

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

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INTRODUCTION

The family Caviidae includes seventeen species in five genera (Nowak, 1999). Native to various parts of South America these rodents range in size from small to medium, except for the Patagonian cavy (see Table 1).. For the purposes of these standards the focus is aimed at the seven species known to exist in captivity according to ISIS, which includes: the wild cavy, *Cavia aperea*; the guinea pig, *Cavia porcellus*; the rock cavy, *Kerodon rupestris*; the cuis or yellow-toothed cavy, *Galea musteloides*; the Southern mountain cavy, *Microcavia australis*; the Patagonian cavy, *Dolichotis patagonum*; the mara or desert cavy, *Dolichotis salinicola*.

With exception of the Patagonian cavy, all caviés share a basic conformation, which includes a large head and short and robust body (Nowak, 1983). Head and body length is 200-750 mm and the tail is vestigial. The pelage in wild forms is fairly coarse or crisp. In the subfamily Caviinae (caviés) the body form is robust, the head is large, and the ears and limbs are short. In the Dolichotinae (Patagonian "hares") the proportions are rabbit like, the ears are long, and the limbs are long and thin. In both subfamilies there are only four digits on the forefoot and three on the hind foot. The nails are short and sharp in *Cavia* and *Microcavia*, blunt but well developed in *Kerodon*, and hooflike on the hind foot and clawlike on the forefoot in *Dolichotis*. The soles of the feet are naked in the Caviinae but mostly haired in the Dolichotinae (Nowak, 1995).

Caviids occur in a wide variety of habitats ranging from marshy, tropical floodplains to dry, rocky meadow (Woods, 1984). None of these rodents hibernate, even when living at high altitudes and/or when temperatures are very low. The diet consists of many kinds of plant material. Breeding may continue throughout the year if climatic conditions are favorable. The gestation period, ranging from about 50 to 70 days, is relatively short for the suborder Hystricomorpha. Nonetheless, the young are well developed at birth and reach sexual maturity rather early (Nowak, 1995).

Caviés' teeth continuously grow. Their incisors are short and the cheekteeth are shaped like prisms (McDonald, 1999). The dental formula is: (I 1/1, c 0/0, pm 1/1, m 3/3) x 2 = 20 (Nowak, 1995).

Small caviés live on the average three to four years in the wild and up to eight in captivity. The Patagonian cavy and mara or desert cavy can live up to fifteen years in captivity (McDonald, 1999).

See Table 1 for more general information pertaining to caviés.

COMMON NAME	SCIENTIFIC NAME	ORIGIN
Cavy	<i>Cavia anolaimae</i>	Colombia
Wild cavy, Aperea	<i>Cavia aperea</i>	N Argen. - E Bra.
Cavy	<i>Cavia fulgida</i>	E Brazil

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

Guinea pig	<i>Cavia porcella</i>	Worldwide
Cavy	<i>Cavia magna</i>	Eastern South America
Cavy	<i>Cavia tschudii</i>	Ecuador to N Argentina
Rock cavy	<i>Kerodon rupestris</i>	NE Brazil
Cavy	<i>Galea flavidens</i>	Brazil
Cuis, Yellow-toothed cavy	<i>Galea musteloides</i>	Peru - C Argentina
Cavy	<i>Galea spixii</i>	Brazil, E Bolivia
Southern mountain cavy	<i>Microcavia australis</i>	Argentina
Cavy	<i>Microcavia niata</i>	Bolivian Andes
Cavy	<i>Microcavia shiptoni</i>	NW Argentine
Patagonian cavy or hare	<i>Dolichotis patagonum</i>	Argentina
Mara or desert cavy	<i>Dolichotis salinicola</i>	NE Argentina, Paraguay, S Bolivia

1. Abiotic Environmental Variables

- 1.1. **Temperature:** Temperatures for all genera except *Dolichotis* should range between 45 - 80°F (7.2 - 26.6°C). If acclimated and provided with shelter, montane species tolerate cooler temperatures without harm (Meek, 1997).

Patagonian cavies and maras are very tolerant and may be kept outdoors in most parts of the country as long as shelter is provided. Temperatures below freezing are readily tolerated if a heated nest box or stall is available (Meek, 1997). Animals need access to shade, especially during the warmer months.

If Guinea pigs are kept outdoors in colder climates, a heated shelter needs to be provided. Fiberglass hog panel style heaters can be utilized (Pryor, 2001). The guinea pig's ambient temperature should not fall below 60°F (15.5°C) or exceed 85°F (29.4°C)(Animal Welfare Act, 2002). Rain shelters and shade need to be provided. Shelter can be wooden structures. If the primary enclosure is indoors there needs to be sufficient ventilation with fresh air provided by doors, windows, vents, or air conditioners. Drafts, moisture build-up and odors must be prevented (Animal Welfare Act, 2002).

The yellow toothed cavy's ambient temperature ranges between 64.4 – 71.6°F (18 – 22°C) (Hohoff, et. al.).

