Standardized Animal Care Guidelines for Hyaenas and Aardwolves

Alan Shoemaker [1], Mike Dulaney [2] and Gary Noble [3]

[1]Riverbanks Zoological Park, PO Box 1060, Columbia, SC 29202
[2]Cincinnati Zoo and Botanical Garden, 3400 Vine St., Cincinnati, OH 45220.
[3]Disney's Animal Kingdom, POB 10,000, Lake Buena Vista, FL 32830

Introduction

The family Hyaenidae includes four species, three of which are heavy set, dog-like carnivores that possess similar husbandry needs. For purposes of this discussion, there are three species of hyaena: the spotted hyaena, *Crocuta crocuta;* the striped or common hyaena, *Hyaena hyaena*; and the Endangered brown hyaena, *Parahyaena brunnea*. An additional hyaenid, the aardwolf, *Proteles cristatus*, is represented as a single, mono-specific genus that, because of its unique morphology and insectivorous diet, is placed within its own subfamily, Protelinae.

Historically, hyaenas were often obtained by zoos as a 'filler' species, with little thought given to the animals' physical or behaviorial needs. In reality, hyaenas (excluding aardwolves) are top-level predators that are now known to be efficient predators on a par with large felids. Regardless, a lack of understanding of their natural behavior, at least until recently, has relegated them too often to small, barren, barred enclosures that offered little opportunity for the animals to display a normal repertoire of behaviors or allowed for behaviorial stimulation or enrichment. Although easily kept and long-lived, even under such circumstances, these husbandry techniques are out-dated, and today it is recognized that when hyaenas are exhibited in large, outdoor enclosures, they are much more likely to exhibit natural behaviors.

As a result of the development of a Regional Collection Plan (RCP) by the Canid and Hyaena TAG, spotted hyaenas are the only species of hyaena recommended for captive maintenance by member institutions in North America. This decision was made because of the three species of hyaenas, the brown hyaena, is considered Endangered by the U.S. Fish & Wildlife Service, and rarely breeds in captivity because of its unique social structure. Striped hyaenas are largely nocturnal, solitary species that are relatively safe in the wild, while spotted hyaenas are both social and easy to exhibit even as they face conservation pressures in their natural habitats. Regardless, the target population of 100 spotted hyaenas has not been met, and ISIS suggests that only 39 individuals are being housed in zoos in North America (Anon, 2001) (excluding the large collection at Univ. of California at Berkeley which was the source for many zoo-held individuals). At the direction of the Canid TAG's RCP, striped hyaenas are to be phased out of AZA collections and as of April, 2001, only 4 specimens were reported by 3 ISIS-participating, AZA member institutions (Anon 2001). ISIS reports no brown hyaenas being kept in North America at that time. A similar target population for aardwolves, 100, has also yet to be met, and only 23 animals are reported to ISIS by 10 ISIS-participating zoos (Anon, 2001).

Hyaenas are well adapted to a scavenging mode of existence, but spotted hyaenas are primarily active predators of large ungulates. Their massive jaws and teeth are capable of cracking large leg bones and ribs; they commonly ingest smaller bones whole. Adults have a head and body length of 41-54", a tail length of 7-10", a shoulder height of 23-37", and an average weight of 55-135 lb. Brown hyaenas are the smallest of the three species and spotted hyaenas are the largest. A matriarchal species, female spotted hyaenas are 10% heavier than males. In captivity, obesity can be a problem among female spotted hyenas, with some individuals exceeding 150lb. The genitalia of female spotted hyaenas closely mimic those of the male. The clitoris is large and highly erectile, and two sacks containing fibrous tissue closely resemble a scrotum and are located in the same area. Although very hardy under the simplest of husbandry regimes, hyaena exhibits must be stout enough to withstand their destructive tendencies. Longevities exceeding 20 years are not uncommon. Spotted hyaenas have reached 41 years of age (Jones, 1982) and brown hyaenas 30 years (Shoemaker, 1992).

While spotted hyaenas are well known for their sociality, all other hyaenids are social to a degree, with striped and brown hyaenas denning in small social groups and aardwolves being tightly bonded as mates. Regardless, hyaenas function at the top of their trophic level, a behavior that also requires that the introduction of potential mates be done carefully to prevent fighting, injury, or death. The aggressive nature and physical capabilities of hyaenas also demands that the utmost care be exercised when designing exhibits to insure that specimens cannot escape or reach into adjacent cages, keeper or public areas.

The aardwolf is the smallest member of the Hyaenidae, having a head and body length of 21-31 inches, a tail length of 8-12 inches, and standing 17-19 inches at the shoulder (Nowak and Paradiso, 1983). Adults weigh 15-22 lb. The body hair is long and coarse; that on top of the neck and back can be erected during times of excitement or when the animals are startled to make the animal appear much larger than normal. Primarily an insectivore, aardwolves feed on termites and ants. Unlike hyaenas that have immensely powerful jaws and up to 34 teeth, the aardwolf has weak jaws that contain only widely spaced, vestigial cheek teeth. Only the incisors and canines of their 24 teeth remain "normal" in size, the others appearing to be of little use. The canines are sharp and pointed, and are probably used for defense and in social interactions (Nowak and Paradiso, 1983). In the wild aardwolves inhabit open, sandy plains or bush country. When not in search of food, they spend the day in underground dens, often taking over burrows abandoned by aardvarks or crested porcupines (Nowak & Paradiso 1983). Though generally found as single animals or in pairs, there have been occasions where family groups of up to six animals have been observed. After a gestation period of 90-100 days, a litter of 2-3 (range 1-5) young are born in the under-ground den site. Aardwolves are capable of making loud growls or roars which, when coupled with mane erection, make them appear quite formidable. Though used primarily as a means of marking their territory, a foul smelling odor can be ejected from anal glands in defensive situations.

1. Abiotic Environmental Variables (address both exhibit and off-exhibit holding)

1.1 Temperature:

Although hyaenids originate from tropical climates, some populations of all species encounter hot (over 100°F) or cool (to 32°F) temperatures during some parts of the year. As a result, most individuals are tolerant of a wide range of daytime temperatures. Regardless, animals kept outside should always have access to shade, especially during warmer parts of the year. When acclimated, most species without young require only minimal shelter at night if temperatures are only expected to reach 32°F, although heated shelters or indoor enclosures are needed for animals kept in northern regions. For exhibit purposes, basking areas will provide a great deal of warmth in cooler weather, and the use of 'hot rocks' will significantly increase their exhibit use in winter.

Aardwolves: In northern areas, aardwolves may be kept outside in winter if they have access to a nest box with bedding, or if possible, a den with heat lamps or heated floor pads or an indoor den. Such accommodations are satisfactory in states where nightly lows reach 32°F. If housed indoors, all hyaenids should be protected from temperatures exceeding 85°F.

1.2 Humidity:

Hyaenids do not have specific humidity requirements but many species originate from arid habitats that have naturally low humidity. Relative indoor humidity levels of 30-50% are adequate for this family; higher levels may cause skin problems if too humid, not to mention moisture condensation on glass windows and barriers during winter.

