AMERICAN ZOO AND AQUARIUM ASSOCIATION
ANTELOPE TAXON ADVISORY GROUP

ANTELOPE HUSBANDRY MANUAL

ALCELAPHINAE

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ZOOLOGICAL SOCIETY OF SAN DIEGO
at the
SAN DIEGO ZOO SAFARI PARK

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(previous page)
Cape Hartebeest
Alcelaphus buselaphus caama

Photograph by Kelly S. Spratt

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ALCELAPHINAE

1. General Characteristics

Hartebeest: wt. 180 (135-200)kg. Males wt. 150 (120-180)kg. Females
ht. 124 (120-145)cm.

Cape Hartebeest *Alcelaphus buselaphus caama* (Cuvier, 1804)
Short, glossy coat is light reddish fawn. The face has a median dark blaze. The backs of the neck, chin, and legs up to the hips and shoulders are tinged black. There is a broad whitish patch on the lower rump.

Jackson's Hartebeest *Alcelaphus buselaphus jacksoni* (Thomas, 1892)
General color is fawn with a red tinge. The legs are the same color as the body. There are no dark or light patches.

Wildebeest:

Eastern White-bearded Wildebeest *Connochaetes taurinus albojubatus* (Thomas, 1902)
wt. 272 (165-290)kg. Males wt. 200 (140-260)kg. Females
ht. 140 (115-145)cm.
Body color is a light grey-brown. The mane, tail, and forehead to nose are black. The body has several dark vertical stripes. The beard hairs are white.

Brindled Wildebeest *Connochaetes taurinus taurinus* (Burchell, 1823)
Size is similar to the white-bearded wildebeest. Short, smooth coat is dark gray-brown. The mane, tail, beard, and forehead to nose are black.

Black Wildebeest *Connochaetes gnou* (Zimmermann, 1780)
wt. 130 (110-148)kg. Males wt. 120 (100-135)kg. Females
ht. 114 (90-120)cm.
Body color is uniform dark brown. Mane, chest, and facial hairs are darkest brown to black. Tail hairs are white except at the base of the tail.

Bontebok, Blesbok, & Topi:

Bontebok *Damaliscus dorcas dorcas* (Pallas, 1766)
wt. 95 (65-125)kg. Males wt. 65 (55-70)kg. Females
ht. 99 (85-100)cm.
Short glossy coat is dark brown with a purplish sheen.
There is a white blaze from the base if the horns to the nose. Also the

white rump patch is very conspicuous.

Blesbok *Damaliscus dorcas phillipsi* (Harper 1939)
Similar in size and shape to the bontebok. The coat is a lighter shade of brown compared to the bontebok. There is no white rump patch.

Topi *Damaliscus lunatus jimela* (Matschie 1892)
Wt. 130 (120-150)kg. Males are slightly larger than females.
Ht. 125 (98-130)cm.
Body color is a glossy reddish-brown. There are dark, almost black, patches on the face, upper part of the front legs, and on the hips. All four legs have rufous lower sections.

ISIS LISTING
(from ISIS Mammalian Taxonomy 1991)

	MAMMALIA	**MAMMALS**	
1419	**ARTIODACTYLA**	**EVEN-TOED UNGULATES**	
1419009	**BOVIDAE**	**COWS, ANTELOPES, SHEEP, GOATS**	
1419009012	**ALCELAPHUS**	**HARTEBEEST**	
1419009012001001	*Alcelaphus buselaphus (no subsp)*	Hartebeest	Chad
1419009012001002	*Alcelaphus buselaphus buselaphus*	Bubal Extinct	
1419009012001003	*Alcelaphus buselaphus caama*	Cape Hartebeest	Southwest Africa, Angola
1419009012001004	*Alcelaphus buselaphus cokii*	Coke's Hartebeest	Kenya, Tanzania
1419009012001005	*Alcelaphus buselaphus invadens*	Hartebeest	Ne.Nigeria-n. Cameroon
1419009012001006	*Alcelaphus buselaphus jacksoni*	Jackson's Hartebeest	Uganda
1419009012001007	*Alcelaphus buselaphus lelwel*	Lelwel Hartebeest	Eq. Af., Sudan
1419009012001008	*Alcelaphus buselaphus major*	Western Hartebeest	West Africa
1419009012001009	*Alcelaphus buselaphus matschiei*	Hartebeest	Ivory Coast-Nigeria
1419009012001010	*Alcelaphus buselaphus modestus*	Hartebeest	Central Africa Republic
1419009012001011	*Alcelaphus buselaphus swaynei*	Swaynes Hartebeest	Ethiopia, Somalia
1419009012001012	*Alcelaphus buselaphus tora*	Tora Hartebeest	Ethiopia, Ervi.
1419009012001013	*Alcelaphus buselaphus tscadensis*	Hartebeest	Chad
1419009012002001	*Alcelaphus lichtensteini*	Lichtenstein's Hartebeest	Tanzania-Angola
1419009013	**CONNOCHAETES**	**WILDEBEEST**	
1419009013001001	*Connochaetes gnou*	Black Wildebeest	Cape Province S. Africa
1419009013002001	*Connochaetes taurinus (no subsp)*	Blue Wildebeest	Tanzania, Kenya
1419009013002002	*Connochaetes taurinus taurinus*	Blue Wildebeest	South Africa
1419009013002003	*Connochaetes taurinus albojubatus*	Eastern White-Bearded Wildebeest	Tanzania, Kenya
1419009013002004	*Connochaetes taurinus cooksoni*	Cookson's Wildebeest	Zambia
1419009013002005	*Connochaetes taurinus johnstoni*	Nyasa Wildebeest	Tanganyika, Mozambique
1419009013002006	*Connochaetes taurinus mearnsi*	W. White-Bearded Wildebeest	Tanzania, Kenya

1419009014	**DAMALISCUS**	**BONTEBOK, BLESBOK, TOPI**	
1419009014001001	*Damaliscus dorcas (no subsp)*	Bontebok/blesbok	South Africa
1419009014001002	*Damaliscus dorcas dorcas*	Bontebok	Cape Province So. Africa
1419009014001003	*Damaliscus dorcas phillipsi*	Blesbok	South Africa
1419009014002001	*Damaliscus hunteri*	Hunter's Hartebeest	Kenya, Somalia
1419009014003001	*Damaliscus lunatus (no subsp)*	Topi	Coastal Kenya-Somalia
1419009014003002	*Damaliscus lunatus lunatus*	Tsessebe	South Zambia
1419009014003003	*Damaliscus lunatus jimela* Topi		NE Zaire-western Kenya
1419009014003004	*Damaliscus lunatus korrigum*	Korrigum	West Africa
1419009014003005	*Damaliscus lunatus lyra*	Tsessebe	Central African Republic
1419009014003006	*Damaliscus lunatus purrurescens*	Korrigum	Ne.Nigeria, N. Cameroon
1419009014003007	*Damaliscus lunatus tiang*	Tiang	Kenya, Ethiopia, Sudan
1419009014003008	*Damaliscus lunatus topi*	Topi	Coastal Kenya-Somalia

2. Veterinary Care

Restraint (Manual)

Manual restraint would only be effective when handling neonates or very young animals in this subfamily of antelope. However, the TAMER (a drop-floor restraint device) has been successfully used to restrain adults of both sexes in both bontebok and blesbok. Drop chute restraint has also been used successfully to perform routine procedures on adult topi and sub-adult white-bearded gnu.

Chemical immobilization, recommended drugs:

Chemical restraint:

Recommended drugs:

Carfentanil.....narcotic
M-99.....narcotic

There are many variables which must be considered when determining proper dosage (age, weight, and physical condition to name a few). A list of sample dosages and more general information on chemical immobilization is available in several books.[1]

Whenever possible, the animal to be immobilized should be shifted from the larger outside exhibit to a smaller adjoining catch pen or inside night quarters prior to darting.

In large multi-species exhibits where it is not possible to shift the animal into a catch pen, care must be taken to protect the darted animal from aggression from conspecifics. Also special care must be given to guard areas with water features such as ponds or wallows. If possible, avoid doing a chemical immobilization during the warmest part of the day. Several species of

[1]DISEASES OF EXOTIC ANIMALS, Joel Wallach D.V.M. and William Boever D.V.M.

Alcelaphinae tend to run for several minutes after being darted. Extreme heat will cause hyperthermia and possibly capture myopathy. Symptoms of these conditions can include panting, unresponsiveness, and inability to stand after immobilization. If these symptoms are present, immediate steps should be taken to cool the animal (such as moving the animal to the shade or a cooler area, hosing the animal with cool water, and cool water enema).

An eye drape or towel should be placed over the animal's eyes once you have "hands on" to protect the eyes and reduce stress. Protective hoses may be placed on the horn tips for the duration of the procedure to prevent injury to personnel. Special care should be taken with immobilized white-bearded gnu that tend to throw their heads a lot while under restraint.

When using narcotics to assist restraint there are instances where wildebeest will be immobile while still standing. For simple procedures this standing restraint may be effective instead of trying to "drop" the animal.

