACQUIRE THE ANIMAL(S) WITHOUT CHARGE. IF (INSITUTION) ELECTS NOT TO RECLAIM THE ANIMAL WITHIN TEN (10) BUSINESS DAYS FOLLOWING SUCH NOTIFICATION, THEN, IN SUCH EVENT, (INSITUTION) WAIVES ANY RIGHT IT MAY HAVE TO THE ANIMAL AND RECIPIENT MAY DISPOSE OF THE ANIMAL AS PROPOSED.

Institutional note: The text above is similar to the language most dog breeders use in their contracts when they sell a puppy. If people can provide that protection to the puppies they place, zoos/aquariums can provide it for animals that we place too! Some entities have been reluctant to sign it, and in that case we revert to a loan and our institution retains ownership of the animal. Either way, we are advised of the animal’s eventual placement and location.
Appendix E: Recommended Quarantine Procedures

Quarantine facility: A separate quarantine facility, with the ability to accommodate mammals, birds, reptiles, amphibians, and fish should exist. If a specific quarantine facility is not present, then newly acquired animals should be isolated from the established collection in such a manner as to prohibit physical contact, to prevent disease transmission, and to avoid aerosol and drainage contamination.

Such separation should be obligatory for primates, small mammals, birds, and reptiles, and attempted wherever possible with larger mammals such as large ungulates and carnivores, marine mammals, and cetaceans. If the receiving institution lacks appropriate facilities for isolation of large primates, pre-shipment quarantine at an AZA or American Association for Laboratory Animal Science (AALAS) accredited institution may be applied to the receiving institutions protocol. In such a case, shipment must take place in isolation from other primates. More stringent local, state, or federal regulations take precedence over these recommendations.

Quarantine length: Quarantine for all species should be under the supervision of a veterinarian and consist of a minimum of 30 days (unless otherwise directed by the staff veterinarian). Mammals: If during the 30-day quarantine period, additional mammals of the same order are introduced into a designated quarantine area, the 30-day period must begin over again. However, the addition of mammals of a different order to those already in quarantine will not have an adverse impact on the originally quarantined mammals. Birds, Reptiles, Amphibians, or Fish: The 30-day quarantine period must be closed for each of the above Classes. Therefore, the addition of any new birds into a bird quarantine area requires that the 30-day quarantine period begin again on the date of the addition of the new birds. The same applies for reptiles, amphibians, or fish.

Quarantine personnel: A keeper should be designated to care only for quarantined animals or a keeper should attend quarantined animals only after fulfilling responsibilities for resident species. Equipment used to feed and clean animals in quarantine should be used only with these animals. If this is not possible, then equipment must be cleaned with an appropriate disinfectant (as designated by the veterinarian supervising quarantine) before use with post-quarantine animals.

Institutions must take precautions to minimize the risk of exposure of animal care personnel to zoonotic diseases that may be present in newly acquired animals. These precautions should include the use of disinfectant foot baths, wearing of appropriate protective clothing and masks in some cases, and minimizing physical exposure in some species; e.g., primates, by the use of chemical rather than physical restraint. A tuberculin testing/surveillance program must be established for zoo/aquarium employees in order to ensure the health of both the employees and the animal collection.

Quarantine protocol: During this period, certain prophylactic measures should be instituted. Individual fecal samples or representative samples from large numbers of individuals housed in a limited area (e.g., birds of the same species in an aviary or frogs in a terrarium) should be collected at least twice and examined for gastrointestinal parasites. Treatment should be prescribed by the attending veterinarian. Ideally, release from quarantine should be dependent on obtaining two negative fecal results spaced a minimum of two weeks apart either initially or after parasiticide treatment. In addition, all animals should be evaluated for ectoparasites and treated accordingly.

Vaccinations should be updated as appropriate for each species. If the animal arrives without a vaccination history, it should be treated as an immunologically naive animal and given an appropriate series of vaccinations. Whenever possible, blood should be collected and sera banked. Either a 70 °C (-94 °F) frost-free freezer or a 20 °C (-4 °F) freezer that is not frost-free should be available to save sera. Such sera could provide an important resource for retrospective disease evaluation.

The quarantine period also represents an opportunity to, where possible, permanently identify all unmarked animals when anesthetized or restrained (e.g., tattoo, ear notch, ear tag, etc.). Also, whenever animals are restrained or immobilized, a complete physical, including a dental examination, should be performed. Complete medical records should be maintained and available for all animals during the quarantine period. Animals that die during quarantine should have a necropsy performed under the supervision of a veterinarian and representative tissues submitted for histopathologic examination.
Quarantine procedures: The following are recommendations and suggestions for appropriate quarantine procedures for [hamadryas baboons]:

**Hamadryas Baboons:**

**Required:**
1. Direct and floatation fecals
2. Vaccinate as appropriate

**Strongly recommended:**
1. CBC/sera profile
2. Urinalysis
3. Appropriate serology (FIP, FeLV, FIV)
4. Heartworm testing in appropriate species
## Appendix F: Sample Forms Used for Hamadryas Baboons

### DETAILED INVENTORY REPORT MAMMALS

#### Report Start Date 1/1/13

#### Report End Date 06/30/2013

<table>
<thead>
<tr>
<th>TAXONOMIC NAME</th>
<th>COMMON NAME</th>
<th>BEGINNING STATUS</th>
<th>BIRTH</th>
<th>ACQ</th>
<th>DEATH</th>
<th>ENDING STATUS</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Papio hamadryas</em></td>
<td>Hamadryas baboon</td>
<td>20</td>
<td>1</td>
<td></td>
<td></td>
<td>21</td>
</tr>
<tr>
<td><em>Gorilla gorilla</em></td>
<td>Western Lowland Gorilla</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td><em>Varecia rubra</em></td>
<td>Red Ruffed Lemur</td>
<td>2</td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
</tbody>
</table>

Example of form that is used for inventory
Appendix G: Animal Data Transfer Form

**ANIMAL DATA TRANSFER FORM**

1. Curator’s copy of information on new arrival
2. Keeper’s copy of information on new arrival
3. Copy for zoo files and/or veterinarian

***Please send a copy of this form to shipping institution and state condition of animal(s)***

Previous Institution(s) ______
Current Institution ______
Contact Person ______
Title ______
Email ______
Receiving Institution ______

<table>
<thead>
<tr>
<th>Common name:</th>
<th>Scientific name:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zoo ID#</td>
<td>House Name</td>
</tr>
<tr>
<td>______</td>
<td>______</td>
</tr>
</tbody>
</table>

*Note if it is actual or estimated

DIET: Present diet and supplements, favored items, problem foods, feeding procedures.