1.3 Illumination

1.3.1. Identify light intensity, spectral, and duration requirements,

Hyaenas, being large, active carnivores, are best exhibited outdoors, at least during warmer months; under such conditions, illumination is not a problem. A 12:12 hour cycle is recommended for short-term, indoor holding, with adjustment made for natural photoperiod if animals are being maintained indoors for prolonged periods of time. Skylights will accomplish this automatically. Whenever possible, full spectrum light should be used and skylighting encouraged in indoor areas.

Aardwolves: Aardwolves are predominantly crepuscular or nocturnal, and may be easily exhibited indoors by using reversed light cycles to stimulate activity during peak visitor hours. Under such circumstances, normal fluorescent lighting is sufficient.

1.3.2. Address the impact of and need for daily changes in light intensity and seasonal changes in light intensity and duration

Facilities keeping striped and brown hyaenas and aardwolves in outdoor exhibits will find the bulk of their animal activity at dawn and

dusk, with little activity being observed during midday unless other means of stimulating activity (periodic feeding and keeper interaction) are employed. Aardwolves appear strongly seasonal, even in captivity, and photoperiod may play a role in some aspects of the biology but details of this have not been studied.

1.4 Space

1.4.1. Behavioral repertoire, space requirements, and complexity.

Hyaenas: Hyaenas are large, territorial animals, including one species (spotted hyenas) that lives in large 'clans' of related individuals that patrol and protect a well-defined area from intrusion by other clans in adjacent areas. Territorial borders of spotted hyaenas are heavily marked with latrines and scent marking. As a result, hyaenas are active animals that can be expected to frequently patrol and investigate their exhibit, marking prominent objects with paste from their anal glands. Objects 2-12 inches above the substrate are used most for this purpose (Wenner, 1984), and enclosures should not be intensely cleaned so as to remove all traces of scent markings. In general, outdoor exhibits will display these species best, and enclosures suitable for small to medium sized bears or large felids will meet most of their behaviorial and spatial needs. In areas where winter temperatures prevent constant outside display, typically smaller, indoor enclosures may force zoos to only maintain non-breeding groups of spotted hyaenas rather than larger clans due to over-crowding and aggression. Due to the spotted hyaenas' display of social dominance, hierarchies and coalitions of related individuals, enclosures should have multiple entrances, escape routes and exits to accommodate aggression.

Like other large, territorial carnivores, hyaenas are prone to pacing and other stereotypic behaviors if housed in small, barren exhibits or ones with regular or pronounced borders. To counter this problem, new enclosures should be irregular in shape. Enclosures without corners will also prevent aggressive individuals or coalitions from cornering subordinate individuals. All enclosures should be provisioned with objects to enhance their marking behaviors and change the route of their movements. Trees, stumps, deadfalls, and rocks placed irregularly throughout the exhibit will greatly enhance their daily routine, provide visual barriers for lower ranking individuals as well as improving the overall appearance of the exhibit, especially if some can be moved periodically (Kranendonk et al, 1983). Provisioning the exhibit with hidden food items, animal skins and bones or foreign scents will also increase their activity, especially if replaced at irregular intervals during the day.

Aardwolves: The same requirements listed above are largely true for aardwolves, although being a much smaller animal, indoor and outdoor enclosures can be smaller. Indoor enclosures have the advantage of allowing for reverse lighting to increase visibility and activity levels.

Although appearing shy, this may relate primarily to their nocturnal nature, and many are content to sleep in full view of the public in logs oriented toward viewers, as long as a secure location is present. As such, priority should be given to the number of hiding places included within the exhibit. For a pair of adults, an enclosure should measure at least 400 sq. feet as long as it contains 2-3 nest boxes, dens or caves. Larger enclosures may be necessary for some pairings because of compatibility problems. If aardwolves must be separated, there should always be an opportunity for the animals to maintain visual, auditory and olfactory contact.

1.4.2. Minimum inter-individual distances that must be maintained and that will influence size of space.

Isolated hyaenas, especially spotted hyaenas, require enclosures similar to those appropriate for medium-sized felids or ursids. A minimum area of at least 8 x 8 feet (64 sq. ft.) should be available, with at least two shift enclosures included in the area design. Public observation seems to cause stress for single animals and more room may be necessary (225 sq. ft.) if solitary animals are on display. Zoos should refrain from separating hyaenas unless absolutely necessary due to the high probability of aggression that may follow the return of the absent individual. If at all possible, isolated individuals should remain in olfactory, auditory and visual contact with the clan. Aardwolves are quite timid and will run into a nest box when keepers enter their enclosure.

1.4.3. Identify appropriate furnishings to accommodate an array of locomotory and foraging behaviors as well as resting and sleeping.

Hyaenid enclosures should be enhanced with rocks, tree stumps, logs and branches to change the pattern of their movements. Although ideally structures that can be moved daily, weekly or periodically are best, hyaenas are strong-jawed animals with a propensity for chewing and all objects in their enclosures should be able to withstand their destructive tendencies or be easily replaced. Rubber tires and boots are inappropriate as furnishings or when used for enrichment as they may be chewed into pieces and swallowed.

1.4.4. Address the need for and appropriateness of visual, acoustic, and olfactory barriers within the space.

If exhibited indoors, odors from their latrines and scent marking may be pungent. For esthetic purposes, glass barriers coupled with separate airflow systems for the public area are recommended for indoor hyaena displays. Aardwolves are not odoriferous, and indoor displays can also use open exhibits employing dry moats or net barriers.

1.4.5. Identify appropriate substrates and nesting/bedding materials if required.

Outdoor enclosures employing natural soils are best. Turf and natural grasses, as well as bushes, should be planted and left to grow. In areas of high humidity or rainfall, mixes of sand and pea gravel also do well to keep skin problems to a minimum. All hyaenids, being active diggers, will dig shallow depressions and holes. A 4 x 4" wire mesh buried 18" below grade will encourage digging but prevent animals from disappearing from view. Also, the size of outdoor enclosures should be large enough to prevent destruction of grasses and plantings, or otherwise convert the enclosure to a sterile, dirt substrate that becomes muddy after rains. Because of the nocturnal habits of striped and brown hyaenas, and aardwolves, a nest box or cave should be provided for sleeping needs. Concrete surfaces in indoor situations are also satisfactory but should be kept dry to prevent skin problems. Aardwolves prefer dens with a soft substrate like sand, litter or carpet that can be changed easily. Hyaenas do fine on hard substrates although straw should be provided in nest boxes during cool weather if housed outside.

1.4.6. Address mechanisms for the provision of change and variation in the environment.

To maximize activity levels, furnishing should be moved about the enclosure, as feasible, to reduce stereotypic pacing and other patterns, a common problem in hyaena husbandry when animals were housed in sterile, concrete-floored, regular shaped enclosures. Aside from exhibiting hyaenas outside in irregular enclosures, adding trees, bushes, fallen logs and rocks will increase the level of daily investigation and scent marking. Edible enrichment items (bones, skins, heads) can be hidden throughout the exhibit to encourage exploration and digging (if desirable) as well as to increase the amount of time the animals are engaged in natural behaviors. Scents and parasite-free ungulate manure also provides a good addition for behaviorial modification and enrichment. Adherence to such practices will help maintain natural activity levels that in turn will assist in maintaining hyaenid popularity within individual institutions and overall success of the Population Management Plan.