Bonteboks pose some special problems when using chemical restraint. They tend to shake and move about a lot during narcotic assisted restraint. In the case of delicate procedures, the use of a portable gas anesthesia machine works well in this species. Bonteboks are also known to be prone to re-narcotization. This is the process where animals start showing signs of narcotic effect, such as pacing or high stepping, hours after the initial procedure was completed. Bontebok should be watched closely after immobilization.

Tranquilization:

Some members of this subfamily, particularly wildebeest, tend to be extremely nervous and flighty when separated from conspecifics or familiar surroundings for treatment or other reasons, necessitating the use of tranquilizers to calm the animals. Recommended drugs for this include:

Haloperidol.....short duration
Haldol Decanoate.....long duration
Trilafon.....long duration

Neonatal examinations:

A neonatal examination should include a check of the heart and lungs, feet and legs (for deformities), and palate (for cleft palate deformities). The umbilicus should be soaked with 3% iodine and checked for herniation. A gluteraldehyde or Bova-S test can be administered to determine the immunoglobulin status. Glucose, temperature, weight, and state of hydration should all be checked. A neonatal exam is typically performed when animals are given their permanent identifications (ear notch, tag, microchip). Examination should be conducted quickly to avoid extended separation from the dam. Wildebeest and topi calves are likely to imprint on keepers or trucks if the separation is too long. One zoo has reported maternal aggression after a calf was returned following a neonatal examination.

Parasites:

In large multi-species exhibits, fecal screening and treatment may be done on a quarterly basis with fecal samples collected one week prior and one week following a scheduled worming to monitor efficacy of treatment. Any additional screenings may be done as needed and should be requested if an animal displays symptoms characteristic of parasitic infestation (i.e. loose stools, stools containing visible tapeworm segments, facial swelling, weight loss, or lethargy).

In more tropical climates a more aggressive protocol may be necessary. Some zoos deworm their herds one a month. In this case, two different deworming medications are used. The two medications are alternately used every other month over the entire year. If a problem persists in an individual, it is darted with ivermectin.

As an extra precaution, in areas with high parasite infestations, pregnant females (along with the rest of the female herd) can be put on Strongid C one month prior to calving in order to pre-empt parasite problems in nursing mothers and calves.[2]

Commonly observed parasites and recommended treatment:

Cestodes..... Droncit

Coccidia..... Albon

Nematodirus.. These parasites may be treated with Ivermectin when you
Strongyles..... have "hands on" the animal. Otherwise, worming
medication, Trichuris..... Fenbendazole, may be milled into the alfalfa
pellet.
Haemonchus...

In large multi-species exhibits, hay amounts may be reduced for four days while animals are offered the medicated alfalfa pellet. The amount of pellet fed out should be increased to compensate for the lack of hay.

Infectious Diseases:

The number one concern for this subfamily is malignant catarrhal fever (MCF). There are two strains of MCF. The sheep-associated MCF (American) and the wildebeest-derived MCF (African). Known herpes virus isolates of African MCF were identified from wildebeest, both species, and hartebeest.

It has been well documented that wildebeest and other alcelaphine antelope (topi & hartebeest)

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[2]Kelly S. Spratt, St. Catherine's Island Wildlife Survival Center (personal comm.)

are carriers of the herpes virus causing the African form of MCF. Transmission from wildebeest to cattle in Africa has been temporally associated with the period of calving of the wildebeest, although the mode of transmission has not been clearly elucidated. Potential carriers of MCF virus can be identified by demonstration of virus neutralizing antibodies in serum.[3]

As carriers of MCF the alcelaphinae do not show clinical signs. However, should the disease be transmitted to any Asian or European ungulates, the resulting infection can be fatal. If alcelaphine antelope are considered for multi-species exhibits, they should be tested for MCF first. Also this subfamily should not be housed near non-African hoofstock.

Another serious health threat, particularly to topi and blesbok, is Johne's disease (*Mycobacterium paratuberculosis*). Johne's disease is caused by bacteria that produce chronic enteritis in ruminants. The incubation period can be as long as several years. Severe clinical signs are persistent diarrhea, which leads to severe emaciation and debilitation. Infection can take place either by fecal-oral transmission or via the placenta. There is no known cure. Control measures include the elimination of infected animals. Testing for this disease is a lengthy process. It involves culturing a fecal sample for at least ten weeks.

Non-infectious diseases:

Problems with copper deficiency are seen in this subfamily. For solutions and a more detailed description of the problem look in the diet section under supplements.

Physiological norms:

See footnote for information on heart and respiratory rates and blood chemistries.[4]

Common injuries and treatments:

Fractures, gore wounds, lacerations, and dystocias are the most common injuries seen in this subfamily.

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[3] Heuschele, W., 1982.

[4] DISEASES OF EXOTIC ANIMALS, Joel D. Wallach D.V.M. and William J. Boever D.V.M., pgs. 203-207.

ISIS PHYSIOLOGICAL DATA REFERENCE, Aug. 1996.

LYNX (software package) Dept. of Veterinary Science, Zoological Society of London, P.M. Bennett.

ZOO AND WILD ANIMAL MEDICINE, Murray Fowler, pgs. 1012-1015.

Some members of this subfamily, particularly wildebeest and hartebeest, tend to be extremely nervous and flighty when separated from familiar surroundings for treatment or other reasons. These cases indicate a need for the use of tranquilizers to calm the animals. (See tranquilizers section)

Other Medical Problems:

Cases of nerve paralysis have been reported in both bontebok and Jackson's hartebeest. The paralysis of the suprascapular nerve is called sweeny. The cause of this paralysis is due to trauma to the nerve where it passes over the cranial border of the scapula or from over stretching**.** Clinical signs of sweeny include lameness with rapid abduction of the shoulder during full weight bearing. This condition has been treated by surgery, where the suprascapular nerve was exposed and a small amount of fibrous scar tissue was removed from around the nerve. Best results for recovery involved returning the patient to a social group after a few months of being alone post surgery.[5]

Other recommended routine medical procedures:

Preshipment/Quarantine: Specific tests may vary depending on the destination of the animal but generally will include: CBC, CHEM, R/C, TB, *Brucellosis, Mycobacterium paratuberculosis* (Johnes), and fecal screening for a parasite check. Also this is typically when animals are given their permanent identifications (ear notch, tag, microchip, etc.)

No vaccinations are recommended for all regions although some particular regions may dictate that animals be immunized against rabies, clostridial diseases, tetanus, bovine viral diarrhea, and equine encaphalides.[6]

Life span: (in captivity) [7]

Alcelaphus buselaphus .....up to 20 yrs.
Alcelaphus buselaphus caama .....up to 19 yrs.
Connochaetes taurinus .....up to 21 yrs.
Connochaetes gnou .....up to 20 yrs.
Damaliscus dorcas .....up to 21 yrs.
Damaliscus lunatus .....15 to 18 yrs.

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[5] Iaderosa, John F., 1996.

[6]Kranz, Karl and LaRue, 1998

[7] Spinage, C. A., 1986 and Marvin Jones 1993

Post-mortem protocol:

A thorough post mortem examination (necropsy) of each animal that dies in the facility, by a veterinarian, preferably a veterinary pathologist, provides valuable information not only on the cause of death for that animal, but also on other concurrent medical problems. Often these problems, such as parasites, nutritional deficiencies, or dental disease, may be present in the animal collection without causing any obvious symptoms. Their detection at postmortem examination indicate that diagnostic tests or treatment should be performed on the remaining animals before clinical symptoms or disease transmission occur.[8]

3. Nutrition

Captive Diets:

Daily feeding with food delivered in the early morning will allow the animals free choice to follow their natural inclination to eat in the early morning and late afternoon hours. The number of feeding and watering sites will be determined by the group size and composition. Regular observations should be made to determine if multiple feeding and watering sites are required, to insure adequate access to all individuals. To minimize fecal contamination and ingestion of sand and dirt, all hays should be fed in racks or feeders above the ground.

Fresh water should be available at all times in both indoor and outdoor areas.

Mineral salt blocks should be available *ad lib.*

Sample diets:

PRESENT DIET USED AT DALLAS ZOO FOR BONTEBOK:

Diet for one animal:*

0-6 months:(once the bontebok is weaned)
1 cup ADF 16 (½ " pellet)
1/4 flake alfalfa hay
Free choice coastal bermuda hay

6-12 months:
2 cups ADF 16
½ flake alfalfa hay
Free choice coastal bermuda hay

12-18 months:

[8] Hinshaw, Amand, Tinkleman, 1996

3 cups ADF 16
3/4 flake alfalfa hay
Free choice coastal bermuda hay

18 months-up:
4 cups ADF 16
1 flake alfalfa hay
Free choice coastal bermuda hay

* All bontebok receive browse three times a week regardless of age.