BEHAVIORAL HISTORY & SPECIFICATIONS: Please list any unique behavioral traits, problems with aggression, safety concerns, or other behavioral problems that may affect management.

General Disposition (skittish, prefers males over females, imprinted, aggressive, etc.):

Stereotypic behavior (frequency, severity, duration, triggers)

Methods used for managing stereotypic behavior:

Does the animal have a history of aggression towards keepers and/or other animals? □ no □ yes

If yes, please explain:

What are the conditions and behavioral precursors to the aggression?

What successful strategies are used for dealing with the aggression?

General comments or describe other behaviors that require further explanation:

MEDICAL HISTORY OR PHYSICAL CONDITION: Medication techniques, immobilization techniques, chronic medical problems, Vet Contact.

ENCLOSURE DATA: Exhibit dimensions and description, disinfection/cleaning needs, temperature and climate control needs.
Hamadryas Baboon (Papio hamadryas) Care Manual

**Exhibit Features:** (When offered or provided, please list or check where applicable. Add comments where necessary)

- Substrates: sand □, gunite □, mulch □, leaf litter □, soil □, other □
- Exhibit Furniture: deadfall □, live trees □, rockwork □, perching □, termite mounds □, other □
- Water features:
  - Holding Area: indoor □, outdoor □, none (see above) □
  - Substrates: sand □, mulch □, leaf litter □, soil □, other □

**Holding Furniture:**

How frequently rotated:

**SOCIAL HISTORY** (check all that apply)

- Rearing type: □ dam, parent or family reared □ hand reared □ with conspecifics □ without conspecifics □ puppet □ supplemental □ foster reared □ by same species □ by different species □ none □ autonomous □ colony/peer

**Comments:**

Animal housed:
- □ individually □ with conspecifics (list # □) □ with mixed species [List species and # of each ________________________]
- □ other, please describe:

Housed on exhibit □, off-exhibit □, access to both □

**REPRODUCTIVE HISTORY:** Relevant information, introduction techniques, behavior toward young, specific concerns.

**ENRICHMENT HISTORY** (Please attach any relevant schedules, approved item lists, sample calendars, etc.)

Goals for the enrichment:

Enrichment activities offered in exhibit:

Enrichment offered: daily □, weekly □, monthly □, scheduled □, other □

How frequently rotated:

Enrichment activities offered in holding (if different from those offered on exhibit)

**Food Enrichment**

Diet Presentation:
- # of feedings per day: □ Varied times □, When: □ Food scattered □, Hidden □

Novel Foods (please list or attach approved list of food items, frequency and amounts offered and presentation):

**Enrichment Devices/Items**
Hamadryas Baboon (Papio hamadryas) Care Manual

PVC feeders ☐ Tires ☐ Burlap/towels ☐ Plastic containers ☐ Puzzle feeders
☐ Cardboard boxes/tubes/bags ☐ Ropes/vines/fire hose ☐ Balls/kegs/barrels ☐ Toys (Kong®, dog chews, etc.)

Attachments methods used (chain, rope, bungee):

Preferred enrichment for this animal (list):

Safety Concerns (ingests cloth, has become impacted, displays at cage mates with large items, etc.):

General Comments (including expanding on any of the data entered, above):

Training or Behavioral Conditioning:
Training goals for this animal (list general behavioral goals and indicate which goals have been achieved and/or which goals were partially shaped but not complete at time of shipment):

How long has animal participated in a behavioral conditioning program?
Frequency and Duration of Training Sessions:
☐ once daily ☐ twice daily ☐ once weekly ☐ twice weekly
☐ other, please specify:

Average length of training session (minutes):

Animal attitude/demeanor towards/during training:
Level of contact between the keeper and animal: ☐ free contact ☐ protected contact

Social arrangement during training sessions:
☐ housed individually and trained individually ☐ separated from conspecifics for training
☐ trained with conspecifics present ☐ trained with mixed species present
☐ other, please describe:

Animal conditioned to enter crate/chute/cage for transport? (circle appropriate device*) ☐ No ☐ Yes

Length: ☐ Width: ☐ Height:

*Attach pictures if necessary to describe training area or device (crates, chutes, etc.).

Reinforcers: ☐ verbal ☐ food List type and amount used:
☐ tactile ☐ combination of all of the above

Bridging stimulus: ☐ clicker ☐ verbal, describe:
☐ whistle ☐ other, describe:

How are undesirable behaviors addressed? ☐ Time-out ☐ ignore ☐ re-direct ☐ incompatible behavior ☐ other (describe):

Which methods have been most successful?:

Association of Zoos and Aquariums 86
### BEHAVIORS TRAINED

(Please provide a brief summary – more detail can be added in subsequent section)

<table>
<thead>
<tr>
<th>Behavior</th>
<th>Verbal cue/command</th>
<th>Visual cue</th>
<th>Criteria for reinforcement</th>
<th>Devices used</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tr>
</tbody>
</table>

Please attach list of behaviors if more room is needed

General Training Comments:
**Appendix H: Body Condition Scoring Scale**

Figure 6.3.1: Body condition scoring system for nonhuman primates, using *Macaca mulatta* as a model. Stylized drawings of ambulating animals in right lateral recumbency attempt to visually depict body prominences, muscle, and fat that are palpated with scoring animals. Note that animals may not actually appear as drawn because of the presence of the haircoat (Clingerman and Summers (2005) and Summers et al. (2012)).