1.4.7. Address issues, such as scent marking, that may influence how and how often space is cleaned.

Hyaenas are very scent oriented and over zealous cleaning/disinfecting can cause stress and reluctance to shift or enter holding or exhibit areas. Enclosures should not be intensely cleaned so as to remove all traces of scent markings. Logs, play objects such as boomer balls as well as food containers should be kept clean but enough scent left on them for the animals to recognize them. Dirt and grass substrates in outdoor exhibits should be spot-cleaned daily.

It is important that holding area floors and other surfaces be kept dry, as many hyaenas do not use benches or other elevated areas. If exhibited indoors, hyaena enclosures should have a separate ventilation system or solid glass barrier separating them from visitors in order to reduce the strong odor produced by their anal glands.

1.4.8. Identify number of air or water changes/hour required

When kept inside for nighttime, winter or year around, ventilation should be sufficient to minimize odors, drafts, ammonia levels and moisture condensation. The number of air changes per hour needed to control odors and maintain a healthy condition for the animals will vary with the number of animals and the size/volume of the enclosure. The initial design should be for the maximum number of animals that could be housed in the enclosure. Standardized rates of change for various non-recirculated air for a pet shop require a rate of exchange of equal to 1.0 cubic foot of air/minute/sq. ft. of floor space in order to keep odors down to a level satisfactory with the public (Anon, 1981). Cubbing dens well need higher rates of air exchange in order to maintain air quality (Anon, 1981).

1.4.9. Identify necessary measures for safety and containment.

Hyaenas: Hyaenas may be kept in both indoor and outdoor situations. Indoor exhibits may employ combinations of glass, gunite, solid masonry products, heavy mesh or bars for barriers, the last requiring adequate space to protect staff and public from being bitten. They may also be kept outdoors using methods mentioned above, or in moated exhibits that have a retaining wall at least 6 feet wide or behind 9-gauge steel (not aluminum) chain link fencing measuring at least 6 feet high. Fencing should have at least a one-foot overhang to prevent escape or egress. In holding areas, 2.5 x 2.5 x 1/4 inch interwoven steel is an excellent choice, small enough to provide keeper safety but large enough to allow training and enrichment activities. Stainless steel is encouraged to counteract the corrosive nature of hyaena urine.

Although not good jumpers or climbers, hyenas swim well and are prodigious diggers. To insure containment, wire mesh or chain link fencing on non-rock surfaces should extended at least 3 feet into the ground, deeper if needed by winter weather conditions, and extended at least 42 inches horizontally into the exhibit. In areas having soft substrate, covering the entire exhibit (subsurface) may be necessary to prevent digging.

Aardwolf: Being solitary and the size of a medium-sized dog, aardwolves do not need as large as exhibit as hyaenas. Enclosures for a pair of adults should be at least 400 square feet, with irregular dimensions if possible. Because of their general shyness, priority should be given to the number of hiding places available, with 2-3 nest boxes,

dens or caves needed for a pair of adults. Larger enclosures may be necessary for some pairing because of compatibility problems.

Aardwolves do not seem to be able to jump more than a few feet off the ground and do not climb well. When kept outside, a shallow dry moat or low (6 feet) wall is adequate to keep them contained. Like hyaenas, aardwolves are prodigious diggers and this form of behavior should be considered if the animals are to be maintained outdoors on natural substrate. A wire mesh or chain link fence apron buried 3 feet into the ground and then extending 42 inches into the enclosure is usually adequate for containment. If new outdoor exhibits are being considered, a wire mesh barrier should be placed under the entire exhibit, as required for outdoor mongoose exhibits, as aardwolves have been known to dig under subsoil aprons and escape. An overhang of at least one foot should be present on outside fences.

1.4.10. Address issue of transport, identifying (in accordance with IATA)

1.4.10.1. Type of transport container

IATA-approved containers suitable for shipping hyaenids by air must be made from solid wood or metal parts bolted or screwed together. If the crate is of wooden construction, the inside must be made of sheet iron or other hard metal sheeting with ventilation holes cut into it. If the total weight of the container and animal exceeds 132 lb., metal bracing must be added to the frame and forklift space bars provided. The front of the container must be constructed of weld mesh with a diameter that will prevent the animal protruding its nose or paws to the outside. A slide shutter that can be raised and lowered to permit feeding must cover the whole front. The door (s) must have a secure way of fastening so that it cannot be accidentally opened.

Space bars must be present to a depth of 1-inch on the sides of the container. Handles should be present for lifting. If animals are being shipped by land transport instead of by air, crates should still mimic IATA requirements needed for air shipment, and the crate's interior lined with sheet metal to prevent the animal from chewing through wood and escaping or otherwise injuring itself.

Being considerably smaller, aardwolves may be shipped domestically in a #300 or 400-sized Sky Kennel modified to fulfill IATA regulations.

1.4.10.2. Appropriate size of transport container

The height of the container must allow the animal to stand in a natural position with its head extended. The width must permit the animal to turn around and lie down comfortably.

The actual measurements will differ between hyaenas and aardwolves. The sides must have two observation holes at least 4 inches in diameter in the upper part of each side. In addition, ventilation holes with a minimum diameter of 1 inch must be spread over the remainder of the surface in order to give good ventilation, but, at the same time, leave the animal in semi-darkness. The roof must also have ventilation holes with a minimum diameter of 1-inch spread across the surface in order to provide good ventilation. Overall, the total ventilated area must be at least 20% of the total area of the surface of all four sides.

1.4.10.3. Provision of food and water during transport

Hyaenids do not normally require additional feeding or watering during transport for periods of up to 24 hours. If unforeseen delays occur, canned dog or cat food may be offered; adequate moisture is present in these foods to take care of water needs during short periods. A metal water bowl can be attached to the corner of an aardwolf crate but hyaenas may well destroy theirs.

1.4.10.4. Provision of bedding or substrate in transport container

Straw or wood shavings should be included in the container for increased comfort by the animal during transport as well as absorption of urine. If the floor is slated to separate the animal from its urine and feces, however, straw or bedding is not necessary for absorption unless it is under the slates.

1.4.10.5. Mechanism(s) for separating animal from urine and feces during transport

In order to separate animals from urine and feces during, transport, the floor must be slatted over a leak-proof droppings tray, remembering that slates that are too wide may catch an animal's feet.

1.4.10.6. Identify appropriate temperature range during transport

General temperatures permitted by airlines for live animals (45-85°F) are adequate for hyaenids, but shipments made in cooler weather will prevent humidity and temperature problems during transit. Animals being transported in unheated vehicles should not be exposed to temperatures below that (32°F) unless previously acclimated to such temperatures and protected from the wind.

1.4.10.7. Consider appropriate light levels and how to minimize noise during transport

1.4.10.8. Address appropriate group size or need for separation of individuals during transport

Because of their aggressive nature, hyaenids of all ages must be shipped in individual containers.

1.4.10.9. Consider need for handler/veterinarian access to animal during transport

Hyaenas can be safely shipped by air without staff accompanying them. Due to their size and powerful jaws, hyaenas should not be released into terminal facilities designed for domestic dogs, even in cases of emergency. Hyaenas normally transport easily, and few problems are likely to be encountered. Overland transportation requiring several days is acceptable although arrangements for feeding will be necessary.