DIET OFFERED AT SAN DIEGO ZOO SAFARI PARK

Maintenance diet for one adult:

Diet items ∴	**Blesbok** *Damaliscus dorcas phillipsi*	**Cape Hartebeest** *Alcelaphus buselaphus caama*	**Black Wildebeest** *Connochaetes gnou*
High fiber herbivore pellet	SMTWThFSa 3 qts (1800g)	SMTWThFSa 3 qts (1800g)	SMTWThFSa 2 qts (1200g)
Coastal bermuda grass hay	SMTWThFSa a flake (887g)	SMTWThFSa a flake (887g)	SMTWThFSa ¼ flake (665g)
Alfalfa hay	SMTWThFSa a flake (887g)	SMTWThFSa a flake (887g)	SMTWThFSa ¼ flake (665g)

DIET OFFERED AT ST. CATHERINES WILDLIFE SURVIVAL CENTER

Diet for one adult Jackson's or Cape Hartebeest

Males-2 kg. ADF 16 Females- 1.5 kg. ADF-16
Free choice coastal hay
Mineral blocks
Strongid C (dewormer) mixed in with the grain.

Supplements:

Salt and mineral blocks should be available, ad lib.

Copper deficiency has been reported in both blesbok and hartebeest. The clinical signs are light coat color and coat texture becomes dull. Also, loss of condition may be noted by observing prominent ribs, scapulas, and hip bones. In some cases infertility, retained placentas, and abortion may occur. The following paragraphs describe several attempts to address the copper deficiency issue.

The New York Zoological Park was observing signs of copper deficiency in blesbok with blood serum copper values of less than 0.8Φg./ml. Dietary supplementation at 20 mg./kg. providing 60 mg. copper daily for adult blesbok, alleviated visual signs and increased serum copper levels over a period of several months. Initially the blesbok were supplemented with a feed top dressing of copper sulfate at 10 mg. copper (as $CuSO_4$) /animal /day. This regimen gave way to a specially formulated grain mixture containing $CuSO_4$ (Herbi-Mix, Blue Seal Feeds, Lawrence, Massachusetts 01842), which gave the total diet approximately 20 mg./kg. copper.[9]

The San Diego Wild Animal Park has also observed signs of copper deficiency in blesbok and Cape hartebeest. The problem in San Diego was complicated by high levels of molybdenum in the water, and low copper levels in the soil. Initially the problem was addressed by requiring a minimum copper concentration of 10 ppm. in the formulated Zoological Society of San Diego herbivore diets. Also $CuSO_4$ was added to the drinkers in very low doses. The problems still persisted in the blesbok due to their foraging habits of grazing the local pasture and not eating the prepared diet. Ultimately each member of the blesbok herd was immobilized and bolused with a capsule containing 12.5 g. of copper oxide. This Copasure 12.5 copper supplement has been used to treat molybdenum induced copper deficiencies in domestic goats. At this time the results of the use of the copper boluses were not available.

4. Captive Management

Individual identification methods:

In smaller collections small numbered eartags may be sufficient. In larger multi-species exhibits, colored eartags plus ear notching has been used successfully.[10] More detailed information on individual identification methods, including micro chipping, has published.[11]

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[9] Dierenfeld, E., 1988.

[10] San Diego Wild Animal Park

[11] Clifford Rice and Penny Kalk, 1996

Recommended crating and transport procedures:

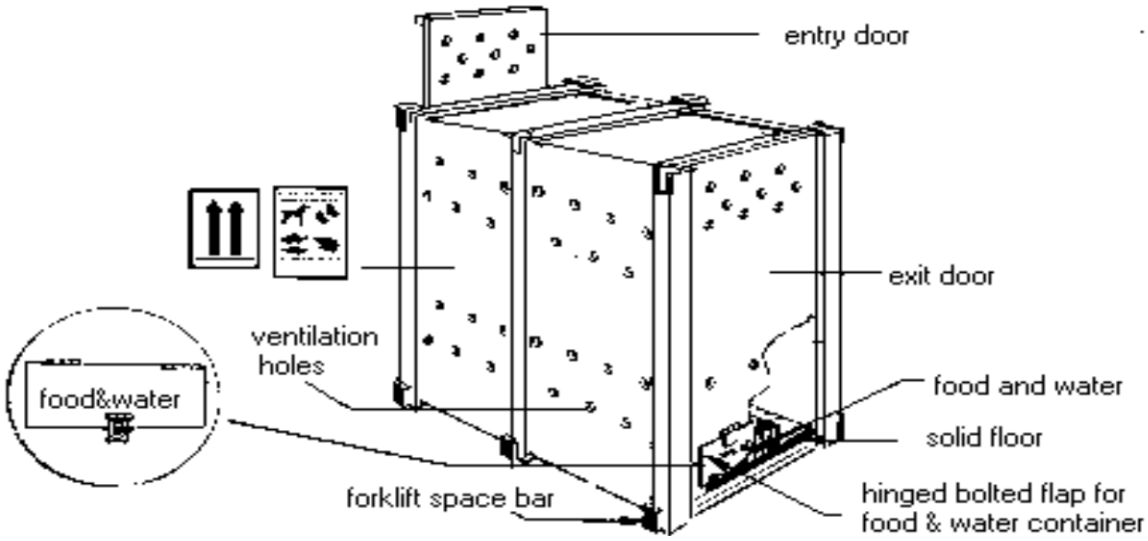
Ideally, exhibit design should incorporate an adjoining smaller “catch pen” into which an animal can be trapped for the purpose of crating. There should be a doorway in the corner of the catch pen leading to an alleyway. The animal is then moved down the alleyway and into a crate or trailer. It may be necessary to follow the animal down the alley with a push board to persuade it into the crate or trailer. A hand held push board may be safely used with juvenile members of this subfamily. A built in push board mounted or suspended on runners is very useful and safer for all involved, when moving adult animals of this subfamily.

Trailer or crate may safely accomplish transport. In both situations it is important to construct a crate or partition the trailer to give the animal only enough space to stand or lie down. Too much room allows the animal to turn around or jump up, potentially injuring itself. Animals will generally be less agitated if their mode of transport is dark, so holes for ventilation should be just large and numerous enough to allow adequate air flow, while limiting light. The ventilation holes should be about 1" in diameter and be placed in a band around the top and bottom of the crate. The crate or trailer may be bedded with Bermuda grass hay, and a tub for water should be fastened into place near the head end of the crate prior to loading the animal. A fill hole should be located to allow convenient watering of the animal during transport.

Container Requirement 73

Reproduced with permission of **IATA**, Mr. Daniel Lebrun, Assistant Director, Marketing & Sales. (The following general IATA information has been slightly modified to reflect the special needs of shipping members of the subfamily Alcelaphinae.)

Container construction



Materials: Wood, burlap for light reduction, if required.

Dimension: The height and width of the container must allow the animal to stand erect with its head extended, even if horned. The size of the container must sufficiently restrict movement so that the animal cannot turn around and in so doing trap or injure itself, nor have space to kick and damage the container. The dimensions will vary according to the species being shipped.

Frame: Must be made of 2.5 cm (1 in) solid wood or metal parts, bolted or screwed together. When the weight of the container plus animal exceeds 60 kg (132 lbs.), additional metal bracing must be present around the whole container.

Sides: Suitable plywood or similar material must closely line the frame to a level slightly above the animal's eye over which there must be an area with a series of holes (no bigger than 2" in diameter) for ventilation extending to the roof. The interior must be completely smooth.

Floor: The base must be solid and leak-proof and bedded with hay to prevent the animal from slipping.

Doors: Hinged or sliding entry and exit doors must be provided. They must be fastened in such a way that they cannot be accidentally opened. They must have similar ventilation openings as on the sides.

Ventilation: Two rows of ventilation holes, with a minimum diameter of (1 inch) 2.5 cm must

be present, above eye level, on all four sides.

Spacer Bars/Handles: Must be made to a depth of 2.5 cm (1 inch) and formed from the framework of the container.

Feed and Water Containers: Food and water containers must be provided with outside access from a hinged bolted flap that must be large enough for the entry of a water dish and/or quantities of appropriate food.

Feeding and Watering Guide: Animals do not normally require additional feeding or watering during 24 hours following the time of dispatch. Shipper's watering instruction must be followed. If feeding is required due to an unforseen delay, fodder must be provided but care must be taken not to overfeed.

General Care and Loading: It is recommended that polyethylene sheeting and absorbent material, such as wood shavings, be placed underneath the container and stapled to the sides of the container (without blocking ventilation holes) to prevent spillage of excreta.

Some animals may require tranquillizing for transportation with a long acting sedative. The name of the medication and the time of administration must be provided by the shipper and affixed to the container and that information must also accompany the Shipper's Certification.

For requirements and regulations regarding transport crate size and design, please refer to IATA, USDA, and APHIS.[12]

Pest control:

It may be necessary to do rodent abatement, particularly in barns or night quarters. Bait stations and snap traps may be placed around the barns where the ungulates have no access. Snap traps have been placed in the exhibits only when all animals have been removed from the exhibit for the evening. All snap traps must be removed from the exhibit prior to returning the animals to the exhibit.