### Body Condition Scoring of Nonhuman Primates Using *Macaca mulatta* as a Model

<table>
<thead>
<tr>
<th>Score</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td><strong>EMACIATED</strong> – Very prominent hip bones (easily palpable and likely visible), prominent facial bones, spinous processes and ribs. Minimal to no muscle mass is palpable over ilium or ischiium. Anus may be recessed between ischial callosities. Body is very angular, no subcutaneous fat to smooth out prominences.</td>
</tr>
<tr>
<td>1.5</td>
<td><strong>VERY THIN</strong> – Hips, spinous processes, and ribs are prominent. Facial bones may be prominent. There is very little muscle present over the hips and back. Anus may be recessed between ischial callosities. Body is angular, no subcutaneous fat to smooth out prominences.</td>
</tr>
<tr>
<td>2</td>
<td><strong>THIN</strong> – Very minimal fat reserves, prominent hip bones and spinous processes. Hips, spinous processes and ribs are easily palpable with only a small amount of muscle mass over hips and lumbar region.</td>
</tr>
<tr>
<td>2.5</td>
<td><strong>LEAN</strong> – Overlying muscle gives hips and spine a more firm feel. Hip bones and spinous processes are readily palpable, but not prominent. Body is less angular because there is a thin layer of subcutaneous fat.</td>
</tr>
<tr>
<td>3</td>
<td><strong>OPTIMUM</strong> – Hip bones, ribs and spinous processes are palpable with gentle pressure but generally not visible. Well developed muscle mass and subcutaneous fat layer gives spine and hips smooth but firm feel. No abdominal, axillary or inguinal fat pads.</td>
</tr>
<tr>
<td>3.5</td>
<td><strong>SLIGHTLY OVERWEIGHT</strong> – Hip bones and spinous processes palpable with firm pressure but are not visible. Bony prominences smooth. Rib contours are smooth and only palpable with firm pressure. Small abdominal fat pad may be present.</td>
</tr>
<tr>
<td>4</td>
<td><strong>HEAVY</strong> – Bony contours are smooth and less well defined. Hip bones, spinous processes and ribs may be difficult to palpate due to more abundant subcutaneous fat layer. May have fat deposits starting to accumulate in the axillary, inguinal or abdominal areas.</td>
</tr>
<tr>
<td>4.5</td>
<td><strong>OBESE</strong> – This animal will often have prominent fat pads in the inguinal, axillary or abdominal region. Abdomen will be pendulous when animal sitting or ambulating. Hip bones and spinous processes difficult to palpate. Bony contours smooth and poorly defined.</td>
</tr>
<tr>
<td>5</td>
<td><strong>GROSSLY OBESE</strong> – Obvious, large fat deposits in the abdominal, inguinal and axillary regions. Abdominal palpation is very difficult due to large amount of mesenteric fat. Pronounced fat deposits may alter posture/ambulation. Hip bones, rib contours and spinous processes only palpable with deep palpation.</td>
</tr>
</tbody>
</table>
Appendix I: Example of Hand Rearing Protocol

Background:
Rhea and Candy are expectant mothers in the current XXX baboon troop. Rhea’s first infant was about two months premature and was stillborn. Rhea showed good maternal instincts with the stillborn baby; she carried it properly and would not put it down. During their time at the XXX, we have not had any baboon births; however, they were present for multiple births at XXX University, and both females were raised by their mothers. Both females are fairly young Rhea: five years, Candy: four years.

Rhea belongs to Negelli’s OMU, and he has not raised any of his young. Rhea follows Negelli very closely and has never been observed straying from him. On the otherhand, Candy belongs to Addis’s OMU, but she spends the majority of her time with Geb, a five year old juvenile male. Addis has raised only one offspring in the troop and was observed abandoning the mother and offspring and being somewhat aggressive with the mother.

Decision to pull infant:
Animal care staff met and discussed criteria for pulling infant from mother for hand raising for previous births. We agreed to manage the troop as normally as possibly (business as usual). When we find that Rhea or Candy has given birth, we will evaluate the following:
• Does the infant appear deserted? Are there any other baboons nearby?
• Who is holding the infant? Is it getting back to its mother to nurse? Is the infant nursing from another lactating female?
• Injury to infant? Anything requiring veterinary care requires pulling.
• Is the infant weak? Have its cries diminished in intensity throughout the day?
• Don’t jump to pull infant if it is being handled roughly. Let’s give mom a chance to prove herself.
• First 24-72 hours are critical nursing times. Observe closely for nursing.
• How aggressive are the males with the mother or the infant?

Handrearing infant:
The infant(s) requiring hand raising will be raised at Pavilion in the old Gerenuk Stalls by animal care staff and neonatal volunteers. This will initially be around the clock care; the infant being held by its caretaker at all times, simulating a mother’s care.

Training:
The lead baboon keepers, Curator of Mammals, and/or neonatal staff supervisor will train all animal care staff and volunteers. For some, a brief refresher is all that is required. New staff members that are inexperienced at primate hand raising will be asked to work a shift with an experienced keeper/volunteer before managing a shift on their own. All staff and volunteers will be coached in baboon behavior so that everyone is acting appropriately and caring for the infant as a mother baboon would.

Shifts:
For the first few weeks of the baboon infant’s life, it will be receiving around the clock care. Four hour shifts will be initially set up. These may change as the infant ages. It is very important that the caretaker finishing their shift updates the incoming caretaker on feed schedules and amount, behavioral information, and/or any other pertinent information. It is then the responsibility of each caregiver to read the Orders and Procedures Record and logbook to catch up on any other information. Shift sign-up sheets will be posted on the door at Mammal Holding.

Shifts and duties are as follows:

8am to noon:
• Record keeping
• Feeding
• Take temperature
• Weigh infant (before feeding)
• General cleaning
• Change footbaths

Noon to 4 pm:
• Record keeping
• Feeding
• Take temperature
• Check and order supplies
• General cleaning

4 pm to 8 pm:
• Record keeping
• Feeding
• Take temperature
• Run dishwasher and put away bottles/utensils
• General cleaning

8 pm to midnight:
• Record keeping
• Feeding
• Take temperature
• General cleaning
• Laundry

Midnight to 4 am:
• Record keeping
• Feeding
• Take temperature
• General cleaning
• Laundry

4 am to 8 am:
• Record keeping
• Feeding
• Take temperature
• Prepare formula for the day
• General cleaning

The infant will be in bodily contact with its caregiver as much as possible during a shift. Exceptions are accounted for at food preparation, general cleaning, bathroom breaks, and doing laundry. These tasks can be done while the infant is taking a nap.

Record Keeping:
Record keeping is very important in tracking infant progress. It is also a very important tool in future handrearings. There are two records that will be kept by all care staff:
• Orders and Procedures Record: record any change in formula, amount fed, time fed, or medication given. This record needs a veterinarian’s approval before a change can take place.
• Daily logbook: record behaviors, medical information, procedures, or “firsts” that occur on a daily basis.