1.4.10.10. Consider maximum duration of transport allowable before temporary transfer to "normal housing" is required.

Animals being transported by vehicle can travel in their crate for 4-5 days, although zoos planning the transfer of hyaenids over several thousand miles should seriously consider air transport.

1.4.10.11. Address appropriate timing of release, size and type of enclosure at transport destination

Objects familiar to the hyaenid should accompany the animal and be added to the release/quarantine area prior to the animal exiting the crate to ease the stress of shipment.

1.5 Water

1.5.1. Acceptable water quality parameters.

Clean, potable water for drinking should be available at all times.

1.5.2. Appropriate means of presentation of water, and appropriate placement of water sources for terrestrial and semi-aquatic organisms.

Water plays an important part of hyaena life, and in outdoor exhibits, water sources for bathing and esthetics should be included in the form of pools, re-circulating streams, or large, built-in water features. Many hyaenas enjoy bathing in shallow pools and will utilize gunite or masonry pools, or commercial tanks as deep as 3 feet deep. To encourage use in winter, 'hot rocks' can be added to the pool. To avoid footpad abrasion, pools should have smooth finished surfaces and multiple entrances should be present to allow for use by more than one animal. For exhibit purposes, most outdoor water facilities are usually

placed in highly visible locations, but indoor/off-exhibit facilities can provide similar water facilities through the use of commercial cattle waters.

Because hyaenids will use such features for bathing, drinking and cooling off in summer, all water features (inside or outside) should be cleaned and disinfected at least weekly. Spigots should be protected as hyaenas will chew on them. On fast days, produce can be added to the pools for enrichment purposes.

1.5.3. Address issues of depth and need for variation in depth and/or current

If young are present, water containers with steep sides should be avoided.

2. Biotic Variables

2.1 Food and Water

2.1.1. Identify appropriate containers and protocols for the provision of food and water

Clean, potable water for drinking should be available at all times. As such, water can be offered indoors or outside with sturdy portable water containers firmly attached to cage or exhibit walls, or as exhibit built-in water features in the form of small shallow pools or streams. Lixit-type devices may also be used in aardwolf enclosures. Regardless of size, portable water containers should be cleaned and disinfected daily; built-in streams and pools should be cleaned at least weekly. Rubber, plastic or thin metal containers should be avoided as hyaenas are likely to damage or destroy them. Aardwolves are less destructive and portable water containers may be used.

2.1.2. Identify appropriate foodstuffs (see below) and feeding schedules

Hyaena: Hyaenas do well on felid diets that are based on commercial beef or horse products that already have appropriate vitamins and minerals added. Similar diets may also be prepared in-house. Whole animal carcasses (rodents, rabbits, or fowl) freshly killed or thawed, should be substituted upon occasion (weekly if possible) to vary the diet. For nutritional purposes, hyaenas may be fed once a day, often in conjunction with shifting needs. In nature, hyaenas are typically gorge feeders and feed only one or two times a day. If only partial diets are fed in order to facilitate shifting, the remainder of their diet may be offered periodically during the day or hidden throughout their exhibit in order to stimulate activity, especially during peak visitor hours.

Because of problems with obesity, hyaenas that are not pregnant or lactating should be fasted one or two days a week. On fast days, bones should be offered to improve dental hygiene, particularly ox tails or knuckles that have cartilage attached to them. Moreover, because hyaenas are highly adapted to consuming bones, bones should be included in their diet several times a week (Berger & Frank 1992). Those from beef and sheep are best; those from pigs or wild cervids are also suitable if frozen first to reduce the potential of infection from pathogens. Hyaenas normally crush and ingest bones without difficulty. Produce is also a good additive on fast days.

In the past, some institutions fed hyaenas muscle meat from freshly butchered livestock. Although this source of feed may used as a primary or occasional food source, the latter for purposes of enrichment, institutions are cautioned that diets consisting primarily of whole or ground muscle meat may be inadequate in vitamin/mineral content and must have appropriate vitamin and mineral supplementation to ensure a balanced diet. Diets containing high percentages of fowl, especially chicken or turkey necks, should be avoided because of inadequate levels of calcium and phosphorous.

Aardwolf: Due to the sheer numbers of insects consumed in the wild, captive aardwolves, like many other insectivorous mammals, have frequently been fed a palatable, high-protein gruel. Traditionally such diets consist of a mixture of ground meats, dry and/or canned cat food, and evaporated milk, supplemented with vitamins. Because of the high caloric content of meat-based diets in comparison to natural ones comprised primarily of insects, captive aardwolves fed such diets may become overweight unless their diet is monitored carefully. In warm climates, meat-based diets containing eggs may cause problems and some institutions in these areas recommend avoiding them.

Newly available "bugeater diets" developed by Mark Edwards (San Diego Zoo) should also be considered. Sample diets from different institutions are available in the North American Regional Studbook (Lyon, 1997). For purposes of enrichment, live insects and grubs can be added to the diet, offered separated in containers, sprinkled periodically throughout the exhibit or placed into a 'feeder' that allows them to periodically escape.

2.1.3. Address the provision of variability in food type and presentation (e.g. spatial and temporal dispersal of food resources)

Hyaenas: Hyaenas are naturally aggressive in feeding situations and should be fed in individual cages. When food items are hidden throughout their exhibits, enough items placed at widely placed locations should be included to reduce aggression while providing adequate time for both dominate and subordinate animals to find food. In situations where more than one animal must be maintained within the same enclosure, at least two feeding areas should be used to reduce aggression.

Aardwolves: While aardwolves are less aggressive, the number of feeding stations should at least equal the number of individuals within the enclosure. For this species, hiding frozen or thawed mice is commonly used, as is scattering live insects (crickets, meal worms, grasshoppers) throughout the exhibit or in slow-release feeders.

2.1.4. Address opportunities for animals to process food in ways similar to their wild counterparts, and consider mechanisms that enable animals to work for food

Hyaenas: Under natural conditions, hyaenas eat as quickly as possible, bolting their food in order to reduce the likelihood that it will be stolen. If circumstances permit, whole or partial carcasses can be offered to simulate natural feeding as well as to enhance educational value of the exhibit. Escape routes must be present for subordinate individuals to escape aggression during feeding. Whole carcasses can be offered after closing if inappropriate for public viewing. Feet, skins and heads from pigs, cows, sheep and native ungulates can be hidden or buried throughout the exhibit to elicit natural searching and scavenging

behaviors. Such items can also be hung at slight elevations to increase activity. If not normally considered part of their daily diet, the caloric content of such enrichment items should be considered to avoid over-feeding. Items from non-domestic stock should be frozen prior to freezing to kill any pathogens that might be present. For enrichment purposes, commercial scents, logs soaked in feces as well as pre-recorded hyaena vocalizations are also effective.

Aardwolves: Aardwolves respond well to crickets and other insects and larva being tossed into the enclosure at unpredictable times. They can also be added via insect feeders that allow for their periodic escape. Overfeeding is less of a problem with aardwolves as the caloric content of insects is low compared to mammalian-based items.