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

- 1.2. **Humidity:** Enclosures should be well ventilated, with protection from the sun and wind. A wide range of humidities (30-50%) can be tolerated (Meek, 1997). The number of air changes per hour needed to maintain a healthy condition for the animals will change depending on the number of animals and the size of the enclosure if kept inside.
- 1.3. **Illumination:** Natural fluorescent or incandescent lighting is acceptable.
 - 1.3.1. Good quality lighting, either natural or artificial, needs to be provided and well distributed. The Animal Welfare Act of 2002 states that excessive illumination must be avoided for guinea pigs. A 12-hour light and 12-hour dark cycle is acceptable (Meek, 1997).
 - 1.3.2. Daily and seasonal changes in light intensity and duration are not necessary.
- 1.4. **Space**
 - 1.4.1. **Housing:** All genera may be kept outdoors with appropriate shelter. All species are excellent diggers and outside exhibits with soil substrates should have solid or wire barriers beneath the exhibit to prevent escape (pers. obs.). Though most species are terrestrial in nature, several species are excellent climbers and walls or fencing should be high enough and have a smooth surface to prevent escape by jumping or climbing. Unlike other caviés, Rock caviés (*Kerodon rupestris*) climb walls with ease and will climb trees in order to eat the leaves (Walker's, 1995). One zoo reported that Rock caviés escaped an enclosure by making several successive diagonal cross-jumps (Grizmek's, 1972). Enclosures with a return on the top of the perimeter border are recommended to prevent escape by jumping or climbing. Provide rocks for shelter and to promote natural behaviors.

A single individual of the smaller genera may be housed in a cage measuring 2ft x 2ft.x 2ft. A group of 3-5 individuals requires at least 4ft. x 4ft. x 4ft. or 64cu.ft. (Meek, 1997). Enclosures can be made out of wire mesh, concrete, glass or metal or non-toxic surfaces that are impervious to gnawing. Avoid glass aquariums due to poor ventilation. The Animal Welfare Act of 2002 states that the interior height of any primary enclosure for guinea pigs needs to be at least 6.5 inches tall.

Patagonian caviés are a large burrowing species and may be housed like woodchucks or other marmots, *Marmota* species. Enclosures for a pair of adults should measure at least 6ft. x 6ft. or 36sq.ft. (Meek, 1997) According to the Florida Game and Wildlife Conservation Commission the standard caging requirement for large and small caviés is an enclosure at least 6ft. x 4 ft. x 3ft. high and for each additional animal, increases the enclosure size by 25% of original floor area.

Due to the shy nature of caviés, priority needs to be given to the number of places to hide within the enclosure.
 - 1.4.2. **Inter-individual distance:** Adequate space is important for specimens to have a comfortable inter-individual distance in a social group.

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

- 1.4.3. **Exhibit/enclosure furniture:** PVC pipe, hollow logs, elevated platforms or other shelters should be available. Providing accessible devices for physical stimulation or manipulation compatible with the species is a recommendation in the Florida Standard Caging Requirements for large and small cavies. A long, camouflaged, hollow concrete tube is used at the Brevard Zoo for shelter and also serves to help capture an animal by allowing it to move to the end of the tube and into a crate if needed.
- Cardboard boxes can be used for shelter for Guinea pigs if replaced on a regular basis especially if soiled. Furniture resembling a natural environment for the species is ideal. Enclosures for yellow toothed cavies must include branches. Rocks or similar materials should be provided for rock cavies.
- Enough furniture must be provided to accommodate all the animals in the enclosure at one time.
- 1.4.4. **Visual, acoustic and olfactory barriers:** Cavies, when frightened, will run into fences/borders resulting in serious injury and/or death. Care should be taken in the design of the enclosure that the animals have areas in which to hide (pers. obs.).
- 1.4.5. **Substrates and nesting/bedding materials:** Substrates and nesting/bedding material such as wood chips or shavings may be used, with care being taken to insure they are not ingested. Hay can also be utilized. Soil is an ideal substrate in an enclosure if cleaned properly. Guinea pigs have been known to ingest pieces of sharp bedding resulting in medical problems.
- 1.4.6. **Change and variation in the environment:** Adding rocks, fallen logs, mulch, trees, bushes, leaves, or other edible items will increase the activity level in the enclosure. If not at risk for escape, digging should be encouraged. Natural behaviors should also be encouraged. Creating new routes and moving furniture help provide variety in the environment.
- 1.4.7. **Substrate and enclosure cleaning:** Substrates in outdoor enclosures should be spot-cleaned daily. Indoor exhibits should be disinfected daily.
- 1.4.8. **Air quality/changes per hour:** To keep odors down to a satisfactory level, various non-circulated air for pet shops require a rate of exchange of equal to 1.0 cubic foot of air/minute/sq. ft. of floor space (Shoemaker, pers. comm.). A rate of ten fresh air changes per hour is accepted by the Michigan Department of Agriculture for pet store animals, such as the guinea pig. The regulations for guinea pigs state that facilities shall provide fresh air either by means of windows, doors, vents, or air conditioning. Ventilation must be such that there are no drafts, odors, or moisture condensation (Animal Welfare Act, 2002).
- 1.4.9. **Safety and containment:** Cavies can be kept in indoor or outdoor situations. All species are excellent diggers and outside exhibits with soil substrates should have solid or wire barriers beneath the exhibit to prevent escape. Several species are excellent climbers and walls or fencing should be high enough and have a

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

smooth surface to prevent escape by jumping or climbing. Rock cavies climb walls with ease and enclosures with returns on the top of the perimeter border is recommended to prevent escape by jumping or climbing. (See Housing)

- 1.4.10. **Container design (in accordance with IATA, 2002):** Documents need to accompany the shipment, attached to the outside of the carrier and be easily obtainable. The carrier must maneuver the container in a manner to avoid physical trauma to the animal.