Animal care staff will maintain other records, to be filled out by baboon staff only:
• Infant Arrival Data
• Infant Medication/Vaccination Data
• Infant Change of Diet Record
• Individual Animal Records
Primate Protocol:

Primate Protocol was written by and is mandated by our veterinarian staff. It was set in place to protect infant primates and human primates from the transmission of all zoonotic diseases. The following is required as part of primate protocol:

- Staff and volunteers will be up-to-date on rabies and hepatitis A and B vaccinations. TB tests should be current and negative.
- Latex gloves, masks, long pants, long sleeved shirts, and designated shoes will be worn at all times when caregiver is in a primate area. Hospital gowns can be worn over street clothes to prevent staff/volunteers from having to change clothes before and after shifts.
- Caregivers will use a footbath upon entering/exiting primate area.
- Necklaces, bracelets, and earrings past the earlobe should not be worn while caring for the infant.
- Hair past the shoulder should be tied up and out of infant’s reach.
- If you are feeling unwell or have a cold, please do not have contact with the infant.

Food and Feeding:

Disinfecting bottles and utensils:

All bottles, nipples, bowls, and feeding utensils should be thoroughly disinfected. Do not reuse unwashed bottles or utensils.

Formula preparation:

The infant baboon will be fed Similac with Iron (nutritionally, 20 Kcal/oz is best concentration for development and weight gain (Moore and Cummings)). The ratio of formula to distilled water is 1:1. That is one can of Similac with iron mixed with one can of distilled water. Bottles should be prepared with this formula in advance, measuring out the current amount fed into bottles. Bottles will then be labeled with the day and time that they were prepared. The formula lasts only 48 hours and should be discarded after this time.

When ready to feed, take the prepared bottle from the refrigerator and place it in a warm water bath. When the formula is warm (wrist test) feed the infant in the manner described below. Add ½ ml Poly-Visol to formula during animal care staff feeding shift daily. If a new nipple is being used, make sure the hole is enlarged to encourage better suckling.

Techniques of feeding:

Baboon infants are held and fed in a vertical position, analogous to a breast-feeding human. We will be feeding the infant in the same manner. Hold the infant so its chest is against your chest and the nipple is being given so that the infant does not have to turn its head. Although this is a bit awkward for the caregiver, it is a natural position for the infant.

If the infant should cough, milk will come out of its nose. Remove the bottle, wipe the infant’s nose and face, and then burp the infant. After this and the infant’s breathing has returned to normal, resume feeding. After feeding, the infant should be burped by rubbing and gently patting the back until it burps. It is best to burp the infant only after it has consumed all the formula it wants. Premature burping may result in reduced suckling activity (Moore and Cummings).

How much formula the infant gets and how often it receives it will be detailed in the Orders and Procedures Record. At each shift change, staff and volunteers should update each other on the status of feeding times and amounts.

Diet changes:

All diet changes will be discussed between animal care staff and the veterinarian. If there is a concern about the diet or if the infant needs an increase, please let animal care staff know. All changes that are approved will be posted in the Orders and Procedures Record.

Introducing solids:

When Ras Mitat was hand-reared, solids were introduced in her second week. Small pieces of fruit and chow soaked in formula were offered in conjunction with formula diet. At one month, a gruel was introduced (1 monkey biscuit soaked in 15cc formula, with ½ mashed banana). We will also plan to follow
this feeding protocol. On observations of our other infants, Geb and Tchabu were mouthing solids around 1 week old. Teeth were observed on Geb at 2 ½ weeks.

Biscuits, vegetables, and fruit will be introduced one at a time. Starting with one novel food and feeding it for several days is a good way to ensure no allergic reaction. After adding one, another is added, etc. Large pieces can be offered so that the infant can use the food for teething.

Food Schedule:

The following is FOR REFERENCE ONLY! It is the feeding schedule of Ras Mitat, infant baboon raised in 2003.

Initially: Fed 30–40 cc formula every 4 hours.
Day 6: Increased formula to 50 cc.
Day 8: Increased formula to 60 cc. Fed 5 times per day, eliminating an overnight feeding.
Day 10: Increased formula to 70 cc.
Day 12: Offering small pieces of fruit and soaked monkey chow.
Day 13: Increased formula to 80 cc.
Day 19: Increased formula to 90 cc.
Day 23: Adjusted feeding times, 4 times a day 6 am, 10 am, 2 pm, 6 pm.
Day 28: Began offering 1/8 cup of gruel and formula.
Day 31: Offering ½ cup gruel, formula, and small pieces of fruit.
Day 39: Offering 120 cc of gruel with more formula.
Day 56: Feedings decreased to 3 times a day, eating 160 cc/ feeding.
Day 60: Feedings decreased to 2 times a day.
Day 86: Eating 200 cc per feeding.
Day 114: Offering 280 cc once a day.
Day 140: Decrease feeding to 200 cc per day.
Day 147: Decrease feeding to 150 cc per day.
Day 154: Decrease feeding to 100 cc per day.
Day 161: Decrease feeding to 50 cc per day.
Day 168: No more supplemental feeding.

Stimulating Urination and Defecation:

A newborn infant will require stimulation to urinate and defecate. To do this, rub the genital area with a baby wipe, soft towel, or wash cloth. The resulting urination and/or defecation should be cleaned immediately.

When the infant begins consuming milk, the milk stools should be loose enough and pass easily. After the infant begins urinating on its own, stimulation will not be necessary.

Weights and Weighing:

The infant should be weighed daily at the beginning of the morning shift before feeding and the weight recorded on the daily intake sheet. This information is important in determining the amount of food offered, measuring growth, and monitoring health.

To weigh the infant, place a blanket in the scale basket and put the basket on the scale. Press zero. Place the infant in the basket. Read weight and record.

Temperature Records:

Taking and recording temperatures is important because it helps us determine if the infant is thermoregulating or is getting sick. This will be done at the beginning of each shift. If the temperature is below 35.8 °C (96.5 °F) or above 38.6 °C (101.5 °F), contact the veterinary hospital.

Place a disposable cover on the thermometer, and coat the tip with KY jelly. Push the button on the thermometer; it is now ready to use. The infant is held in the upright position or laid in a horizontal position. The thermometer bulb (just the silver part) is gently inserted in to the anus. The thermometer will beep when the reading is finished. Record temperatures in the daily record and consumption sheet.

Incubator Care:
For the first two to three days of the infant’s life, we may need to use the incubator (isolette) if the infant cannot thermoregulate or is injured. According to Moore and Cummings, an isolette reading temperatures between 31–33 °C (88–92 °F) will result in a rectal temperature of 36.7 °C (98 °F). This temperature range is the temperature where the infant does not have to expend energy to raise or lower their own temperature.