2.2 Social Considerations.

2.2.1. Group Composition, including as appropriate

2.2.1.1. Suggested age and sex structure of social group

Hyaenas: Depending on the species, the social makeup of captive groups will vary widely, and groups should be developed according to the behavioral characteristics of the species. In nature, spotted hyaenas form permanent, multi-male, multi-female groups (called clans) that are composed of one or several matrilines of adult females and young. As adults, some males will disperse and join other clans. This is the only social hyaenid, and this species may be kept in groups containing several members if space is sufficient and both genders are obtained when young. A group containing 5-6 adults is probably as large as can be maintained without too much aggression developing, or causing ultimate injury to the lowest ranking individual (L. Frank, pers. comm.). Although, Artis Zoo, Amsterdam, starting with a pair of young founders, developed a group of 14 individuals that included the founding pair, 9 additional captive born adults and subadults, and 3 young (Kranendonk et al, 1983). Because female spotted hyaenas are larger than males, they can be expected to dominate males in competitive situations.

Striped and brown hyenas are more solitary and should be kept in pairs. Although establishing pairs of striped hyenas is generally easy, the female being dominant over the male, establishing a pair of brown hyenas can be difficult if one or both were hand-reared. Also, brown hyenas have a unique social order in nature that is seldom broken in captivity (Mills, 1982; Owens & Owens, 1979). In nature some young males leave their natal clan to live solitary lives. Other males remain with their natal group. Those males that remain with

the natal clan become non-breeders, tolerating periodic visits of nomadic males. Conversely, nomadic males periodically visit various clans to breed with estrus females. In captivity, most males assume the role of a clan male. If breeding does occur, reproduction usually ceases after 1-2 litters and long before either animal is old, the male showing little interest in mating.

Aardwolves: Depending on enclosure size, aardwolves can be housed singly, in pairs, as single sexed small groups, or as extended family groups. Compared to other carnivores, aardwolves may be extremely difficult to re-pair, even if they have bred before or grown up together as siblings. Because some pairs may never be compatible, facilities planning on breeding this species should be prepared to try several combinations of adults. Unlike husbandry techniques commonly employed when breeding other carnivores, it is not always necessary to separate male aardwolves from females prior to parturition. Males often act as protectors of the "nursery" den.

2.2.1.2. Temporary isolation of parturient females and young, or of males, and corresponding adequate and appropriate space for animals when removed

Some zoos move late term hyaenas to small cubbing dens just prior to parturition so that the young can be born in isolation from rest of the group (spotted hyaena) or male (other species). Dominant females may be left with the group as their aggressiveness should persist and allow them to defend their offspring. A cubbing den measuring 10 x 12 feet with multiple areas is minimum. Large carnivores should not be housed immediately adjacent to hyaenids, especially breeding ones, as the stress from their actions may deleteriously impact the survival of young. When female spotted hyaenas and their young are reintroduced back to their clan, care and observation should be taken to insure that they are not attacked by other clan members. Although high ranked females are better able to defend their young, low ranking females may not be able to prevent them from being injured (Kronendonk et al 1984). In temperate climate zoos where animals are housed indoors for prolonged periods, exhibit and back-up areas must be large enough to insure the social integrity of the group while the female and young are being reared nearby.

Aardwolves: Aardwolves are not nearly as aggressive toward late term females, and females may remain with male

and prior offspring as long as additional dens or nest boxes are made available. Under those circumstances, nursing females appear able to keep other aardwolves out of their nursery location.

2.2.1.3. Seasonal separation of sexes. For those species that are truly solitary, seasonal introduction of sexes

2.2.1.4. Nursery groups (groups of mothers with most recent young)

In the wild, the social spotted hyaena gives birth to 1-2 young in an isolated den well off from the rest of the clan. Weeks later, females moved their young to a communal den with as many as 20 young of various ages (Kruuk, 1972). Regardless, such a situation is probably not feasible under captive conditions and should not be attempted for risk of injury to young.

2.2.1.5. Forced “emigration” of adolescents

Young adult solitary hyaenids can be removed from their natal group for pairing or transfer to other zoos when 1-2 years old. Spotted hyaenas and aardwolves can remain with their clan longer, especially females, as long as the enclosure is large enough for increased numbers of animals. Typically male spotted hyaenas emigrate from their natal clan and social disorder is not likely to occur by removing adult or subadult males. Because both aardwolves and spotted hyaenas are managed through regional studbooks and Population Management Plans, juveniles should not be separated from their dams or natal groups except as requested by the species manager (and barring medical issues). Handling of surplus individuals should be accomplished with input from these managers.

2.2.1.6. Multigenerational groups (e.g. many primates, elephants)

2.2.1.7. Groups deriving from cohorts (e.g., dolphin male pairs)

2.2.1.8. All male groups

2.2.1.9. Daily and life stage variation in patterns of social affiliation

2.2.2. Group Size, including

2.2.2.1. Minimum and optimum group sizes

2.2.2.2. Inter-individual distances required

2.2.3. Conspecific groups, consider the need for/influence of adjacent groups, or similar taxa, on territorial species

2.2.4. Mixed species groups

2.2.4.1. Identify appropriate species

Unlike hyaenas, aardwolves may be housed with other species. Successful combinations include colobus monkeys, various guenons, meerkats, scuirids, turacos and starlings. Other species should be considered.

2.2.4.2. Identify key environmental elements for each species

2.2.4.3. Identify interspecific inter-animal distances required

2.2.4.4. Address appropriateness of single-sexed groups

2.2.5. Introductions

Initial pair formation is best done when hyaenids are young. Strange individuals should be housed next to each other, i.e., in visual, olfactory and auditory contact, for several weeks in order for them to become familiar with each other. If no aggressive behavior is observed, then they can be introduced while under careful observation. Regardless, successful pairings will still be dependent on individual animals, facility design and trial and error. Removal or death of a dominant individual can be expected to change the hierarchy of a clan; reintroduction of this individual may cause aggression although dominant individuals coming back into a clan after a brief separation can be expected to quickly regain their former position. Enclosures to be used for introductions should have wire mesh 'howdy' doors for olfactory, auditory and visual contact, plenty of furnishings to permit escape, and visual barriers should animals start chasing or fighting with each other. Regardless, hyaenas are 'tough' animals and injuries heal quickly with infection rarely resulting.

Aardwolf: Aardwolf introductions are easiest when the females are in oestrous and being seasonal breeders, at least in some parts of North

America (Texas), pairing can be planned for winter (Evans, pers. comm.). Unlike many species of carnivores, aardwolves may be put together with little introduction. If the female is in oestrus, they will mate almost immediately. If animals fight face-to-face, they should be left alone. Animals biting at each other's flanks will probably not be successful and should be separated. If an introduction is successful, do the animals should not be separated again (male and female). Siblings can be kept together for a time if they are never separated. If compatible aardwolves are separated, re-paired individuals will fail to recognize each other and the introduction will be starting from scratch.

2.2.6. Human-animal interactions

2.2.6.1. Identify acceptable forms of human/animal interaction

Hyaenas adapt easily to daily keeper routines, shifting readily as well as accepting training to allow routine veterinary tasks. Being large, powerful predators that can easily cause injury to other hyaenas or humans, great care should be used when raising young hyaenas as hand raised ones may become very tame toward humans. Nevertheless, they are very capable of injuring their caretakers and care should be taken before entering the cage of such animals. Hyaenas can also be readily conditioned for inspection and treatment in off-exhibit areas and time should be allowed for such training.