5. Housing and Enclosure Requirements

Containment barriers:

In a single species exhibit, members of the subfamily Alcelaphinae may be contained in an enclosure with a 6 ft. fence (providing the facilities perimeter fence is 8 ft.). The fencing should

[12]International Air Transport Association, United States Dairy Association, Animal & Plant Health Inspection Service

be constructed of 11 gauge woven wire chain link.[13] Requirements may vary slightly from state to state.

In large multi-species exhibits other features may need to be incorporated into the design of the containment barriers, i.e. 6-8 ft. high fences with a 3 ft. in rigger (inside overhang), solid construction wall (block wall, concrete, etc.) depending on the other species you are "containing".

Shelter requirements:

Shelter design will vary according to weather and temperature at individual institutions. Either a tree or shade structure can provide adequate shade in areas, which experience high temperatures. Places which experience cold temperatures may need to provide a shelter which has a roof and three walls or indoor housing.

Substrate/topography:

A relatively flat natural substrate of dirt and grass is preferred.

Water source:

Fresh clean drinking water should be available at all times. Plastic, rubber, or stainless steel containers are suitable as well as automatic float drinkers.

Special furnishings:

Large mounds of soil should be added to the flat substrate. These mounds are frequently used by males in this subfamily as lookout positions or to allow for territorial display. Also, areas of soft substrate can be used as "dry wallows" or for horn scraping by males.

In large multi-species exhibits it is sometimes difficult to position the veterinarians close enough to dart animals during chemical immobilizations. This is particularly true of blesbok and white-tailed gnu. It would be wise to incorporate into the exhibit design a built in shooting blind (rock or tree stump ring or a wall with cutouts to shoot from, etc.) These blinds, if properly positioned, may serve as a visual barrier that is useful to reduce aggression toward lower ranking individuals.

Environmental enrichment:

The antelope in this subfamily are typically not the easiest species to enrich. Common forms of enrichment, like training and keeper interaction, are either ignored or prove to be very difficult to use due to the skittish nature of these animals. The Dallas Zoo has been able to successfully use the following enrichment items with bontebok. However, other members of this group may also

[13]California Department of Fish and Game

be similarly enriched.

The first item introduced was deadfall. Piles of dead branches were introduced to stimulate the bontebok's curiosity. The branches were soon used as scent marking sites, scratching posts and sparring partners. The fact that the antelope chewed on some of the branches led to the introduction of fresh browse branches. Sixteen different types of browse have been offered. The favorite species were; hackberry (*Celtis* sp.), elm (*Ulmus* sp.), mulberry (*Morus* sp.) and bamboo (various species).

Another form of enrichment that was used successfully was a substrate mound. By dumping several wheelbarrow loads of clay-like substrate, in one location, a large pile was formed. This mound was scraped, pawed, dug at by their horns. There was plenty of olfactory stimulation as well. Once the substrate was firmly packed it served as a high point to stand on as wild individuals would use it. The addition of these natural forms of enrichment successfully increased the activity levels of the captive bontebok.[14]

Temperature/humidity requirements:

Alcelaphinae species range over nearly all of Africa where water is available, and they are exposed to a wide range of climates. They can tolerate a wide range of temperatures and can be kept outside year round in many parts of North America. An exact temperature at which animals should be moved from outdoor to indoor housing cannot be mandated since a variety of factors will affect the decision to move the animals indoors. Besides temperature, other weather conditions such as rain, sleet, sunny vs cloudy, wind conditions, availability of shelter, the length of time the weather conditions continue, acclimation, etc. are all factors in the decision to move animals indoors. Animals kept outdoors may need to be protected from frostbite in the ears, horns or feet. Animals kept outside should be given access to shade and drinking water in hot weather and shelter or windbreaks during colder months. Animals kept inside can tolerate relatively high temperatures provided a constant supply of drinking water is available, but should be protected from temperatures above 90EF if exposure is prolonged. Heat should be provided in stalls if the outside temperature falls below 45EF.

Minimal acceptable and optimal size of enclosures:

Indoor facilities:

A single animal should be provided with at least 70 sq. ft., and the size of the stall may need to be increased if the animal will be continuously confined for an extended period of time. Stall size should be increased for each animal housed in the same stall. An increase of about 50 sq. ft. per animal may be sufficient.

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[14]Robertia, J., 1999.

Outdoor enclosure:

Generally 600 sq. ft. for one animal, 800 for two, plus 200 for each additional animal is required.[15] Requirements may vary from state to state.

Capture, handling, restraint facilities:

In a more "traditional" zoo exhibit it is advisable to have a smaller catch pen (which can also be the inside quarters) adjacent to the large enclosure into which the animal can be trapped or moved prior to capture and handling. The TAMER® (a drop-floor restraint chute) has been successfully used to restrain an adult female blesbok, adult male topi, sub-adult white-bearded gnu, adult male and sub-adult female bontebok for routine procedures such as TB testing and blood sampling.

In large multi-species exhibits, if unable to trap the target animal into a smaller catch pen, chemical immobilization may be necessary to facilitate capture.

Utilities:

In indoor areas, natural, incandescent, or fluorescent lighting all provide adequate environments. Inside housing areas should be provided with fans or cross ventilation. Water drinkers should be situated so as not to interfere with the horns of these species.

Sanitation:

Indoor quarters should be cleaned daily. The outdoor enclosures should be cleaned daily. In large multi-species exhibits where it is not possible to clean the entire enclosure, the areas around the feeding stations should be cleaned daily.

Isolation from similar or the same species:

The following hybridizations have occurred in zoological collections worldwide:

Alcelaphus Blainville
Alcelaphus buselaphus Pallas (Hartebeest, Red Hartebeest)
x *Damaliscus dorcas phillipsi* Harper (Blesbok)
Alcelaphus buselaphus caama G. Guvier (Cape Hartebeest, Red Hartebeest)
x *Damaliscus lunatus lunatus* Burchell (Sassaby, Bastard Hartebeest)
Alcelaphus buselaphus cokei Gunther (Coke's Hartebeest)
x *Alcelaphus buselaphus jacksoni* Thomas (Jackson's Hartebeest)

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[15]California Department of Fish and Game

Alcelaphus buselaphus jacksoni Thomas (Jackson's Hartebeest)
x *Alcelaphus buselaphus cokei* Gunther (Coke's Hartebeest)
Alcelaphus buselaphus lelwel Heuglin (Lelwel Hartebeest, Heuglin's Hartebeest)
x *Alcelaphus buselaphus swavnei* P.L. Sclater (Swayne's Hartebeest)
x *Alcelaphus buselaphus tora* Gray (Tora Hartebeest)
Alcelaphus buselaphus swaynei P.L. Sclater (Swayne's Hartebeest)
x *Alcelaphus buselaphus lewel* Heuglin (Lelwel Hartebeest, Heuglin's Hartebeest)
Alcelaphus buselaphus tora Gray (Tora Hartebeest)
x *Alcelaphus buselaphus lewel* Heuglin (Lelwel Hartebeest, Heuglin's Hartebeest)

Connochaetes Lichtenstein
Connochaetes gnou Zimmermann (Black Wildebeest, White-Tailed Gnu)
x *Connochaetes taurinus* Burchell (Brindled Gnu, Blue Wildebeest)
Connochaetes taurinus Burchell (Brindled Gnu, Blue Wildebeest)
x *Connochaetes gnou* Zimmermann (Black Wildebeest, White-Tailed Gnu)

Damaliscus Sclater and Thomas
Damaliscus dorcas dorcas Pallas (Bontebok)
x *Damaliscus dorcas phillipsi* Harper (Blesbok)
Damaliscus dorcas phillipsi Harper (Blesbok)
x *Alcelaphus buselaphus* Pallas (Cape Hartebeest, Red Hartebeest)
x *Damaliscus dorcas dorcas* Pallas (Bontebok)
Damaliscus lunatus lunatus Burchell (Sassaby, Bastard Hartebeest)
x *Alcelaphus buselaphus caama* G. Cuvier (Cape Hartebeest, Red Hartebeest)[16]

6. Behavior and Social Organization

All Alcelaphinae are gregarious with a social organization involving territorial males, female herds and bachelor groups. Males typically become territorial upon sexual maturity. Mixed groups of several males and females are generally not advised. The tendency for dominant bulls to become aggressive with subordinate and young males is commonplace, even in large multi-species exhibits

Associated females establish dominance hierarchies. In the absence of a bull, the dominant cow may actually behave like a territorial male. Even performing many of the typically male social displays.[17]

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[16] Annie P. Gray, 1972

[17] Richard Estes, 1991

Bachelor herds of topi and blesbok have been successful in the absence of females.[18] It is probable that bachelor herds are also possible with several other Alcelaphinae, although this needs further exploration. At the San Diego Wild Animal Park, a bachelor herd of three same age male bontebok did well in a one acre pen. However, three topi males of different ages eventually fought with fatal injuries in a one half acre pen.