The infant will not be wearing a diaper, so a towel will need to be placed in the bottom of the incubator. The incubator should be cleaned daily with the proper disinfectant, and soiled linens should be changed. The incubator will be set at a temperature determined by the veterinarian. This should only be changed under the guidance of the veterinarian. An alarm will sound if the temperature should rise above or fall below the established temperature. The water level in the incubator should also be maintained. The reservoir needs to be filled with distilled water.

Cleaning/Laundry:
It is important that all areas around the infant are kept clean and clutter free. The infant’s enclosure should be kept free of all soiled items, including bottles, gloves, baby wipes, etc. Labeled laundry baskets will be placed in the hallway for “Infant Laundry” and “Personal Laundry”. “Infant Laundry” includes all blankets, towels, etc. that would be soiled by the infant. “Personal Laundry” would include hospital gown, or pants and shirts used as part of primate protocol. When baskets get full, please take laundry to be washed. Wash/dry “Infant Laundry” in the machines labeled “Animal Use” at Mammal Holding or Cat/Chimp. “Personal Laundry” will be washed/dried in machines labeled “Human Use”.

Supplies:
The following supplies need to be kept on hand. It is the responsibility of the animal care staff to keep track of these supplies and order them when needed.
- Formula-Similac with iron
- Monkey chow biscuits
- Baby cereal
- Baby food
- Baby wipes
- Laundry detergent
- Baby bottles (4 oz. [0.25 lbs.] and 8 oz. [0.5 lbs.])
- Nipples
- Masks
- Gloves
- Paper towels
- Pedialyte®
- KY jelly
- Simple Green/bleach

Security Information:
Any time animal care staff or volunteers are in the park after normal operating hours, ranger staff needs to be aware. It is also necessary for them to know when to open locked gates for you. If the schedule remains consistent, a ranger should already be there to open a gate when you arrive. If you choose to come early, or the schedule times change, please call ZooCom, 879-7540, to contact a ranger to meet you. The phone number at the Pavilion building is 879-7672. Contact numbers for the Curator of Mammals, Pavilion Supervisor, and Baboon Lead Keepers will be made available to you.

Please be aware that you will be in the building with the baboon troop. We ask that you use common sense and refrain from trying to touch any of these individuals. Animal care staff will brief all volunteers on baboon behavior so that you can act appropriately in their presence. If there are any animal escapes, please leave the building immediately, and contact ranger staff.
Appendix J: Commonly Trained Behaviors for Hamadryas Baboons

Commonly trained hamadryas baboon behaviors:

- Hand target
- Station
- Hand
- Foot
- Stay
- Belly
- Scale
- Mouth
- Shift to squeeze cage
- Hand injection
- Tb testing
- Arm extensions
- Ultrasound
- Stethoscope
- Trade
- Blood pressure from leg or tail
- Tail presentation
- Blood draw from tail or leg
- Sit
- Stand
- Back
- Mouth
- Brush/ water pic teeth
- Come
- Hind quarter presentation
- Chest
Appendix K. Training Definitions and Signals

<table>
<thead>
<tr>
<th>North Carolina Zoological Park</th>
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<tbody>
<tr>
<td>Hamadryas Baboon Training</td>
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The North Carolina Zoo houses a multi-male breeding troop of 13 Hamadryas Baboons. We began a training program with the troop in 2005. We have successfully trained 16 of the 18 baboons. All of the baboons are at different stages in our training program. This training booklet is a comprehensive list of behaviors that have been taught thus far. New behaviors will be constantly added as they are taught.

### Target
- White piece of pvc
- Verbal command “target”
- Baboon must touch the pvc with their hand

### Stand
- Stand with both hands extended above your head
- Verbal command “stand”
- Baboon must stand in their station

### Hand
- Hand is presented to baboon (right hand is baboon’s left hand and vice versa)
- Verbal command “hand”
- Baboon is to present right or left hand dependent on which hand the trainer asks for

### Stay
- Hand is open, palm facing the baboon
- Verbal command “stay”
- While the baboon is exhibiting a behavior (i.e. Stand, butt, ultrasound) the trainer will instruct the baboon to stay. The baboon is to hold the position until the trainer is done with the behavior asked.
Hamadryas Baboon (Papio hamadryas) Care Manual

Chest
- Hand is in a fist with the index finger and middle finger extended together
- Verbal command “chest”
- Baboon must present their chest and push it against the mesh

Present (Butt)
- Hand is in a fist with the index finger flexing straight to close
- Verbal command “butt”
- Baboon is to present hind quarters to the trainer

Needle Injection
- While the baboon is presenting “butt”, the trainer instructs the baboon to “stay.”
- While the baboon is staying the trainer will poke the hind quarters with a syringe

Tail
- While the baboon is presenting “butt”, the trainer shows a flat hand with thumb facing upward
- Verbal command “tail”
- Baboon is to sweep their tail upward, at that time the trainer pulls the tail through the mesh

Hold
- Depending on baboon size to hold one or two poles - trainer uses one or two hands
- Fist is clinched perpendicular to the ground
- Verbal command “hold”
- Baboon is to grasp (one or two) poles with hands.

Tail Blood Draw
- While baboon is presenting “butt,” “tail,” and “hold” simultaneously the trainer tells the baboon to “stay” while veterinary staff draws blood
Hamadryas Baboon (Papio hamadryas) Care Manual

Belly

• Palm is facing upward flexing fingers inward then straightening fingers.
• Verbal command “belly”
• Baboon is to press its belly against the mesh presenting it to the trainer

Ultrasound

• While the baboon is demonstrating “hold” with the ultrasound pole mechanism, the baboon is instructed to “stay” at this point the ultrasound probe is placed on the baboon’s lower abdomen

Mouth

• Hand is in a fist with the index and middle fingers pointing upward and thumb is parallel to the ground
• Verbal command “mouth”
• Baboon opens their mouth exposing their teeth

Foot

• Hand is in a fist, palm side down.
• Verbal command “foot”
• Baboon places foot on top of the fist

Brush Teeth

• Verbal command “Mouth”
• Baboon will open mouth and bite lightly on a piece of pvc
• Trainer will then begin to brush the baboon’s teeth

Stethoscope

• Verbal command “belly” and “stay”
• While baboon is presenting their abdomen trainer can use a stethoscope on abdomen/chest area
## Appendix L: Baboon Behavior Chart