1.4.10.1. **Type of transport container:** The transport container should be wood, lined with wire mesh, fiberglass, rigid plastic, strong welded wire mesh, wire mesh, or nylon mesh. Strong weld mesh lining can form an internal cage round which the outer casing of wood or other suitable material is constructed. The frame must be screwed together when the frame is constructed from solid wood.

The doors and sides must be constructed of plastic, weld mesh lined wood, or metal sheeting. The front of the container must consist of one-third weld mesh. Wire meshed screening must cover all ventilation openings if the containers are made without a wire mesh liner. The doors must slide to provide access at the rear of the container. All doors must be secure when fastened and not able to open accidentally.

The floor must be leak-proof and solid.

The roof must be made of plastic, wood, or solid sheet metal.

When utilizing a rigid plastic pet container the floor must be non-slip prior to adding bedding. The ventilation openings and mesh doors must be covered with fine wire mesh, which if used on the inside of the container, needs to be made smooth. The door must be secured as to not open easily.

If the container has wheels, they must be made inoperable or removed before transporting.

The carrier needs to be free of protrusions, which may cause injury.

- 1.4.10.2. **Appropriate size of transport container:** The animal(s) must be able to move around freely with normal habits and movement taken into consideration. The size of the container will vary with the species. Multiple compartments within one container must have individual access doors.

- 1.4.10.3. **Provision of food and water during transport:** Food and water containers must be provided and fixed to the front of the transport vessel so that the animal(s) can not move them. Outside access for replenishment must be available. Soldered tin is not acceptable for food and water containers.

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

Animals normally do not require additional feeding or watering during a 24-hour period following the time of dispatch.

If a delay occurs in transport, herbivorous species must be provided with carrots, figs, nuts, and/or grains. The instructions of the shipper must always be followed and made obvious for the caretaker.

1.4.10.4. Provision of bedding or substrate in transport container:

Absorbent bedding, such as wood shavings, must be used in the transport container.

1.4.10.5. Mechanism(s) for separating animal from urine and feces during transport: Mesh inner containers can be utilized to elevate the animal from the floor allowing urine and feces to fall through during transport. Absorbent bedding must be utilized.

1.4.10.6 Temperature range during transport: Temperatures for all genera should range between 45-80°F (7-26.6°C). If multiple animals are housed in the same compartment in a container reduce the number by 10% if the ground temperature exceeds 75°F (23.8°C).

1.4.10.7 Light and noise management during transport: Nylon mesh shade cloth needs to be utilized on containers with animals prone to stress, to reduce the amount of light but allow good ventilation. Mesh on openings can minimize noise.

1.4.10.8 Group size during transport: One animal per compartment is normal unless animals are used to co-habiting. Four animals weighing less than 2,000 grams can be housed in one compartment if the height of the box is eight inches. Two animals weighing 2,001 to 5,000 grams can be housed in one compartment if the height of the box is ten inches. If the animal weighs more than 5,000 grams it should be housed alone in a box with a height of twelve inches.

Guinea pigs weighing up to 350 grams need a minimum space of 30 square inches per animal. Guinea pigs weighing 350 to 600 grams need 45 square inches each and animals weighing over 600 grams need 55 square inches of space.

1.4.10.9 Handler/veterinarian access to animal during transport: If a situation arises where a handler and/or veterinarian requires access to the animal during transport the necessary tools need to be available. Gloves need to be available for handling as biting and scratching are dangers. The animals need to be properly restrained in order to prevent injury.

1.4.10.10 Maximum duration of transport: Food and water must be presented after a 24-hour period of transport. Normal housing needs to be

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

provided if the animal appears stressed from a prolonged transport period.

1.4.10.11 **Appropriate timing of release, size, and type of enclosure at transport destination:** The animal(s) must be released in an enclosure suitable for normal activity. The door of the container can be left open to allow the animal(s) to exit on its own. The enclosure must be escape proof.

1.5. Water Features

1.5.1. Water elements can be included in the enclosure in the form of pools, streams, etc., but cavies do not need them for bathing. These elements may be necessary if exhibited with other species.

1.5.2. Fresh drinking water should be available at all times. Water bottles should be hung to prevent chewing, or heavy crocks which are impervious to chewing or tipping used, as appropriate. All bowls and bottles should be disinfected daily and hard water deposits removed to prevent buildup (Meek, 1997).

Regulations state that unless food supplements are consumed that supply guinea pig's normal water requirement, potable water must be provided daily. Containers must be attached to the primary enclosure to avoid contamination from exceta and sanitized when dirty. Water receptacles must be cleaned every two weeks (Animal Welfare Act, 2002).

1.5.3. Use caution with depth of water if a cavy is immobilized for a medical procedure. There is potential for drowning if an animal stumbles into a water area after a procedure (pers. obs.).

2. Biotic Variables

2.1. Food and Water

Enclosures and shelters should be spot cleaned daily, removing feces, soiled substrates, and uneaten food. All bedding materials should be removed and the entire enclosures cleaned and disinfected weekly. Food containers should be cleaned and disinfected daily.