Introductions of new animals:

When introducing new animals to the facility, it is preferable to establish them in an off-exhibit holding area before releasing them into a new exhibit enclosure. During this acclimation period, the animal adjusts to its new surroundings and learns the daily routine. When the animal has learned the daily routine and recognizes the holding area as a site for food and security, usually within 1 to 2 weeks, the animal can be released into the exhibit.

Animals should be permitted to "drift out" into the exhibit at their own pace. Animals should never be forced into new exhibits, as this may needlessly stress them. The shift doors should be left open so that animals can return to the safety of the holding area.

It may be advantageous not to clean the holding areas during the introduction. The odor of the soiled bedding may help attract the animal back to its holding area and make it feel more secure on reentry.[19]

New animals should have a period that allows them to familiarize with the existing group. Preliminary introductions should be accomplished with visual, olfactory, and limited tactile contact.

Age of dispersal/removal of young:

18 - 24 months for males if the bull is left with the herd, 12 months if the herd bull is removed. Male calves will begin to show sexual interest in females as early as nine months of age.

At the San Diego Wild Animal Park, a territorial male white-bearded gnu chased males out of the female herd at as young an age as 6 months old. Currently, our male chases out juvenile males that are 8 - 10 months old.

Introductions and removals (effect on group and group reaction):

Introductions, whether of new animals to an existing group, or of the bull to the female herd for

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[18] Anita Schanberger, 1998

[19] Karl R. Kranz, 1996

breeding, is an incredibly challenging endeavor. Species that tend to be particularly difficult include *D. lunatus, D. hunteri,* and *A. b. jacksoni*.

Due to strict dominance hierarchies in the female herds, introductions of new animals over two years of age are extremely difficult. Aggression often runs linearly, with aggression running from 1 – 2 – 3 – 4 (1 being the alpha female, 2 being the beta, etc.). The lowest ranked female is customarily the most aggressive to the new animal. Introductions of new females also have the effect of restructuring intermediate positions in the hierarchy; however, extremely high and extremely low positions remain unchanged. This dominance hierarchy is continually reasserted. Removals of animals, even briefly, can cause significant digression of their position in the hierarchy.

There also appears to be some correlation between the physiological condition of females and their temperament towards each other.[20] Agonistic behavior is at the highest frequency during periods when the bull is removed and females are neither pregnant nor with calves. Therefore female introductions should be attempted at a time when the breeding male is present. It might also be beneficial to introduce two or more females together as a group, rather than one at a time.

Breeding introductions have a similar effect. There is a lot of actual sparring and aggression, not just symbolic postures and displays. Males will often pursue the lowest ranking females upon initial introduction. Introductions involving "experienced" females tend to go the smoothest. Young females that have never been bred are frequently injured. Introducing younger breeding males into a female herd has proven more successful because they are less aggressive with the inexperienced females. Horn clashing and sparring can last up to two hours in topi.[21] Sparring of Hunter's hartebeests can become so extreme that fatalities are possible and have been recorded.[22] Bontebok will on occasion run into obstacles and collide with each other to elude the bull.[23]

In several species of Alcelaphine antelope there seems to be an optimal herd size depending on the size of the enclosure. Hartebeest are a good example. Obviously the number of males in the herd will be restricted by the dominant male. However, female numbers are influenced by the strict dominance hierarchy. At St. Catherine's Island, female hartebeest will start to be excluded from a basic herd of 10. They are lower ranking females that are limited in their access to

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[20] Jeff and Kelly Spratt, St. Catherine's Island Wildlife Survival Center (personal comm.)

[21] Jeff Stehle, San Antonio Zoological Gardens and Aquarium (personal comm.)

[22] Greeley Stones, Gladys Porter Zoo (personal comm.)

[23] Lisa Fitzgerald, Dallas Zoo (personal comm.)

resources such as shade or shelter.[24] At the San Diego Wild Animal Park, the white-bearded gnu herd eventually split into two distinct groups in a 125-acre exhibit.

Seasonal changes in social behavior:

Wildebeest species are seasonal breeders in the wild and in captivity. They are an excellent example of the reproductive strategy called breeding synchrony. The other species in this subfamily tend to lose some of their seasonality in breeding when put in a captive situation. Captive herds may breed and produce calves all year round.

Behavioral indicators of social stress, harassment, or impending social changes such as dispersal:

Increased aggression (chasing, horn clashing and horn butting, isolating individuals).

Olfactory behavior, scent marking, flehmen:

All species have preorbital glands that are well developed and functional in both sexes (although males have larger and more active glands). The preorbital secretions vary in color and consistency among species. The exudates tend to be sticky or waxy and can be black, yellowish, or colorless. All species mark inanimate objects with these glands, however, members of the *Alcelaphus* and *Damaliscus* genera will actually insert stems, twigs, and blades of grass into the gland. The animal will then "weave" its lowered head back and forth, so that glandular scents collect on the annuli of the horns and the hair of the face and head. Members of the genus *Connochaetes* preorbitally mark the hindquarters or flanks of an opponent during territorial encounters, and as a form of social contact.[25] Members of the genus *Alcelaphus* have been known to self-mark by rubbing their face on their flanks and shoulders.

All species possess well-developed hoof glands on the forefeet. *C. taurinus* and *D. lunatus* also possess rudimentary glands on the hind feet.[26] Ground pawing and scraping is a common form of territorial marking.

Territorial males of all species may establish dung piles, although this behavior is greatly reduced in *D. d. dorcas*. Topi will urinate and defecate over the feces of conspecifics. Hartebeests and wildebeests will role in their dung. Wildebeests are the only true wallowers of the *Alcelaphine* sub-family. All species partake in ground horning. Topi will face-rub in the dirt

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[24] Jeff and Kelly Spratt, St. Catherine's Island Wildlife Survival Center (personal comm.)

[25] Fritz R. Walther, 1984

[26] Kelly S. Spratt

and bedding material, then will wipe their flanks and back with their horns (unlike hartebeest which wipe with their heads).

Males of the genus *Connochaetes* perform flehmen. This behavior is non-existent in all other species.

Auditory behavior:

Alcelaphus:

Produce explosive snorts when alarmed. Fighting males sometimes bark. Juveniles are more vocal than adults and make quacking distress calls that are commonly uttered when the calf is pursued or threatened. This call is closely associated with the appeasing behavior of an inferior animal and is occasionally heard in similar contexts in adults. Mothers make a quavering bleat when searching for calves. Calves bleat and produce contact calls for up to two years. Herds on the run make a peculiar cough call.[27]

Damaliscus:

Topi: Snort when alarmed. Males grunt when trying to herd females and while mating. Females rumble or grunt gently at their young and the young bleat and even squeak in excitement.[28]

Bontebok/blesbok: Snorting when excited, grunting "mboa" of mother to bleating calf (straying call), snorting of mother as call to calf to follow. Calves produce a "beep" like contact call for up to two years. Males may grunt during copulation.

Hunter's Hartebeest: Snorts and grunts. Males will bleat repeatedly if frightened. Respond to alarm calls of other species.

Connochaetes:

Brindled/blue wildebeest: Snort when alarmed. Groaning-croaking calls ("ugh"), particularly when moving, but also during other maintenance activities. Will grunt when angry, females produce lows, calves bleat. On territory males may repeat a sharp metallic call in morning, evening and also by night, in rutting season doubled or trebled, often ending in a high squeal. Females call like males but without the squeal. Ssp. *albojubatus* the most vocal. Bulls call at an increased frequency during courtship.

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[28] Jonathon Kingdon, 1982

Black wildebeest: Snorting when disturbed. Tail slapping that produces a hissing sound that can be heard nearly ½ km distance. Grunts when angry, female lows, calves bleat. Basic sound in relation to threatening associates a "mooing" becoming a loud cry afterwards when in great danger. Submissive lying down is sometimes accompanied by vocalizations frequently heard from calves. The territorial advertising call is very shrill and strophic and sounds much like a "hic", greatly magnified into a "hicc-up" (or "he-itt") and has great carrying power. With each hic the bulls chin jerks upward. Bachelor males rarely call and tend to produce an adolescent croak.

Parental care:

Alcelaphus:

Before parturition females will isolate themselves from the herd, often accompanied by one or more previous offspring. Hartebeests retain the "hider" system. The hiding phase of calves typically lasts two weeks. Females will eat the afterbirth.

Damaliscus:

This is the most variable genera of the sub-family. The topi calving strategy is intermediate between the "hider" and the "follower" system. Females will isolate themselves to calve. Young are sometimes bedded down in nursery herds overseen by one or more mothers.

Blesbok/bontebok display the "follower" strategy, but not to the extreme of wildebeest. Females do not isolate, but rather calve in small herds. After births are left uneaten, however some exceptions have been recorded. There have been occasions where females that simultaneously gave birth, permanently switched offspring.

In the Hunter's hartebeest, calves display a brief lying-up phase. Females will consume the fetal membranes.

Connochaetes:

Wildebeest do not isolate to give birth. Calves are strict followers, often standing within 5 minutes of being born (slightly longer in black wildebeest). Black wildebeest will chew on the afterbirth, but do not consume it as blue wildebeest do.