Baboon Behavior Chart  
*P=Performer, R=Receiver*

<table>
<thead>
<tr>
<th>Name</th>
<th>Definition</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brow-raising</td>
<td>P stares at R and raises eyebrows</td>
<td>I don’t like what I see; watch out</td>
</tr>
<tr>
<td>Ground-beating</td>
<td>P stares at R and beats palms against the ground</td>
<td>Stop or I will attack you</td>
</tr>
<tr>
<td>Grooming</td>
<td>P uses hands to investigate R’s hair and skinnearness interests and soothes me</td>
<td>I want to be near you; your</td>
</tr>
<tr>
<td>Interposition</td>
<td>P places him/herself precisely between two R’s.</td>
<td>Stop paying attention to each other</td>
</tr>
<tr>
<td>Kecking</td>
<td>Staccato sound, ca, four pulses per sound</td>
<td>I’m beginning to be afraid of you</td>
</tr>
<tr>
<td>Lip-smacking</td>
<td>Audible, rapid opening and closing of the lips</td>
<td>Your hindquarters, your hair makes me feel friendly/erotic.</td>
</tr>
<tr>
<td>Neck bite</td>
<td>P pinches R’s neck between incisors</td>
<td>That’s too much</td>
</tr>
<tr>
<td>Possession grip</td>
<td>P, a male, holds R, a female, firmly by her sides or back</td>
<td>I claim this female for myself</td>
</tr>
<tr>
<td>Presenting</td>
<td>P turns the hind parts to R and remains so for more than a second.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Head lowered onto hands, female to male</td>
<td>Invitation to copulate</td>
</tr>
<tr>
<td></td>
<td>Knees bent, with kecking, to threatening superior</td>
<td>Submission; I’m afraid of you, but want to stay with you.</td>
</tr>
<tr>
<td>Notifying behavior</td>
<td>Male to male presenting in passing</td>
<td>Come or go in peace.</td>
</tr>
<tr>
<td>Circle wiping</td>
<td>One-handed vertical circle movement in front of the nose</td>
<td>I am frustrated I can’t do what I want because I am afraid; this event did not proceed as I expected (motivations in conflict)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Protected Threat</td>
<td>Female A places herself in between a male (she is presenting to him) and rival female B (A is threatening her). Any threat toward A from B would also be directed towards male.</td>
<td>Political play. Female B is virtually powerless to retaliate against A without incurring the wrath of the male.</td>
</tr>
<tr>
<td>Bahuu call</td>
<td>Loud ba-huu call</td>
<td>Alarm call</td>
</tr>
</tbody>
</table>
General behaviors:
- Looking at partner
- Sniffing mouth
- Approaching or following
- Walking away or avoiding
- Pulling closer
- Shoving away

Aggression:
- Staring
- Raising brows
- Protruding head
- Slapping ground
- Pumping cheeks with chewing movements
- Opening mouth
- Lunging at partner
- Biting on shoulder
- “oohu” roar

Submission, escape:
- Presenting rear
- Baring teeth with closed jaws
- Staccato-coughing
- Screaming, squealing
- Bending elbows and knees while standing
- Crouching (pressing belly to ground)
- Escaping

Herding:
- Aggressive patterns, excluding shoulder-biting
- Biting female’s nape of neck or back
- Crouching over female

Maternal behavior:
- Inspecting (putting nostrils close to)
- Grabbing
- Embracing
- Presenting lowered hindquarters to infant as an invitation to carry him
- Carrying on belly or back

Infantile behavior:
- Clinging, being carried
- Sucking
- Humming (when left by mother)

Sexual:
- Presenting anogenital region (female)
- Inspecting and touching anogenital region (male)
- Putting hands on partner’s flank (male)
- Mounting and copulating
- Being mounted

Comfort, appeasement:
- Contact grunt
- Tongue and lipsmacking
- Presenting part of body to be groomed
- Being groomed
- Grooming
- Cuddling together

**Play:**
- Wrestling
- Biting (inhibited)
- Chasing
- Being chased

**Notifying among adult males:**
- Presenting face
- Presenting anal field
- Touching genitals

**Uncertainty, crisis:**
- Scratching
- Touching hand to muzzle (circle –wiping)
- Undirecting "yawning"
- Bahuu bark
Appendix M: Baboon Ethogram

**Aggressive Contact (AC):** an individual uses its hand to swipe at, pull hair of, or slap another individual.

**Aggressive Hold (AH):** use of hand to hold another down, pressed against floor or in corner.

**Aggressive Movement (AM):** individual lunges at another, but does not make contact.

**Allogroom (AL):** an individual picks through another individual’s hair or picks at their fingers, toes, or other body parts.

**Approach (AP):** an individual walks towards another individual.

**Autogroom (AU):** an individual picks through their own hair or picks at fingers, toes, or other body parts.

**Avoid (AV):** individual walks, runs, crawls from an approaching individual; a submissive behavior.

**Bahu Call (BC):** loud alarm bark sounding like “bahu’ or wahu’

**Beg (BG):** most often an infant behavior but can be observed in juveniles and adults. Individual will try to take food from another individual’s mouth or hand by begging with their hands and/or mouth.

**Bite (BT):** an individual uses its teeth to make contact with another individual.

**Brow-raising (BR):** individual stares at and raises eyebrows at another individual; an aggressive behavior.

**Carry (CA):** individual carries enrichment items, rocks, sticks, or other inanimate objects.

**Chase (CH):** individual runs or trots after an avoiding animal; an aggressive behavior.

**Circle Wiping (CW):** individual makes a one-handed vertical circle movement in front of the nose; a behavior signifying frustration when an event does not go as expected, or an individual is not able to do what it wants due to fear.

**Climb (CB):** individual climbs up on tree, climbing structure, or rock wall.

**Clinging (CL):** infant clings to and is being carried by its mother.

**Copulation (CO):** male stands behind the female with his feet on her ankles or calves. Male inserts penis into female’s vagina and thrusts.

**Copulation Present (CP):** a female will present anogenital area to male, lowering her head onto her hands.

**Crouch (CR):** male crouches over female possessively.

**Explore (EX):** Passive (visual) or active (moving) exploring of surroundings by infant.

**Fear Grin (FG):** individual bares teeth and pulls back corners of mouth into open mouthed grin; a fearful and submissive behavior.