2.1.1. **Water:** Water bottles should be hung to prevent chewing, or heavy crocks which are impervious to chewing or tipping used, as appropriate. Clean, potable water for drinking should be available at all times. (See 1.5 - water features).

2.1.2. **Food:** Food needs be offered at least once a day. In nature, all species feed on vegetation, primarily leaves, grasses and occasionally fruits (Meek, 1997). All species should be offered a diet containing a commercial rodent chow, greens (kale, endive, escarole, spinach, or parsley), raw vegetables, hay and browse.

Brookfield Zoo reported in the A.A.Z.K. Diet Notebook that a captive yellow-toothed cavy diet consisted of commercial guinea pig pellets, seed mix (wild bird seed, dog chow, sunflower seeds, rabbit chow and cracked corn), greens, sweet potato, fruits and alfalfa hay ad lib. Piece size is ½" x ½" x ¼".

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

Patagonian caviés consume alfalfa hay, greens, raw vegetables (sweet potato and carrot), horse feed and rodent chow in captivity according to the Columbus Zoological Gardens as reported in 1985 in the A.A.Z.K Diet Notebook. The Brevard Zoo reported feeding in addition to the above mentioned, monkey biscuits.

Guinea pigs can be fed a diet specifically formulated for the species. Food items with Vitamin C must be supplemented for guinea pigs. Seeds need to be excluded from the diet. Hay is free choice at all times. The Fort Wayne Children's Zoo feeds collards, oranges, strawberry, kiwi, and cantaloupe to meet the Vitamin C requirements (Pryor, 2001). The Mazuri web site states that rabbit and hamster food should not be fed to guinea pigs since the unique balance of helpful bacteria in their intestines will be destroyed by the antibiotics found in the feed (Sadler, n.d.)

For all caviés, hay must be offered free choice and checked for quality. Mineralized salt blocks should be available ad lib. Food and water containers should be cleaned and disinfected daily.

Food supplies need to be adequately protected against spoilage or infestation by pests. Perishable foods must be refrigerated. Measures must be taken to prevent caking of feed or molding of food if self-feeders are utilized. Food receptacles must be located within the primary enclosure in a manner to prevent competition between animals and contamination by feces and urine.

- 2.1.3. **Schedule:** Caviés need to be fed at least once a day. Enough food stations need to be available to avoid aggression between dominant and subordinate animals. Separate animals if accurate food consumption measurements are required. If husbandry training is required, a fraction of the diet can be withheld.
- 2.1.4. **Enrichment – Opportunities for animals to procure food in ways similar to their wild counterparts:** Food items can be dispersed or hidden within the enclosure to encourage natural foraging behaviors. Browse, such as grapevine and willow, can be offered in addition to the normal diet (pers. obs.). Rock caviés like to climb trees to eat leaves, which would be easy to replicate in captivity. Planting and replacing edible species in an enclosure on a regular basis is another enrichment opportunity for caviés.

Visit enrichment websites at www.enrichmentonline.org and www.csew.com/enrich for more ideas.

2.2. Social Considerations

Table 2 details information on social considerations.

In the wild the yellow-toothed cavy lives in large mixed-sex groups. Only one adult male is recommended for a group in captivity, unless a large space can be provided with a variety of safe areas for animals to retreat. Females are dominant to males and older animals are dominant over younger animals. Aggressive displays, serious wounds and

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

fighting have been common in the wild. Individuals are chased by adults after one month of age (Nowak, 1995).

Wild caviés live in small groups of about five to ten animals. Like yellow-toothed caviés, a dominance hierarchy is created and subordinate animals either retreat or get attacked (Nowak, 1995).

Guinea pigs are sociable animals and require a lot of attention. They are best kept in pairs, one male and one female. Place a neutered male with females to prevent births (Sadler, n.d.). Male guinea pigs should not be housed together (Grizmek, 1972).

Cavia, Galea, and Microcavia all have a similar social structure where mating is promiscuous and no male-female bonds are formed (McDonald, 1999). Moderate levels of adult-juvenile aggression are found within the social structure of Galea (Nowak, 1995).

Kerodon inhabit isolated patches of boulders, which can be defended by a single male, and has what appears to be a harem-based mating system: one in which a single male has exclusive access to two or more females. In captivity it is recommended that one single adult male is kept in a group. Males in the wild establish a linear dominance hierarchy that is maintained by aggression. In general, older animals are more dominant than younger and females are more dominant than males (Rood, 1972).

Patagonian caviés social system consists of the monogamous pair bond, where the bond between a pair lasts for a lifetime. In the wild a dominance hierarchy with males is perpetuated by aggression (MacDonald, 1999). Males have been observed fighting in captivity. Consideration of space, amount of animals, feeding stations, and individual behavior must be considered before adding a male into an established group (pers. obs.).

2.2.1. **Group Composition:**

2.2.1.1. **Suggested age and sex structure of social groups:** Groups with one adult male are recommended to avoid aggression. Juvenile males reaching adulthood should be separated if problems with aggression begin to occur.

Captive populations of Patagonian caviés consisting of multiple males have been successfully housed together in large enclosures with minimal aggression (pers. obs.). If increased aggression becomes evident the number of individuals in the group may have to be reduced.

2.2.1.2. **Isolation of parturient females and young:** If aggression is observed the parturient female and young need to be separated. Adequate space should be provided to the separated animals.