Courtship behavior:

All species share the same basic courtship behaviors. The most pronounced male displays are the rocking canter, the erect posture, and the low stretch. In the low stretch position, the male will stretch the head and neck horizontally forward. The tail is either held horizontally raised or

curled over the back. The ears are lowered or held out sideways from the head. The male will approach the female in this position and sniff her genitalia..

There is also some degree of vocalization associated with courtship in almost every species. Sexually excited wildebeest bulls call at twice the normal tempo and become so worked up that they literally froth at the mouth.[29]

Topi and wildebeest also have additional courtship behaviors. Topi have a very conspicuous high-stepping behavior that is performed from the erect posture. Wild populations of topi are also known to occasionally adopt a 'lek' mating system. Additional sexual behaviors of the wildebeest include urination on demand and urine testing (*flehmen*), resting of the chin on the female's croup,
and walking bipedally on hind legs with a full erection.

Copulation of all species is brief, but as a rule is repeated multiple times.

[29] Richard D. Estes, 1991

Mixed species exhibit capability and recommendations:

The initial phases of setting up a mixed-species exhibit are crucial. Many species will live together compatibly once they become accustomed to each other's presence. However, members of the *Alcelaphus* and *Damaliscus* genera are often inherently antagonistic towards other species, and are difficult to work into multiple-species displays unless exhibits are very large. [30]

Cape hartebeest have been successfully exhibited with the following species: Thomson's gazelle, red lechwe, Defassa waterbuck, greater kudu, impala, nyala, sitatunga, blesbok, gemsbok, springbok, Grant's gazelle. (North Carolina Zoo)

The following exceptions are noted:

* Male hartebeest fought with male gemsbok. Hartebeest removed.

Also with: Springbok, blesbok, eland, waterbuck, gemsbok, lechwe, nyala, Soemmering's gazelle, greater kudu, sable, gnu, buffalo, rhinos, zebra, giraffe. (San Diego Wild Animal Park)

* Hartebeest removed from exhibit due to poor calf survival

Jackson's hartebeest have been successfully exhibited with the following species: Slender-horned gazelles. (St. Catherine's Wildlife Conservation Center)

Black wildebeest have been successfully exhibited with: Springbok, blesbok, eland, waterbuck, gemsbok, lechwe, nyala, red hartebeest, Soemmering's gazelle, greater kudu, sable, buffalo, rhinos, zebra, giraffes. (San Diego Wild Animal Park)

* Wildebeest males were aggressive with almost any other species that entered their territory.
* Connochaetes gnou are typically considered so dangerous as fighters that they are never kept with other species. (D. Bakhaus and H. Fradrich, 1965)

Blue Wildebeest have been successfully exhibited with: Greater kudu, Grant's gazelle, blesbok. (Dickerson Park Zoo)

* Male involved in minor sparring with other males.

Also with: Thomson's gazelle, white rhino, sitatunga, ostrich, geese (Jacksonville Zoo), Zulu suni (SDWAP), ibis and crowned cranes (Sedgwick

[30]Thomas, Warren and Edward Marushka, 1996

County Zoo).

Bontebok/blesbok have been successfully exhibited with: Addax, sand gazelles (Detroit Zoo)

Also with: Greater kudu, Grevy's zebra (Detroit Zoo). Greater Kudu, Grant's gazelle, blue wildebeest (Dickerson Park Zoo).

* Male involved in minor sparring with other males.

Sable, blackbuck, scimitar-horned oryx, Thomson's gazelle, ostrich, Fallow deer, Axis deer (Fossil Rim Wildlife Center). Gemsbok, eland (Greater Baton Rouge Zoo).

* Gemsbok have shown aggression.

Kori bustards (Los Angeles Zoo)
Greater Kudu, Ankole cattle, ostrich, peafowl (Mesker Park Zoo).

* Male blesbok became aggressive and killed ostrich.

Marabou stork, Stanley cranes (Miami Metro Zoo).

Nyala, sitatunga, Grant's gazelle, springbok, gemsbok, Thomson's gazelle, Defassa waterbuck, greater kudu, impala, cape hartebeest (North Carolina Zoo).

* Male blesbok very aggressive toward male hartebeest, gemsbok, and his own females. He was removed.

Topi have been successfully exhibited with: ostrich, zebra, giraffe (Brookfield Zoo).

* Do not put in with giraffe dam and calf.

Also with: Reticulated giraffe, Grant's zebra (Columbus Zoo).

* Male zebra not kept in group.

Thomson's gazelle, Grevy's zebra, crane, ostrich (San Antonio Zoo).
Roan, eland, sitatunga, gnu, fringe-eared oryx, impala, waterbuck, lechwe, Roosevelt's gazelle, slender-horned gazelle, Thomson's gazelle, kob, giraffe, buffalo, rhino, zebra, pygmy hippo (SDWAP).
Grant's zebra, Thomson's gazelle, greater kudu (Audubon Park and Zoological Garden).

Infant development and growth characteristics::

7. Reproduction and Ontogeny

Characteristics of cyclicity

As many of the recorded interbirth intervals substantially exceed the presumed gestation periods, females must go through a post- partum anestrus or several periods of non-fertile estrous before becoming pregnant.

Bontebok / Blesbok *Damaliscus dorcas*

Estrous cycle lasts ..... days
Females estrus lasts ..... hours
Gestation ..... 7 ½ months
Interbirth interval ..... days
Fecundity .....Females and Males @ 27 months
Age at first reproduction .....
Weight of offspring ..... 6-7 kg.

Hartebeest *Alcelaphus buselaphus*

Estrous cycle lasts ..... days
Females estrus lasts ..... 1 day
Gestation ..... 8 months
Interbirth interval ..... 9-10 months
Fecundity .....Females - 18 months Males - 30 months
Age at first reproduction ..... 26 months
Weight of offspring ..... 13-15 kg.

Topi *Damaliscus lunatus*
Estrous cycle lasts ..... days
Females estrus lasts ..... 1-1 ½ days
Gestation ..... 7½-8 months
Interbirth interval .....
Fecundity .....Females - 18-24 months Males - 36 months
Age at first reproduction ..... 26-32 months
Weight of offspring ..... 10-12 kg.

Blue Wildebeest *Connochaetes taurinus*

Estrous cycle lasts .....
Females estrus lasts ..... 1 day
Gestation ..... 8-8½ months

Interbirth interval ..... 12 months
Fecundity .....Females 15-18 months Males -
Age at first reproduction ..... 23-26 months
Weight of offspring .....14-18 kg.

Black Wildebeest *Connochaetes gnou*

Estrous cycle lasts .....
Female's estrus lasts .....
Gestation ..... 8-8 ½ months
Interbirth interval ..... 12 months
Fecundity .....Females - 18 months Males - 36 months
Age at first reproduction ..... 26 months
Weight of offspring ..... 10-12 kg.

Behavioral signs of estrus:

Hartebeest & Topi: Females are frequently urine tested by males. The cows in estrus will perform a head-down-tail-out posture when ready to copulate after being urine tested.

Common Wildebeest: Cows signal estrus merely by holding the tail to one side as the bull performs the standard urine test. A cow in full estrus may follow a bull between copulations, and may solicit copulation by rubbing her head on his torso and sniffing his penis.

Black Wildebeest: Cows will lift their tails when a male urine tests and they will brush the long tail hairs across the male's face.

Behavioral signs of impending parturition:

Hartebeest: Expectant females isolate, accompanied by one or more previous offspring.

Topi: Females isolate to calve. Some even leave the herd's range and stay away for weeks, giving birth and remaining on guard during the calf's concealment stage.

Bontebok/Blesbok: Females do not isolate, but calve either in small herds or, in the aggregated state, on calving grounds in maternity bands.

Wildebeest: Females never seek isolation at parturition or afterward. Cows congregate in large herds on calving grounds which are located on short grassland.

Management of pregnant animals:

Pregnant animals are monitored for signs of impending parturition and symptoms that might indicate dystocia (vaginal discharge, malpositioned calf, dams inability to deliver after lengthy labor) requiring veterinary intervention.

For hartebeest, pregnant females are not managed any differently than usual. Given ample space, calving females should not be removed from the herd so that the existing social structure of the group is not disrupted.

8. Assisted Reproduction Techniques

embryo transfer-

electroejaculation and other semen collection methods-

cryopreservation of semen-

Zoological Society of San Diego,
Center for Reproduction of Endangered Species
"Frozen Zoo"

Species	Collection method	

estrous cycle manipulation-

9. Contraception

Contraception has been used with *Damaliscus lunatus* and *Connochaetes gnou* in zoological collections.[31]

Damaliscus lunatus: method-Melengestrol Acetate Implant (MGA)

Connochaetes gnou: method-castration

[31] AZA Contraception Advisory Group Database

For more detailed information please refer to:

-AZA Contraception Advisory Group Contraception Report, II Ungulates.