**Forage (FO):** individual actively searches for, eats, and masticates food; includes drinking.

**Follow (FL):** an individual walks after another individual. In case of a female following a male, the female may or may not be agitated.

**Genital touch (GT):** male touches genitals or genital area of another male; an affiliative behavior.

**Grooming present (GP):** an individual presents body part to another individual to be groomed.

**Ground-beating (GB):** individual stares at another and slaps palms against the ground; an aggressive behavior.

**Ground-sweeping (GS):** individual, sitting or standing, begins to rapidly sweep at surrounding substrate. Observed when an individual is displacing frustration.

**Grunt (GR):** vocalization made when an individual is excited or is anticipating something favorable.
**Head-bob (HB):** an individual move head down and up quickly; often accompanied with BR or GB; an aggressive behavior.

**Immature carry (IC):** individual (other than immature’s mother) carries infant or juvenile

**Immature hug (IH):** individual (other than immature’s mother) holds and hugs infant or juvenile to its stomach. Often an adult male performs this behavior.

**Inspect (IN):** an individual closely looks at, sniffs and/or touches the anogeital region of another.

**Interposition (IP):** individual places himself in between two other individuals. A warning to both individuals to stop paying attention to each other.

**Jockey (JO):** infant rides on mother’s back. Can be belly down or sitting.

**Jump (JU):** individual jumps around or upon or off an object.

**Kecking (KE):** A staccato vocalization from the back of the throat. Indicates growing fear from the vocalizer towards another individual.

**Lick Object (LO):** individual licks rock, enrichment item, glass, or other inanimate objects.

**Lipsmack (LS):** an individual’s audible, rapid opening and closing of the lips, the tongue touching the lips; an affiliative behavior.

**Manipulate Object (MO):** an individual uses their hands, feet, or mouth to manipulate an object.

**Mount (MT):** an individual approaches another from behind, places hands on the hips of the other and stands bipedal on legs, often touching genitals to anal area of the individual being mounted; dominating behavior.

**Neck-bite (NB):** an individual pinched another’s neck between incisors, usually from behind. Most often male direct towards female.

**Nipple contact (NC):** infant’s mouth has contact with mother’s nipple. Suckling not observed.

**Notifying present (NO):** A male will present his anogenital region to another male while passing him, often accompanied with LS; an affiliative behavior.

**Not Visible (NV):** individual is not visible to observer. Behaviors can not be recorded.

**Piggyback invitation (PI):** an individual turns its hindquarters to another and bends their knees. Directed towards infants or juveniles.

**Play (PL):** individual plays with self or another, not including objects (MO). May be running, jumping, trotting, rolling around, wrestling, chasing, being chased, etc.

**Possession-grip (PG):** a male holds a female from behind by her sides or back, sometimes lying on the female.

**Protected threat (PT):** performed by female individual A. Female A places herself between a male (she presents her anal field to him, therefore submitting to him) and rival female B. Female A threatens female B. Any threat from female B would also be directed towards the male.

**Protest (PR):** individual, usually an infant, struggles to break physical contact with another.

**Reach Out (RO):** individual reaches out to raise arms towards another; an affiliative behavior.

**Run (RU):** individual runs across exhibit. Not associated with running away from an aggressor (AV).

**Scream (SR):** can be an attention getting vocalization by juveniles when they are looking for back up from an adult. Most often heard in times of stress, such as fighting. Also used during submission and escape.

**Self-notify (SN):** male performs notifying behavior (presenting anal field) to reflection in glass or mirror. Looks over his shoulder to see anal field as he presents.
Sexual Mount (SM): male stands behind female with feet on her ankles or calves, thrusting. Copulation not observed.

Sit (SI): individual sits, either at rest or observing, at a distance >20 cm from another individual. May be exhibiting other behaviors such as FO.

Sitting Close (SC): individual sits in close proximity (<20 cm) to another individual.

Submissive present (SP): With knees bent and KE, an individual will turn anogenital region to threatening individual.

Suckle (SK): infant suckles at mother’s nipple, jaw moving up and down and cheeks are indented.

Tail Flop (TF): male individual places tail on back of female who is traveling with him. Observed in times of stress.

Touch (TC): individual reaches out and calmly touches another (not AL or AC)

Travel (TR): individual walks or runs in coordination with other members of the troop.

Ventral carry (VC): mother carries infant ventrally on her belly.

Vocalize (VO): includes vocalizations not included in this ethogram (BC, GR, KE, SC) or those that can not be clearly identified.

Walk (WK): individual walks across exhibit or enclosure. Not associated with FL or AV.

Watch (WA): individual watches conspecifics or people.

Yawn (YN): individual yawns towards conspecifics or person, displaying canines. A threat towards receiving animal.
## Appendix N. Ethogram “Cheatsheet”

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>AC</td>
<td>aggressive contact</td>
</tr>
<tr>
<td>AH</td>
<td>aggressive hold</td>
</tr>
<tr>
<td>AM</td>
<td>aggressive movement</td>
</tr>
<tr>
<td>AL</td>
<td>allogroom</td>
</tr>
<tr>
<td>AP</td>
<td>approach</td>
</tr>
<tr>
<td>AU</td>
<td>autogroom</td>
</tr>
<tr>
<td>AV</td>
<td>avoid</td>
</tr>
<tr>
<td>BC</td>
<td>bahuu call</td>
</tr>
<tr>
<td>BG</td>
<td>beg</td>
</tr>
<tr>
<td>BT</td>
<td>bite</td>
</tr>
<tr>
<td>BR</td>
<td>brow raising</td>
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<tr>
<td>CA</td>
<td>carry</td>
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<td>CO</td>
<td>copulation</td>
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<td>CR</td>
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<tr>
<td>EX</td>
<td>explore</td>
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<td>FG</td>
<td>fear grin</td>
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<td>FO</td>
<td>forage</td>
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<tr>
<td>FL</td>
<td>follow</td>
</tr>
<tr>
<td>GT</td>
<td>genital touch</td>
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<tr>
<td>GP</td>
<td>grooming present</td>
</tr>
<tr>
<td>GB</td>
<td>ground beating</td>
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<tr>
<td>GS</td>
<td>ground sweeping</td>
</tr>
<tr>
<td>GR</td>
<td>grunt</td>
</tr>
<tr>
<td>HB</td>
<td>head bob</td>
</tr>
<tr>
<td>IC</td>
<td>immature carry</td>
</tr>
<tr>
<td>IH</td>
<td>immature hug</td>
</tr>
<tr>
<td>IN</td>
<td>inspect (anogenital region)</td>
</tr>
<tr>
<td>IP</td>
<td>interposition</td>
</tr>
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<td>JO</td>
<td>jockey</td>
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<tr>
<td>JU</td>
<td>jump</td>
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<td>KE</td>
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<td>lipsmack</td>
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<td>NB</td>
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<td>piggyback invitation</td>
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<td>PG</td>
<td>possession grip</td>
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<td>Description</td>
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<td>------------------------</td>
</tr>
<tr>
<td>SM</td>
<td>sexual mount</td>
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<td>SI</td>
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<td>vocalize</td>
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<td>WK</td>
<td>walk</td>
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<tr>
<td>WA</td>
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<tr>
<td>YN</td>
<td>yawn</td>
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## Appendix O. Examples of Enrichment Items