2.2.1.3. **Social interactions of “solitary” species:** Caviés, typically social, do not have to be kept as a solitary species. If an animal is isolated, social interactions are important. Interactions can be visual, for example, through a mesh barrier. Establishing a rotating schedule for solitary

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

animals from holding to an exhibit that houses the same or similar species can be beneficial.

- 2.2.1.4. **Groups of mothers with most recent young:** Mountain cavy young have been observed nursing from a female other than their individual mother. In general cavy females do not tolerate nursing from young that are not their own (McDonald, 1999).

One zoo reported that a subordinate female's newborn fell down a burrow and she was prevented to enter the burrow by the dominant female in the group (Davenport 2001).

Patagonian cavies have been observed in colonial breeding situations. An adult female will approach a burrow containing youngsters from various females and successfully seek out her own, while chasing off unrelated animals (McDonald 1999).

- 2.2.1.5. **Forced "emigration" of adolescents:** Patagonian cavy young remain with the mother for at least nine months. At this time the mother may chase them away when a new litter arrives (Nowak 1999).

Removing animals is not likely to cause social disorder.

2.2.2. **Group Size**

With the exception of Patagonian hares and maras, all genera may be kept in small groups containing no more than one male. Patagonian hares and maras may be kept in groups of ten or more if adequate space and shelter is present.

- 2.2.2.2 **Inter-individual distances required:** Visual barriers help reduce the amount of exhibit space needed for adequate inter-individual distance. Adding various elements and increasing the complexity of the space also helps reduce problems associated with inter-individual distance.

- 2.2.3. **Influence of adjacent groups:** Conspecific groups housed next to each other may result in aggression if not separated properly.

- 2.2.4. **Mixed Species Groups:** Microcavia is more of a browser, and arboreal which can reduce competition with Galea when exhibited together.

Patagonian cavies have been successfully housed with macaw species, iguana, tamandua, small primates, rhea, capybara, llama, anteater, and agouti. Care must be taken to avoid other species from eating the cavy diet or preventing them from reaching the feeding areas (pers. obs.).

Male single sexed groups are not recommended due to aggression.

- 2.2.5. **Introductions:** Care must be taken when cavies are introduced to heterospecifics. The above mentioned species have been reported as a successful combination with cavies but the individual animals may have to be

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

observed for potential problems. Anteaters have been reported to chase cavies and show interest in newborn Patagonian cavies (pers. obs.). Consider separating heterospecifics to prevent injury to newborns when a pregnant female is close to giving birth.

During initial introductions it is ideal to encourage the perception that the habitat is shared. The area can be designed to rotate animals through the entire habitat and at the same time preventing them from coming into contact. Physical contact should come after the animals have first been provided olfactory, auditory and visual opportunities. Providing howdy cages is an alternative to shared space. Giving access to a space inhabited by a female to a male may be a less aggressive approach to introducing cavies.

It is important that introductions are carefully planned. A key element is to be able to recognize aggressive behavior. Equipment needed to intervene when aggression occurs should be readily available and in good working condition. Staff, including the veterinarian, needs to be involved in a well thought out plan during an introduction.

If there is any concern about leaving the introduced animals together unsupervised, consider separating the animals until the next introduction attempt.

2.2.6. Human-animal interactions

2.2.6.1. Acceptable forms of human/animal interactions: Cavies will adapt to the presence of humans in captivity but tend to keep a safe distance and will flee to areas in which they feel secure.

Patagonian cavies have been known to run into enclosure perimeters to escape humans resulting in serious injury or even death (pers. obs.).

Guinea pigs tend to have the greatest tolerance for humans and if kept alone require human interaction to fulfill social needs.

Humans need to become familiar with the flight distance of the species in which they work in captivity. Care must be taken not to frighten the animal. Hand reared animals may have more tolerance for human presence and may even seek attention from humans.

2.2.6.2. Animal and keeper safety: Cavies are not aggressive towards humans. Wearing gloves is recommended when capturing and handling due to the ability of cavies to bite and scratch. Guinea pigs do not require gloves. Care should be taken when handling, especially if unfamiliar with the animal (Fowler, 1995). Please address the standard operating procedures at your facility for direction on animal and keeper safety.

3. Health and Nutrition

3.1. Diet

3.1.1. Existing standards for nutrient requirements: Nutrition requirements for

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

cavies in captivity appears to be based on research conducted on rodents, specifically laboratory rodents. The Mazuri website (<http://www.mazuri.com>) contains detailed rodent nutritional requirements and states that “Rodent Pellets are a highly nutritious and complete diet that is specially formulated to meet the nutritional requirements of breeding, as well as non-breeding rodents.”

- 3.1.2. **Nutrient requirements for all life stages:** Factors such as older animals, body size, and seasonal changes in ambient temperature, activity levels and health status need to be considered for nutrition purposes. Consider adding an extra food dish for older animals if they seem to be having trouble competing for food.
- 3.1.3. **Influence of dietary requirements on reproduction:** Reproductive and parturient females may require additional caloric intake.
- 3.1.4. **Issues of palatability, texture, processing that encourage species-appropriate appetitive behaviors:** Supplement a well balanced diet with palatable browse appropriate for the species if available.