-CAG Forum located at **www.worldzoo.org/CAG**

-Karen Dematteo, CAG database manager/CAG Forum manager at **kdematteo@aol.com** or phone 314-781-0900

10. Hand rearing

ZOOLOGICAL SOCIETY OF SAN DIEGO NEONATAL FACILITIES
HAND REARING STANDARD PROTOCOLS

Formula Information:

Bovine colostrum, procured from certified *Mycobacterium paratuberculosis* (Johnes)-free commercial dairies, is the best choice; but when that is unavailable other colostrum substitutes have been used with good results.

San Diego Wild Animal Park (Infant Isolation Unit and Animal Care Center)

1st 24 hours:	100% Bovine Colostrum (Igg's>90 mg/ml)
2nd 24 hours:	50% Bovine Colostrum (Igg's>90 mg/ml) 50% Formula
To 1 month:	10% Bovine Colostrum (Igg's>60-85 mg/ml) 90% Formula
To weaning:	100% Formula

Supplements:

All facilities: Visorbin - SID through weaning (0.15 cc/lb.)

SDWAP: Microbial powder (Probios TM[32]) - every bottle for first 7 days, then SID through weaning.

All facilities: A 3% iodine solution is used to treat the umbilicus to prevent

[32]Probios microbial powder contains a source of live (viable) naturally occurring microorganisms including: *Enterococcus faecium, Lactobacillus acidoophilus, Lactobacillus casei, Lactobacillus plantarum,* not less than 10 million CFU (colony forming units)/g.

infection.

Solid food introduction:

SDWAP: After first week:
- alfalfa hay and bermuda hay
- acacia browse
- 1/4" low fiber alfalfa pellet
- manna milk pellet
- omalene (horse ration)
- rolled corn and barley mix
- access to mineral/salt block

Gradually: Increase proportion of low fiber alfalfa pellet and decrease amount of other pellets.

SDZ: After five days:
- alfalfa hay and bermuda hay
- acacia browse
- 1/4" low fiber alfalfa pellet
- omalene horse ration
- manna milk pellet
- access to mineral/salt block
- diced carrots, yams, apple

HAND REARING PROTOCOL FOR BLESBOK (*Damaliscus dorcus phillipsi*)

Birth Weight:

Female - 7.3 kg avg.	n = 2	range 6.4 - 8.2 kg
Male - 8.0 kg.	n = 1	

Birth Temperature (F):

Initial	102.2E average	n = 2	range 101.1 - 103.2
1st night	102.9E average	n = 2	range 102.3 - 103.5
next a.m.	103.4E average	n = 2	range 102.6 - 104.1

Current Formulas:

1) Whole cow milk (WCM): Evap. Cow milk (ECM): prediluted Milk Matrix	* Untried, but similar in composition to previous

33/40 (1:5.25 with water) 3:1:1 formula #1.

2) WCM: ECM: prediluted Milk Matrix 33/40 2:1:1 * Also untried. Alternate if calf is very hungry on above formula.

Previous formulas:

1) ECM: SPF- lac: water 2:1:1 * SPF-lac no longer manufactured
2) ECM: SPF-lac 2:1 * Soft stools

Formulas Not Recommended:

1) ECM: water 2:1 * Poor stool consistency (loose to liquid).

Feeding Apparatus:

Soft, pop-bottle nipple (Caprine Supply). Hard, lambing nipple (Nasco).
Note: Start with soft nipple and transfer when nursing well.

Feeding Regimen

Age (weeks)	Minimum Number of Feedings	Suggested Feeding Times
1-3	5	6:00 am, 9, 12, 3, 6 pm
3-6	4	6:00 am, 9, 1, 5pm
6-12	3	6:00 am, 11, 4 pm
12-14	3 decreasing volume mid	6:00 am, 11, 4 pm

Age (weeks)	Minimum Number of Feedings	Suggested Feeding Times
14-16	2 decreasing volume both	6:00 am, 4 pm
4 mos	Weaned	

Growth

Formula: ECM:SPF-lac 2:1 and ECM:water 2:1

N=2

Age (wks)	% change from birth wt. = Body wt. - Birth wt. / Birth wt. X 100				% Body weight Intake of formula
1	11.8%	n=2	range	9.8% to 13.8%	11.0 % n = 2
2	25.4%	n=2	range	22.0% to 28.8%	13.2 % n = 2
3	46.3%	n=1	range		11.6 % n = 1
4	72.0%	n=1	range		11.3 % n = 1
5	97.6%	n=1	range		10.2 % n = 1

HAND REARING PROTOCOL FOR
BONTEBOK (*Damaliscus dorcus dorcus*)

Birth Weight:

Female - 7.34 kg avg. n = 5 range 6.68 - 8.06 kg
Male - 6.43 kg. n = 1

Birth Temperature (F):

Initial	103.4E average	n = 6	range 102.6 - 105.0
1st night	103.0E average	n = 5	range 101.8 - 103.9
next a.m.	103.4E average	n = 5	range 103.0 - 104.4

Current Formulas:

1) Whole cow milk (WCM): Evap. Cow milk (ECM): prediluted Milk Matrix 33/40 (1:5.25 with water) 3:1:1 * Untried, but similar in composition to previous formula #1.

2) WCM: ECM: prediluted Milk Matrix 33/40 2:1:1 * Also untried. Alternate if calf is very hungry on above formula.

Previous formulas:

1) ECM: SPF- lac: water 2:1:1 N = 5 (+1 after day 19) * SPF-lac no longer manufactured Good stools and weight gain.

Formulas Not Recommended:

1) ECM: water 1½:1 or 2:1 N = 1 (1½:1 for days 2-8; 2:1 for days 9-17) * Hungry
2) ECM:SPF-lac 2:1 N = 1 (for days 18-19) * Loose stools

Feeding Apparatus:

Soft, Pop-bottle nipple (Caprine Supply). Hard, lambing nipple (Nasco).
Note: Start with soft nipple and transfer when nursing well.

Feeding Regimen

Age (weeks)	Minimum Number of Feedings	Suggested Feeding Times
1-3	5	6:00 am, 9, 12, 3, 6 pm
3-6	4	6:00 am, 9, 1, 5pm
6-12	3	6:00 am, 11, 4 pm
12-14	3 decreasing volume mid	6:00 am, 11, 4 pm
14-16	2 decreasing volume both	6:00 am, 4 pm
4 mos	Weaned	

Notes:

* Base increases on appetite rather than percentages
* Tend to have frantic response to feeding times
* Confinement can be a stressor
* Raised in pairs; strong buddy bond

Growth

Formula: ECM:SPF:Water 2:1:1

N = 4 (+1 after 20 days)

Age (wks)	% change from birth wt. = Body wt. - Birth wt. / Birth wt. X 100	% Body weight Intake of formula
1	10% n=5 range 8% to 18%	12.4% n=5
2	27% n=4 range 21% to 33%	11.8% n=4
3	44% n=5 range 33% to 48%	14.5% n=5
4	70% n=5 range 54% to 82%	14.2% n=4
5	95% n=2 78% & 112%	12.9% n=3
6	117% n=4 range 96% to 143%	12.4% n=4
8	181% n=2 154% & 208%	10.1% n=2
11	242% n=2 210% & 274%	8.5% n=2
14	310% n=2 278% & 342%	6.4% n=2
15	372% n=1	5.8% n=1
16	297% n=1	2.5% n=1
17	379% n=1	2.5% n=1

HAND REARING PROTOCOL FOR JIMELA TOPI (*Damaliscus lunatus jimela*)

Birth Weight:

Female - 6.3 kg avg.	n = 2	range 5.9 - 6.6 kg
Male - 9.3 kg.	n = 3	range 7.7 - 10.3 kg

Birth Temperature (F):

Initial	99.5E average	n = 5	range 95.1 - 102.7
1st night	101.8E average	n = 5	range 101.0 - 102.8
next a.m.	101.8E average	n = 5	range 100.7 - 103.5

Current Formulas:

1) Whole cow milk (WCM): Evap. Cow milk (ECM): prediluted Milk Matrix 33/40 (1:5.25 with water) 3:1:1	* Untried, but similar in composition to previous formula #1.
2) WCM: ECM: prediluted Milk Matrix 33/40 2:1:1	* Also untried. Alternate if calf is very hungry on above formula.

Previous formulas:

1) ECM: Water 1:1	* Poor stools and weight gain.

Feeding Apparatus:

Soft, Pop-bottle nipple (Caprine Supply). Hard, Lambing nipple (Nasco).
Note: Start with soft nipple and transfer when nursing well.