2.2.6.2. Address both animal and keeper safety

Exhibits should be monitored for items thrown or dropped into them by visitors, because hyaenas will eat almost anything (e.g., plastic cups, baby bottles, sunglasses, hats, etc.), thereby placing them at risk from intestinal impaction.

3. Health and Nutrition

3.1. Diet

3.1.1. Identify existing standards for nutrient requirements for all life stages if available

Hyaenas, like other cat-like carnivores, may be fed commercial feline diets on a basis of 2-4% of their body weight. Young and reproductive aged adults will probably require close to 4% of their body weight in commercial diet; older animals will require less.

3.1.2. Provide sample recommended diet(s) for all life stages based on nutritional requirements and identify body condition norms as determined from wild animals, if possible

3.1.3. As appropriate address the influence of the following variables on dietary requirements

3.1.3.1. Age (infant, juvenile, reproductive adult, senescent adult, etc.)

3.1.3.2. Body size

3.1.3.3. Reproductive status

3.1.3.4. Seasonal changes in ambient temperature

3.1.3.5. Seasonal changes in body condition

3.1.3.6. Seasonal changes in nutritional requirements

3.1.3.7. Activity levels

3.1.3.8. Health status

3.1.4. Address issues of palatability, texture, processing, etc. that will encourage species-appropriate appetitive behaviors.

3.2. Medical management

3.2.1. Quarantine and hospitalization

Prior to accepting new animals, the following results from the most recent physical examination (within 2 months), CBC, chemistry panel, rectal culture for Salmonella, Campylobacter and Toxoplasmosis and heartworm antigen screening should be received by the receiving veterinarian. A negative fecal should be present 30 days prior to shipping.

All incoming hyaenids should be quarantined for at least 30 days. Each animal should receive a complete physical examination during the quarantine period, and a visual physical examination at the end of the quarantine period. Other tests include:

- Three fecal examinations should be completed (direct & float).
- Two follow-up exams should be done following treatment.
- A rectal culture for *Salmonella* and *Campylobacter* should be completed.
- A complete urinalysis should be run.
- During the initial physical, blood samples should be taken for a CBC, serum chemistry panel and serum banking.
- If the animal is over 5 years old, a thyroid screen should be run.
- Animals should be free from external parasites prior to release from quarantine.
- A seriology test for Toxoplasmosis and an occult heartworm antigen test should be performed.
- A transponder should be implanted between the scapula.

3.2.1.1. Identify problems arising from isolation of social taxa and suggest possible mechanisms for avoiding these problems

Once a group has become stable and its members' social ranking established, it is not wise to remove individuals from the group unless absolutely necessary. Adult spotted hyaena females are especially intolerant of other females, and fighting may develop even after only brief separations. In order to maintain the status quo, medical treatment should be conservative whenever possible. Indeed, it is "routine" for subordinate individuals to have bite wounds about their shoulders and ears but due to their particularly thick skin, such injuries are usually superficial.

3.2.2. Preventive medicine (testing, vaccinations, parasite control, etc.)

Physical exams: Routine physicals should be done once a year, including blood collection for CBC, chemistry panel, heartworm antigen testing, T4/TSH test if greater than 5 years of age, selected serology for Toxoplasmosis, serum banking, rectal culture for *Salmonella* and

Campylobacter, and urinalysis. Because of their small size, aardwolves can be netted or chased into Sky Kennels for routine weighing or injection (see section 3.2.4 for additional information).

Parasite control: In addition to annual physical exams, hyaenids should receive fecal exams every 6 months. Individuals requiring treatment should have 2 follow-up fecal exams at weekly intervals 1-2 weeks post-therapy. In warmer parts of the country, Ivermectin heartworm prevention should be done at monthly intervals. In colder climates, prevention should be done at least during the warmer months, as appropriate.

Vaccinations: Annual vaccinations are recommended and veterinarians unfamiliar with this family are urged to contact the AZA Canid-Hyaena TAG Veterinary Advisor if questions arise. The degree of susceptibility of the Hyaenidae to viruses commonly impacting both canids and felids is not well understood, and many practices are based upon successes with other families of carnivores. Taxonomically, hyaenids are more closely related to felids than canids. Most carnivores should receive Fromm D canine distemper of embryo origin that is derived from modified live virus (MLV) products. Although opinions vary, quarantine or annual vaccinations should probably include prophylaxis against both canine distemper (a paramyxovirus) and feline distemper (a parvovirus) (Berger *et al*, 1992). The large colony of spotted hyaenas maintained at the University of California-Berkeley are vaccinated against canine distemper, the adults on an annual basis, the young at 2, 3, 4 and 12 month intervals (Berger *et al*, 1992). Berger *et al* (1992) also recommend protection against rabies – using only killed virus (KV) rabies products.

Like the poorly understood nature of viral susceptibility impacting hyaenids, the use of modified live virus (MLV) products versus killed virus products varies among practitioners. Rettig and Divers (1986) prefer MLV products on viverrids (another closely related family) for more reliable protection, while Berger et al (1992) uses KV products to minimize the possibility of vaccine induced viral infection. Given the endangered status of one species of hyaena, coupled with the increased scarcity of others from wild or captive born sources, KV products are probably the safer of the two approaches even if more frequent levels of vaccination are required. For more information, owners should consult Fowler (1986) and Berger et al (1992).

3.2.3. Management of (hereditary) diseases or disorders

3.2.4. Appropriate capture, restraint and immobilization techniques and training for routine and non-routine procedures.

Most recent immoblization protocols for brown, spotted and stripped hyaena consist of Telazol 5mg/kg IM. Should supplementation be required, Ketamine at 2mg/kg IM may be used. Protocols using alpha-2 agonists have been described (see Kreefer, 1997) but may cause respiratory depression. As with other carnivores, Alpha-2 agonists can be antagonized with yohimbine or atipamazole. Brown hyaenas have longer hair and this may interfere with proper weight estimation and dart placement (Kreeger, 1997). Medetomidine and ketamine are much easier on the animals than either Telazol or ketamine-xylazine although more expensive (L. Frank, pers. comm.)

Ketamine 15 mg/kg and acepromazine 0.3mg/kg combinations have been used successfully in the aardwolf. Supplementation with 8mg/kg Ketamine is acceptable with this protocol. Because of the smaller size of this hyaenid, care must be taken to use a lightweight, low impact remote delivery system to avoid injuring the animal (Kreeger 1997). Optionally, their small size allows them to be safely netted for injection.

For lengthy procedures, endotracheal intubation with administration of Isoflurane in O_2 is preferred over repeated supplementation with injectable agents. Anesthetic monitoring is as for other carnivores. Training to allow for hand injection of biologics and pharmaceuticals would be advantageous wherever possible.

3.2.5. Management of neonates and geriatric animals

Neonates: Young should receive FVRCP vaccine at 8, 12, 16 weeks, anthelminthics (Strongid T) every 4 weeks until 16 weeks old, and rabies vaccine (Imrab - killed) at 4 months of age.