3.2. Medical Management

3.2.1. Quarantine and hospitalization

The Accreditation of Zoos and Aquariums manual provides quarantine guidelines for small mammals. The standard quarantine period for cavies is 30 days. A CBC and serum profile, three negative fecals (direct and float) and a fecal culture for enteric pathogens are recommended prior to shipment. A complete physical exam should be performed on each animal at the beginning of the quarantine period and a visual examination at the end of this period. Three negative fecals (direct and float) are recommended before leaving quarantine.

During quarantine or hospitalization a cavy may need to be protected from injury by being held in a quiet area with smooth walls (pers. obs.). A shelter in which the animal can hide needs to be provided.

Abscesses can develop from wounds caused by fighting. Treating abscesses may require that the animal be separated from the group in order to provide proper medical care (pers. obs.).

- 3.2.2. **Vaccinations/Preventative medicine:** No vaccinations are currently recommended for rodents. Routine fecal checks should be performed twice yearly. With appropriate dietary components (browse, nuts, etc.), there should be no need for tooth trimming. Nails may need periodic trimming, particularly if animals are kept in smaller enclosures (Meek, 1997).
- 3.2.3. **Management of diseases:** Captive Patagonian cavies have been reported to experience dystocia in captivity. With proper medical care this condition can be managed successfully. One zoo reported a female cavy that periodically experienced seizures from hypoglycemia. This animal was treated with NutriCal, a corn syrup based nutritional supplement with the consistency of toothpaste, and released back into the enclosure once it recovered. This animal

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

is offered its own food dish at feeding time to ensure it is receiving the proper diet on a timely basis (pers. obs.).

NutriCal can also be used to mask oral medications (pers. obs.).

- 3.2.4. **Appropriate capture, restraint, and immobilization techniques; husbandry training:** Cavies can be handled with gloves. Except for Guinea pigs, nets are useful, the type varying with the size and behavior of the animal. Biting, scratching, and clawing are common defensive and offensive actions by cavies (Fowler, 1995).

It is recommended that Patagonian cavies weighing between 9-16 kg be immobilized with 10 mg/kg Telazol. If supplemental drugs are required 5 mg/kg Ketamine is used. No antagonists are recommended. Alternative drugs used are 10 mg/kg ketamine plus 12 mg/kg xylazine. Care must be taken not to harm the animal during immobilization (Kreeger, 1999).

Alexandria Zoo reported immobilizing a Patagonian cavy with a one to one mix of 100 milligrams per ml of Ketamine and 20 milligrams per ml of Xylazine. Generally 1 cc per 25 pounds was used for calculations.

Cavies can be immobilized with isoflurane alone via chamber induction, if handled properly. Isoflurane is recommended, instead of injectable agents, for longer procedures and because it provides rapid induction and rapid recovery (pers. obs.).

NutriCal (a supplement discussed in 3.2.3) can be a very effective training aid, some cavies find it irresistible.

- 3.2.5. **Management of neonates and geriatric animals:** Cavies do not receive vaccinations. Geriatric animals need to be monitored for food intake. Consider separating geriatric animals to an adjoining enclosure if heterospecifics and/or conspecifics become aggressive. The separated animal should be in a social situation with other cavies that are not aggressive.

- 3.2.6. **Management during pregnancy:** Impending births may be detected by the change in the female's behavior. Pregnant females must be monitored to detect dystocia.

4. **Reproduction**

- 4.1. **Seasonality of reproduction:** Table 2 details information on the seasonality of reproduction.

Yellow-toothed cavies show signs of having a promiscuous mating system. Dominant males will try to guard a female during estrus, but may not be able to prevent other males from mating. Estrous females have been known to copulate with two to four different males. During estrus, females will initiate courtship by racing around and frequently changing directions. This behavior attracts the attention of males, who then run behind

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

her. From time to time, the female stops abruptly and copulates with the male directly behind her. Large testes relative to body mass also suggest a promiscuous mating system. Yellow-toothed cavies have a higher relative testicular mass than any terrestrial mammal known to have a promiscuous mating system. The presence of a male is required to induce estrous in a female (Rood, 1972). Female mating behavior was observed to occur nine times during the light period and only once during the dark period after a median time of 64 minutes (Hohoff, 2003).

- 4.2. **Hormonal tracking to identify reproductive state and assess feasibility of introduction for solitary species:** Information on hormonal tracking is limited.
- 4.3. **Timing of introductions:** Information pertaining to reproduction and estrus cycles is listed in Table 2, which helps determine the timing of introductions.

Male mountain cavies in the wild display aggression towards each other when a pregnant female is close to giving birth, due to postpartum estrus. Up to six males have been observed chasing a female that has recently delivered offspring (Nowak, 1999)

Female yellow-toothed cavies are apparently induced ovulators and estrus is stimulated by the presence and possibly mating by a male. A male will closely follow a female in a chin to rump fashion to induce estrus. Like the mountain cavy, yellow-toothed cavy males will gather around a female that has recently given birth. Rock cavy behavior is similar to the yellow-toothed cavy, but a male will also circle a female to limit her movements (Nowak, 1999).

Guinea pig dominant males aggressively guard a pregnant female and fend off subordinates. If the dominant male is successful, he will mate first after she has given birth. If the dominant male can no longer protect the female, the subordinates will mate with her (Nowak, 1999).