Feeding Regimen

Age (weeks)	Minimum Number of Feedings	Suggested Feeding Times
1-3	5	6:00 am, 9, 12, 3, 6 pm
3-6	4	6:00 am, 9, 1, 5pm
6-12	3	6:00 am, 11, 4 pm
12-14	3 decreasing volume mid	6:00 am, 11, 4 pm
14-16	2 decreasing volume both	6:00 am, 4 pm
4 mos	Weaned	

Notes:

* See Bontebok HRP

Growth:

Formula: ECM:Water 1:1 n=4

Age (wks)	% change from birth wt. = Body wt. - Birth wt. / Birth wt. X 100	% Body weight Intake of formula
1	-0.6% n=5 range -5% to 4%	12.7% n=5
2	10% n=4 2% to 17%	12.1% n=4
3	19% n=4 13% to 22%	12.6% n=4
4	33% n=4 29% to 38%	11.7% n=4
5	47% n=4 42% to 52%	11.3% n=4
6	60% n=4 52% to 68%	11.3% n=4
8	93% n=4 82% to 110%	10.2% n=4
10	125% n=4 114% to 142%	9.6% n=4
12	144% n=3 128% to 174%	5.8% n=3
14	186% n=3 162% to 219%	3.9% n=3
15	237% n=1	2.5% n=1

Notes:

* Base increases on appetite rather than percentages.
* Weight gains on the recommended formula are expected to be much improved over these.

HAND REARING PROTOCOL FOR
JACKSON'S HARTEBEEST (*Alcelaphus b. jacksoni*)

Birth Weight:

Female - 10.05 kg n = 1

Birth Temperature (F):

Initial	98.1E	n = 1
1st night	101.7E	n = 1
next a.m.	99.5E	n = 1

Current Formulas:

1) Whole cow milk (WCM): Evap. Cow milk (ECM): prediluted Milk Matrix 33/40 (1:5.25 with water) 3:1:1	* Untried, but similar in composition to previous formula #1.
2) WCM: ECM: prediluted Milk Matrix 33/40 2:1:1	* Also untried. Alternate if calf is very hungry on above formula.

Previous formula:

1) ECM: SPF-lac: Water 2:1:1	* Good stools and weight gain, but SPF-lac no longer manufactured.

Feeding Apparatus:

Soft lambing nipple with small hole or crosscut. Enlarge hole as nursing response improves and they become frustrated with the slower rate.

Feeding Regimen

Age (weeks)	Minimum Number of Feedings	Suggested Feeding Times
1-3	5	6:00 am, 9, 12, 3, 6 pm
3-6	4	6:00 am, 9, 1, 5pm
6-12	3	6:00 am, 11, 4 pm
12-14	3 decreasing volume mid	6:00 am, 11, 4 pm
14-16	2 decreasing volume both	6:00 am, 4 pm
4 mos	Weaned	

Notes:

***** Base increases on appetite rather than percentages
* Tend to have frantic response to feeding times.
* Confinement and solitude can be a stressor.
* Introduce changes slowly - respond poorly to rapid changes in the environment.

Growth
Formula: ECM:SPF:Water 2:1:1
N = 1

Age (wks)	**% change from birth wt.** = **Body wt. - Birth wt. / Birth wt. X 100**	**% Body weight Intake of formula**
1	10%	7.8%
2	35%	14.2%
3	39%	12.0%
4	64%	10.7%
5	81%	10.7%
6	97%	11.3%
8	122%	10.1%
10	155%	7.8%

Age (wks)	% change from birth wt. = Body wt. - Birth wt. / Birth wt. X 100	% Body weight Intake of formula
12	184%	4.4%
14	225%	1.7%
16	263%	0%
17	288%	0%

Growth Rates - of hand reared animals in kilograms (weights of typical, healthy, neonates)

Jimela Topi

Birth weight - 8.5 kg
Week 1 ------- 8.9 kg
Week 2 ------- 9.8 kg
Week 3 ------- 10.6 kg
Week 4 ------- 12.0 kg
Week 5 ------- 13.3 kg
Week 6 ------- 14.6 kg
Week 7 ------- 16.1 kg
Week 8 ------- 17.7 kg
Week 9 ------- 17.5 kg
Week 10 ------ 18.9 kg
Week 11 ------ 20.4 kg
Week 12 ------ 22.8 kg
Week 13 ------ 24.3 kg
Week 14 ------ 19.9 kg
4 months ----- weaned

Jackson's Hartebeest

Birth weight - 10.1 kg
Week 1 ------- 11.1 kg
Week 2 ------- 13.6 kg
Week 3 ------- 14.0 kg
Week 4 ------- 16.5 kg
Week 5 ------- 18.2 kg
Week 6 ------- 19.8 kg
Week 7 ------- 21.1 kg
Week 8 ------- 22.3 kg
Week 9 ------- 23.5 kg
Week 10 ------25.6 kg
Week 11 ------27.6 kg
Week 12 ------28.5 kg
Week 13 ------30.5 kg
Week 14 ------32.7 kg
Week 15 ----- 35.2 kg
Week 16 ----- 36.5 kg
Week 17 ----- 39.0 kg
4 months ---- weaned

Blesbok

Birth weight - 7.5 kg
Week 1 ------- 9.1 kg
Week 2 ------- 10.2 kg
Week 3 ------- 12.0 kg
Week 4 ------- 14.1 kg
Week 5 ------- 16.2 kg
4 months ----- weaned

White-Tailed Gnu

Birth weight - 14.1 kg
Week 1 ------- 16.4 kg
Week 2 ------- 18.5 kg
Week 3 ------- 20.0 kg
Week 4 ------- 21.4 kg
Week 5 ------- 25.9 kg
Week 6 ------- 28.4 kg
Week 7 ------- 30.9 kg
4 months ----- weaned

Feeding Regimen Cross fostering:

Reintroduction of hand-reared animals:

As soon as possible the hand-reared animal should be taken back to the original enclosure from the nursery. A temporary fence consisting of portable panels may be erected inside the original enclosure and the animal placed inside. At least one panel should have a door/gate for keeper access. Nursery keepers may then continue to bottle feed at the original enclosure. Reintroduction to the other animals in the exhibit is determined by the animal management team, and may occur before weaning. St. Catherine's Island reintroduces hartebeest calves at about 4-6 weeks. The calves are still bottle-fed since the keepers have trained them to come for a bottle when they are called.

In large multi-species exhibits, occasionally hand-reared animals will not rejoin their conspecifics. Sometimes they will stay on the perimeter of the herd, join up with another species, or remain solitary.

Methods to reduce chances of imprinting on humans:

In many species of antelope it would be preferable to allow the dam and calf to spend several hours together before any human intervention. This would allow for a stronger maternal/neonate bond and reduce the possibility of imprinting on humans. Unfortunately because of the precocious nature of alcelaphine neonates, it is best to perform your neonate exam as soon as possible post-partum. In this situation speed-in-handling is of paramount importance to prevent imprinting. Care must also be taken when separating the dam and calf. Wildebeest dams can be particularly aggressive in the defense of their young. In one case a female wildebeest popped a truck tire while defending her calf against well-meaning keepers.

Reproductive success of hand-reared animals:

11. Role of Keeper in Animal Management

Level and type of contact:

A daily husbandry routine is acceptable. Keep in mind that the level of contact should be adjusted depending on the temperament of the individuals. The larger the living space for the animal the longer a keeper may be tolerated in that space.

Role in management decisions:

Keepers are responsible for making accurate daily observations and evaluations of animals in their area, reporting any suspected health problems or abnormalities, and behavioral or social problems which may be occurring within the exhibit.

Animal training for husbandry and veterinary routines:

12. *In Situ* Programs:

Also see African Antelope Database 1998, (Rod East) IUCN/SSC Antelope, Specialist Group Report, December 1998.

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Regulatory Agencies:

International Air Transport Association
IATA Building
2000 Peel Street
Montreal, Quebec
Canada H3A 2R4
tel. 514-844-6311
fax 514-844-5286

USDA - APHIS -AC
Western Region
9580 Micron Ave., Suite J
Sacramento, California, 95827
tel. 916-857-6205

USDA - APHIS - AC
Eastern Region
2568 - A Riva Rd., # 302
Annapolis, Maryland, 21401
tel. 410-571-8692

USDA - APHIS - AC
Central Region
Fort Worth Federal Center, Bldg. #11
Fort Worth, Texas, 76115
tel. 817-885-6923

USDA - APHIS - AC
Headquarters Office
4700 River Road, Unit 84
Riverdale, Maryland, 20737-1234
tel. 301-734-4981

Products mentioned in this manual:

Low fiber herbivore pellet a.k.a. **ADF-16** is distributed by several companies including:

O. H. Kruse Grain and Milling
3730 Monterey
El Monte, CA 91734
Phone (818) 575-0658
Prod. No. 391026

HMS Zoo Diets, Inc.
1220 Echo Lane
Bluffon, IN 46714-2805
Phone (219) 824-5157
FAX (219) 824-5157

Purina Mills, Inc.
Specialty Feeds Group
P.O. Box 66812
Phone (314) 768-4593
FAX (314) 768-4859

(1401 South Hanley Road)
Saint Louis, MO 63166-6812

MAZURI® Bovine Browser Maintenance 5654

PMI Nutrition Intl., Inc.
P.O. Box 19798
Brentwood, MO 63144

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CHR HANSEN/BioSystems
9015 West Maple Street
Milwaukee, WI 53214-4298

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Acknowledgments

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