3.2.6. Management during pregnancy

Pregnant females should be separated from the clan prior to birth although olfactory, auditory and visual contact should be maintained if at all possible. Primiparous females frequently experience dystocia and should be monitored closely at birth (Berger et al, 1992). In such instances, stillbirths were more common than live births but subsequent breedings usually produced viable young (Frank & Glickman 1994). Impending birth may often be recognized by the pregnant female's refusal to eat, frequent urination and spotty defecation, pacing and/or licking the vulva.

4. Reproduction

4.1. Identify seasonal changes in physiology and behavior associated with reproduction and address management implications of such changes

Hyaenas breed throughout the year, and seasonality of reproduction does not present management issues. It should be noted that the inter-birth intervals between hyaena litters may be as short as 8 months or as long as 26 months - the intervals not apparently related to age or social rank.

Aardwolves: Aardwolves appear to cycle seasonally; females in Texas enter oestrus during winter months (January - March).

4.2. Address hormonal tracking as a mechanism for identifying reproductive state, and assessing feasibility of introduction for solitary species

To date, this form of testing has not been done on hyaenids but would be valued for academic, if not management purposes.

4.3. Address timing of introductions for individuals of solitary species

Hyaenids are normally housed together and pairs not intended to breed should be contracepted if young are not desired. Although aardwolves and striped hyaenas are relatively solitary in the wild, pairs can normally be maintained together in captivity, barring issues of incompatibility.

4.4. Address provision of and describe facilities for parturition and as appropriate, management of females during isolation or denning.

Subordinate female hyaenas approaching parturition should be removed from the social group or male to prevent stress or injury to young. Dominant ones can often successfully raise their young as long as sufficient numbers of dens are available. Some female aardwolves accept the presence of the male, particularly if the enclosure is large enough. If the female appears stressed with his presence, however, the male should be removed. While raising young, denning areas should be quiet and dark to reduce stress. When young hyaenids are large enough, females with young should be slowly introduced through a 'howdy' gate to better prepare the male or clan to accept the female and young. Female striped hyaenas and their young are maintained in separate enclosures from the male. To reduce stress from keeper staff, remote video monitors should be included in cubbing areas to monitor young and female behaviors. Although female hyaenas may not raise their first litter, many will learn and they should be allowed to try and raise their second or third litter in order to produce young that have normal behaviorial skills.

Females of all species of hyaenids average 1-3 young per litter. Gestation is 90-110 days, the spotted hyena having the longest gestation. It is common for spotted hyenas to rear only a single young at a time, the largest cub often killing the smaller ones. An isolated cubbing den should be provided for females approaching parturition. This includes aardwolves housed in pairs where the male is not well bonded or otherwise thought to be a potential threat to the

young. In the case of spotted hyaenids, escape tunnels are useful when young spotted hyaenas are being introduced to their dam's clan.

When breeding aardwolves, multiple dens will better meet housing needs for pregnant females. Although husbandry techniques have improved, neonatal mortality is still high compared to other carnivores (Lyon, 1997) although 58% of young were mother raised (n=65). An additional 13% were successfully hand raised (n=15); other rearing techniques were not specified (n=29). Gestation averages 90-100 days (Nowak, 1983).

4.5. Address what, if any, circumstances might warrant hand-rearing and identify acceptable hand-rearing and reintroduction protocols.

Many hyaenas feel insecure in captivity and demonstrate this by carrying neonates around the enclosure, or injuring or killing them. The offspring of females with histories of such behaviors, or young abandoned inside or outside the nesting enclosure may be hand-raised. It should be noted that at least very young striped hyaenas have been successfully introduced to lactating domestic dogs (Wenner, 1984), and this may be an acceptable technique if conditions permit. If attempted, the young hyaenas should be rubbed with the dog's urine to reduce their own odor while making them smell more dog-like.

Hyaena: If hand rearing is necessary, young can be hand raised on Esbilac or milk formulas that are developed for kittens. At the University of California at Berkeley, neonates are fed 70 ml of formula four times a day, gradually changing to 200 ml of formula twice a day (Berger et al, 1992).

Aardwolf: If hand-raised, young aardwolves should be kept in an incubator to keep their skin from drying. For hand-feeding animals, similar protocols at Memphis and San Antonio Zoos feed Esbilac in the following amounts (Lyon, 1997):

Table 1: Recommended feeding protocol for hand-reared aardwolves (Lyon 1997)

Age	Number of feedings	Avg. Amount/feeding
Day 1-10	Fed every 2 hours, 11/day	5-20ml
Day 10-20	Fed every 3 hours/7 day	25-30ml
Day 20-30	Fed every 4 hours/6 day	40-50ml
Day 30-45	Fed 4/day, offer food in bowls	
Day 45-60	Fed 2/day, offer food in bowls	

4.6. Recommend means and duration of contraception for taxon; include all acceptable alternatives and identify the benefits and drawbacks of each

Until there are more data on the action of steroid hormones on the hyaenid reproductive system, they should be considered similar to felids and/or canids in which progestins (natural or synthetic) are associated with uterine and mammary tissue pathology. The safest method of birth control is ovariohysterctomy of females. However, if a reversible technique is needed, an MGA implant is recommended for a 2-year period, followed by a pregnancy to

reverse possible deleterious uterine effects. Non-fertile ovulatory cycles are not a substitute for a pregnancy. According to the AZA Contraceptive Database, MGA implants have been used effectively in seven hyaenas and six aardwolves, with no side effects. However, no samples have been submitted for histologic examination. Other progestins (Depo-Provera, Norplant, Megace or Ovaban) can be substituted but, as with MGA, should not be used for more than 2-year periods without intervening pregnancies. Porcine zona pellucida vaccine has not been used in hyaenids but is not recommended for felids or canids because of possible severe side effects and permanent sterility. Separating males from females is also an option if introductory skills and facilities are available.

5. Behavior management

5.1. Identify procedures that have been successful in managing the taxon for routine husbandry.

Routine husbandry needs include shifting from one area to another, tolerating close visual inspection, tolerating close proximity to caretakers, etc. Hyaenids respond well to whistles, clickers, voice commands and food. As such, getting individuals to accept predictable feeding schedules should make shifting from exhibit to other housing simple. The same is true for inducing individuals to approach enclosure sides for visual inspection and vaccination or contraceptive injections. Aardwolves respond readily to hand feeding.

5.2. Identify procedures that have been successful in managing the taxon for non-routine husbandry.

As in above, training through positive reinforcement may be used for all hyaenids. Adults should be separated from other adults prior to starting training. Hyaenids should be trained in a protective contact situation with the animal contained and a physical barrier (steel mesh, heavy gauge chain link, etc.) separating the keeper and the animal. Non-routine husbandry behaviours include: regular weighing, sample collection, blood pressure monitoring, injections, crating, walking into a small stall/funneling space, transport, etc. Those behaviors that have been the most effective include full body inspection (station, open mouth, lay over, paw presentation, etc.), blood collection, urine collection on cue, body positioning and tolerance of IM injections, subcutaneous injections and fluid administration (Hylton 2001). These behaviors allow for routine medical and husbandry procedures without the stress of manual or chemical restraint.

5.3. Identify procedures that have been successful in facilitating introductions. These may include separation of individuals from group, stationing, tolerance while feeding, “howdy” units, visitation gates, etc.