The social unit of a Patagonian hare is basic and includes strict monogamy. Males remain close to females and fend off other males (Nowak, 1999).

For separated pairs, the best approach to introduction is to provide a mesh type barrier between adjacent enclosures and observe behavioral responses.

- 4.4. **Facilities for parturition and management of females during denning:** Females need to have access to shelter during parturition. This shelter does not have to be complicated, three sided enclosures or a dog kennel can be utilized. Cavies may give birth inside dens dug in the ground if large enough. If enclosed in a mixed species exhibit it may be necessary to separate other species immediately prior to female giving birth and as needed to prevent death of newborns. Patagonian cavies will give birth next to a burrow into which the young will move inside afterwards (McDonald, 1999).
- 4.5. **Hand-rearing:** A variety of factors may contribute to the need for hand-rearing cavies. For example: if the female giving birth dies; is unable to nurse; or shuns the newborn. The hand-rearing environment must be arranged to prevent the neonate from becoming cold. Newborn cavies need to be kept in a small enclosure with a substrate such as hay and provided a heat lamp and substitute burrow.

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

There are benefits to hand-rearing neonates in groups due to the physical contact and stimulation between animals leading to improved social development.

Be careful not to over expose neonates to UV light, which may cause sunburn, skin damage, or long term retinal damage.

Cavies are precocial and some species eat solid food a few days after birth. Cavies are a part of the rodent family and when compared to either bovine or human milks, rodent milks are lower in carbohydrates, higher in fat and more concentrated. As a result, milk replacers used for bovines or humans are not the leading choice for hand-rearing members of the rodent family. Esbilac can be utilized and mixed according to the instructions on the label. Use caution when adding carbohydrates, such as sugars and syrups, due to the speculation of causing possible diarrhea and ingestion in some species. Lactaid, a lactase enzyme, can be added to reduce the effects of carbohydrates (Edwards, n.d.).

Hand-reared newborn Patagonian cavies can be fed a low lactose milk formula every 3-4 hours, at least 6 times/day. The total daily milk intake needs to equal at least 15% of the body weight each day (Edwards, n.d.). Alexandria Zoo reported for the first week of hand feeding that the newborn consumed 92.6 cc's per day, averaging between two to five feedings per day. This zoo used one part esbilac to two parts water (pers. comm.).

Water used to dilute formulas must be boiled prior to use and then refrigerated until used again. Pedialyte can be used for weak or dehydrated animals alone or with the formula to replenish lost electrolytes. A syringe can be utilized for hand feeding, fitted with a rubber nipple. Check the hole in the nipple to prevent a fast flow of formula into the animal's mouth and causing aspiration. Prior to feeding formula must be warmed to the body temperature of the animal. Unused formula can be stored no more than 48 hours. The age and species of animal, as well as energy content of the formula, determines the number of daily feedings (Edwards, n.d.).

The weaning process is best if slow and gradual. Introduce solid foods at a time interval appropriate for the specific species. Patagonian cavies have been observed to first consume solid foods between fourteen and twenty one days (Edwards, n.d.).

If separated from a group, reintroduction can be attempted with a howdy cage initially if available. If aggression occurs between animals in this situation the reintroduction may not be successful. Patagonian cavies have been reintroduced successfully without utilizing an introduction period (pers. obs.). (Also refer to section 2.2.4).

- 4.6. **Means and duration of contraception:** MGA implants and depo-provera are recommended by the AZA Contraception Advisory Group for rodents (<http://www.stlzoo.org/images/CAGrecs2002.htm>). If MGA implants are utilized monitor the implant site for abscesses and rejection. Little data exists on the success of these methods and deleterious effects (DeMatteo, 1999). Male cavies can be neutered. The AZA Contraception Advisory Group website is www.worldzoo.org/cag.

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

5. Behavior management

- 5.1. **Training for routine husbandry procedures:** Training for routine husbandry procedures is recommended for performing visual inspections, shifting, and enduring being close to animal keepers. Hand reared animals and animals used to being around humans are more likely to respond to training. Avoid the use of negative reinforcement.
- 5.2. **Training for non-routine husbandry procedures:** Opportunities should exist for the animals to adjust to crates, tunnels, scales, etc., before training for non-routine husbandry procedures. It is ideal in a captive environment to arrange the enclosure in a manner that encourages caviés to shift through “tunnels” or similar devices on a daily basis. Crates can be placed at the end of the “tunnel” when capturing to reduce stress and avoid injury (pers. obs.).
- 5.3. **Procedures for facilitating introductions:** Introducing adult males is not recommended but if needed be prepared for aggression. Introductions of adult males may be achieved successfully depending on the species, the individual animal, and the size of the habitat.
- 5.4. **Facility design and training techniques:** A facility designed to shift caviés from one area to another is ideal. This helps with husbandry practices and reduces stress of the animal by being able to maintain a safe distance from humans. This applies to groups that are not accustomed to human interaction. For larger caviés it is ideal to have a system where animals can be safely herded into a crate or transport container. One zoo reported utilizing a tunnel with a crate at the end to safely capture Patagonian caviés (pers. obs.).
- 5.5. **Effective techniques for training:** Information pertaining to training techniques is vague. Patagonian caviés have been leashed trained but the techniques or steps used to achieve this behavior are not documented. Hand reared animals are more perceptive to learning behaviors, such as, walking on a leash. Hand feeding animals is one way to obtain close contact for visual inspection and gaining trust from the animal.
- 5.6. **Technical skills and competencies needed by staff:** Animal care staff with experience maintaining medium to large rodents in captivity should have the necessary experience to successfully care for members of the caviidae family. Staff needs to fully understand cavy natural history and behavior. It is vital for staff to be familiar with the potentially flighty behavior of captive populations of caviés to prevent injury or escape and have the ability to safely capture and restrain.