<table>
<thead>
<tr>
<th>Item given</th>
<th>Desired behavior</th>
</tr>
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<tbody>
<tr>
<td>plastic Spools</td>
<td>observe, touch, displacement (aggression), play</td>
</tr>
<tr>
<td>large plastic ball</td>
<td>observe, touch, displacement (aggression), play</td>
</tr>
<tr>
<td>browse</td>
<td>forage (food)</td>
</tr>
<tr>
<td>bowling pin</td>
<td>observe, touch, displacement (aggression), play</td>
</tr>
<tr>
<td>white plastic tub</td>
<td>observe, touch, displacement (aggression), locomotion</td>
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<tr>
<td>sunflower seeds</td>
<td>forage (food)</td>
</tr>
<tr>
<td>Kong toys</td>
<td>displacement (agression), touch, forage (food), learn</td>
</tr>
<tr>
<td>cardboard tubes</td>
<td>touch, forage (food), learn</td>
</tr>
<tr>
<td>newspaper</td>
<td>displacement (agression), touch</td>
</tr>
<tr>
<td>frozen juice cups</td>
<td>forage (food)</td>
</tr>
<tr>
<td>tennis balls</td>
<td>observe, touch, displacement (agression), play</td>
</tr>
<tr>
<td>floating bowls of food in water</td>
<td>observe, touch, displacement (agression)</td>
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<tr>
<td>ginger powder</td>
<td>smell object/air</td>
</tr>
<tr>
<td>magazines</td>
<td>displacement (agression), touch</td>
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<tr>
<td>plastic gas container</td>
<td>observe, touch, displacement (agression), forage (food)</td>
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<tr>
<td>tire</td>
<td>observe, touch, displacement (agression), forage (food)</td>
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<tr>
<td>burlap sacks</td>
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<tr>
<td>ice cubes</td>
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<td>boomer balls</td>
<td>observe, touch, displacement (agression)</td>
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<td>paint</td>
<td>touch, observe</td>
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<td>Cornflakes</td>
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<td>plastic tubes- feeding puzzle</td>
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<td>crickets</td>
<td>forage (food), hunting behavior</td>
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<td>frozen ice block with fruit</td>
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<tr>
<td>mulch with meal worms</td>
<td>forage (food), hunting behavior</td>
</tr>
<tr>
<td>paper burritos</td>
<td>forage (food), object manipulation</td>
</tr>
<tr>
<td>garbage can lids</td>
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<td>brown bags</td>
<td>displacement (agression), touch, forage (food), learn</td>
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<tr>
<td>Jell-O-sugar free</td>
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<td>thyme</td>
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<td>perfume</td>
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</tr>
<tr>
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<tr>
<td>Item</td>
<td>Interaction</td>
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<td>-----------------------------</td>
<td>--------------------------------------------</td>
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<tr>
<td>fire hose</td>
<td>arboREAL locomotion, INCREASE locomotion, resting behavior, explore</td>
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<tr>
<td>yoghurt</td>
<td>forage</td>
</tr>
<tr>
<td>hanging plastic toys</td>
<td>increasing locomotion, arboREAL locomotion, observe</td>
</tr>
<tr>
<td>pizza boxes</td>
<td>observe, touch, displacement (aggression), forage (food), learn</td>
</tr>
<tr>
<td>tree branch</td>
<td>forage (food), play, arboREAL locomotion</td>
</tr>
<tr>
<td>cherry scents</td>
<td>smell object/air</td>
</tr>
<tr>
<td>fox urine scent</td>
<td>smell object/air, hunting behavior</td>
</tr>
<tr>
<td>banana scent</td>
<td>smell object/air</td>
</tr>
<tr>
<td>construction barrel</td>
<td>observe, touch, displacement (aggression)</td>
</tr>
<tr>
<td>traffic cone</td>
<td>observe, touch, displacement (aggression)</td>
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<tr>
<td>water tub with soap suds</td>
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</tr>
<tr>
<td>straw</td>
<td>forage (food)</td>
</tr>
<tr>
<td>peanut butter</td>
<td>smell object, forage</td>
</tr>
<tr>
<td>grits</td>
<td>forage (food)</td>
</tr>
<tr>
<td>bran flakes</td>
<td>forage (food)</td>
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<tr>
<td>radishes</td>
<td>forage (food)</td>
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<tr>
<td>paper maché balls</td>
<td>touch, forage (food), learn, object manipulation</td>
</tr>
<tr>
<td>banana tree stumps</td>
<td>forage(food)</td>
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<tr>
<td>shredded paper</td>
<td>displacement (aggression), touch</td>
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<tr>
<td>alfalfa</td>
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<td>bubbles</td>
<td>observe, play</td>
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<tr>
<td>tissue paper</td>
<td>displacement (aggression), touch</td>
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<tr>
<td>wrapping paper</td>
<td>displacement (aggression), touch</td>
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<td>millet</td>
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<td>pine shavings</td>
<td>displacement (aggression), touch, smell object/air</td>
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<tr>
<td>plastic pumpkins</td>
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<tr>
<td>bison wool</td>
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<tr>
<td>pine cones</td>
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<tr>
<td>vanilla scents</td>
<td>smell object/air</td>
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<tr>
<td>plastic jug</td>
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<tr>
<td>music</td>
<td>listen</td>
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<tr>
<td>jolly balls</td>
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<tr>
<td>mint</td>
<td>smell object/air, forage</td>
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<tr>
<td>root balls</td>
<td>observe, touch, smell object/air, forage (food)</td>
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