Spotted hyaenas should not be separated unless absolutely necessary due to the aggressiveness of remaining individuals. Prior to introducing strange individuals, females with young and other separated, individuals should be introduced slowly by housing them next to each other (at night) or otherwise allowing them to maintain contact via wire mesh doors or enclosure sides. After animal reactions to each other appear safe (i.e., no snapping, snarling), a period that could extend for several weeks, individuals can be allowed access to each others enclosure but staff with water hoses or $C0_2$ fire extinguishers should be available in case fighting breaks out. Aardwolves engage in rituatalized fighting which is head to head, often resting on their knees. Such fighting is normal and the animals should not be separated. If aggression is directed at an animal's sides or rear, they should be separated.

5.4. Identify facility design considerations, husbandry training techniques, and implementation plan that can be used to elicit desired behaviors in a way that is safe for both caretakers and animals.

Hyaenids respond quickly to voice and artificial commands (clicker) when done in conjunction with positive (food) rewards. Animals on exhibit are very attentive to commands and learn quickly. The same is true for training in off-exhibit situations where animals can be trained for physical inspection and vaccination prior to positive reward. Hyaenids should be trained in a protective contact situation with the animal contained and a physical barrier in place between the caregiver and the animal. Training can also be done in one of many commercially or custom designed available restraint crates that possess removable bars, access panels or sliding doors that allow safe access to the animal. Depending on the staff and facility, rewards can be administered via a meat stick, food slot or food tray. For enrichment on or off exhibit, successful items include bones, rawhide bones or chips, whole prey, carcasses or partial carcasses, eggs, fruits and vegetables, dog biscuits, and animal hides are used by many. Hiding food in the exhibit or in papier-mâché animal forms, paper bags, Boomer Balls, boxes or tubes will stimulate natural behaviors and provide exercise, as will Christmas trees, flowers and other horticultural cuttings and scents from natural prey (urine or feces) or commercially available animal scents.

5.5. Identify those techniques that have been shown to be most effective.

Successful training programs include those that involved establishing training goal by the entire staff. These goals include a list of behaviors that facilitate desired husbandry procedures. Goals are accomplished by developing training plans that define training steps, cues and criteria for the desired behaviors. Progress of training plans should be monitored and evaluated. Once the desired behaviors are achieved, they should be maintained on a regular basis.

5.6. Identify technical skills and competencies needed by staff

Staff familiar with the husbandry and daily routines necessary for maintaining large, dangerous carnivores (felids, ursids, large canids) should be well prepared for maintaining hyaenids.

5.7. Appropriate methods of enrichment for the taxon should be identified if not included in categories 1-3 above.

6. Documentation

Reviewed by:

References:

Anon. 1981. Outdoor Air Requirements for Ventilation (ASHRAE Standards 62-1981): 3.1 Commercial Facilities (Offices, Stores, Shops, Hotels, Sports Facilities, Etc.) AMERICAN SOCIETY OF HEATING, REFRIGERATION AND AIR CONDITIONING ENGINEERS (ASHRAE): 74-85.

Anon. 2001. MAMMAL ABSTRACTS, International Species Inventory System. www.worldzoo.org. Apple Valley, MN.

Berger, D.M.P.; Frank, L.G. and S.E. Glickman 1992. Unraveling Ancient Mysteries: Biology, Behavior, and Captive Management of the Spotted Hyaena, *Crocuta crocuta*. 1992 PROCEEDINGS, JOINT MEETING AAZV/AAWV: 139-147.

Corbet, G.B. and J.E. Hill 1991. A WORLD LIST OF MAMMALIAN SPECIES, THIRD EDITION. Oxford University Press, London. 243 pp.

Divers, B.J. 1986. Hyaenidae. ZOO ANIMAL MEDICINE, M. Fowler (ed.): 827-831.

Fowler, M. 1986. ZOO ANIMAL MEDICINE, W.B. Saunders Co., Phila., PA. 1127 pp.

Frank, L.G. and S.E. Glickman 1994. Given Birth Through a Penile Clitoris: Parturition and Dystocia in the Spotted Hyaena (*Crocuta crocuta*). JOURNAL OF ZOOLOGY. 234: 659-690.

Hylton, J. 2001. Felid Husbandry Training at Disney's Animal Kingdon. In: FELID TAXON ADVISORY GROUP ACTION PLAN 2001 REPORT (Wildt, D.; Mellen, J. and D. Morris, ed.). Disney's Animal Kingdom, Lake Buena Vista, FL.

Jones, M. 1982. Longevity in Captive Mammals. DER ZOOLOGISCHE GARTEN. 52: 113-128.

Kranendonk, H.J.; Kuipers, J. and B. M. Lensink 1983. The Management of Spotted Hyaenas, *Crocuta crocuta*, in Artis-Zoo, Amsterdam, The Netherlands. DER ZOOLOGISCHE GARTEN. 53: 339-353.

Kreeger, T.J. 1997. HANDBOOK OF WILDLIFE CHEMICAL IMMOBILIZATION. International Wildlife Veterinary Services, Laramie, WY. 342 pp.

Kruuk, H. 1972. THE SPOTTED HYENA: A STUDY OF PREDATION AND SOCIAL BEHAVIOR. University Chicago Press, Chicago. 335 pp.

Lyon, F. 1997. AARDWOLF (*Proteles cristatus*) NORTH AMERICAN REGIONAL STUDBOOK 1996. Oklahoma City Zoological Park, Oklahoma City, OK. 30 pp.

Mills, M.G.L. 1982. The Mating System of the Brown Hyaena, *Hyaena brunnea*, in the Southern Kalahari. BEHAVIORAL ECOLOGY AND SOCIOBIOLOGY. 10:131-136.

Noble, Gary 2000. NORTH AMERICAN REGIONAL SPOTTED AND STRIPED HYENA STUDBOOK (*CROCUTA CROCUTA* AND *HYAENA HYANEA*) UPDATE. Disney's Animal Kingdom, Lake Buena Vista, FL. 17 pp.

Owens, D.D. and M.J. Owens 1979 Communal Denning and Clan Associations in Brown Hyaenas (*Hyaena brunnea* Thunberg) of the Central Kalahari Desert. AFRICA JOURNAL OF ECOLOGY. 17:35-44.

Nowak, R.M. and J.L. Paradiso 1999. WALKER'S MAMMALS OF THE WORLD, Vol. 6. The Johns Hopkins University Press, Baltimore and London. 1936 pp.

Rettig, T. and B.J. Divers 1986.
Viverridae. ZOO ANIMAL MEDICINE, M. Fowler (ed.):822-827.

Sevenich MacPhee, M. and Jill Mellen 2001.HUSBANDRY TRAINING AT DISNEY'S ANIMAL KINGDOM. www.animaltraining.org

Shoemaker, A.H. 1992. 1992 INTERNATIONAL BROWN HYENA STUDBOOK. Riverbanks Zoological Park, Columbia, SC. 25 pp.

Wenner, M.-.L. 1984. Einge Bemerkungen zur Zucht der Steifenhyaene (*Hyaena hyaena*). DER ZOOLOGISCHE GARTEN 54: 191-194.