It is essential that staff has the ability to recognize and report verbally and in writing to management and/or the veterinarian potential problems with caviés. Diets must be properly prepared and distributed. Staff must be able to provide proper enrichment and be able to perform a variety of husbandry techniques.

- 5.7. **Appropriate methods of enrichment:** Enrichment can be offered in the form of fresh cut browse. Caviés are curious and will search for food. Food can be hidden throughout the habitat. Non-food enrichment can include mixed species exhibits and digging opportunities. Bamboo, suspended from rope to present a challenge, can be

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

utilized with captive populations of Patagonian cavies (pers. obs.). Use enrichment that encourages natural behaviors.

For more ideas utilize the *Shape of Enrichment* and the *Animal Keepers' Forum* or visit the enrichment websites www.enrichmentonline.org and www.csew.com/enrich.

6. Documentation

References Cited:

Anon. Mammal Species of the World. Washington, D.C., Smithsonian Institution: National Museum of Natural History. 1997.

American Association of Zookeeper's, A.A.Z.K. Animal Diet Notebook, n.d.

American Zoological Association (AZA). Accreditation of Zoo's and Aquariums, n.d.

Davenport, Danielle. "Re: [Zoo Biology] Hand-rearing of Patagonian Cavies." Email to Michelle Smurl. 9 Sept 2001.

DeMatteo, Karen, Taxonomic Listing for AZA CAG Contraception Database. 1999.

Edward's, Mark, "Handrearing Members of Rodentia" Infant Diet Notebook; AZA Animal Health Committee, (n.d.) 9-1 – 9-37.

Florida Game and Fresh Water Fish Commission, Standard Caging Requirements for Captive Wildlife, 1997.

Fowler, Murray. Zoo & Wild Animal Medicine. Philadelphia: W.B. Saunders Company, 1999.
- Restraint and Handling of Wild and Domestic Animals, 2nd ed. Iowa: Iowa State University Press, 1995.

Grizmek, B. Grizmek's Animal Life Encyclopedia. Vol 11. NY, NY: Van Nostrand Company, 1972.

Hohoff, et. al. "Female choice in a promiscuous wild guinea pig, the yellow-toothed cavy (*Galea musteloides*)" *Behavioral Ecology and Sociobiology* 53 (2003): 341-349.

Hohoff, et. al., "Monogamy in a new species of wild guinea pigs (*Galea* sp.)" *Naturwissenschaften* 89 (2002): 462-465.

International Air Transport Association (IATA), Live Animal Regulations, 29th ed., 2002.

Kreeger, Dr. Terry J. Handbook of Wildlife Chemical Immobilization. Fort Collins: Wildlife Pharmaceuticals, Inc., 1999.

MacDonald, Dr. David., ed. The Encyclopedia of Mammals. Barnes and Noble, 1999.

MacNamara, M. "Notes of the behavior and captive maintenance of mara, *Dolichotis patagonum*, at the Bronx Zoo." Zoologischer Garten N F, Jena 50 (1980): 422-426.

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

n.a., "Mazuri Rodent Pellets." Mazuri. n.d. <http://www.mazuri.com>

Meek, Caroline. "Zoo Standards for Keeping Cavies and Patagonian Hares in Captivity." AZA's Minimum Husbandry Guidelines for Mammals. AZA, 1997.

Nowak, R.M. Walker's Mammals of the World, 4th ed. Vol 2. Baltimore: John's Hopkins University Press, 1999.

- Walker's Mammals of the World Online, 1995:

<<http://www.press.jhu.edu/books/walker/rodentia.caviidae.html>>.

Pryor, Warren. "Re: Guinea Pig's." Email to Michelle Smurl. 3 July 2001.

Rood, J.P., "Ecological and behavioural comparison of three genera of argentine cavies. Animal Behavior Monogram 5 (1972): 1-83.

Sadler, William. "Fun Facts on Guinea Pigs." Mazuri. n.d. <http://www.mazuri.com>.

United States Department of Agriculture (USDA). Animal Welfare Act and Animal Welfare Regulations, 2002.

Woods, C. A., "Hystricognath rodents." *In* Anderson and Jones (1984): 389-446.

6.1 Definitions

Animal welfare. a) A state of well being facilitated by species-appropriate opportunities, a species-representative social group, and the satisfaction of physiological needs; b) the state of an individual animal as regards its attempts to maintain homeostasis with respect to its environment. Successful coping implies problem-focused strategies to avoid, escape, predict or otherwise control exposure to environmental stressors.

Animal well being. a) An animal may experience well being if it is free from distress most of the time due to its ability to avoid, escape, predict or otherwise control its exposure to environmental stimuli, is in good physical health, and exhibits a substantial range of species-typical behaviors and relative time spent in those behaviors.

Stress. a) A non-specific response of the body to any demand made on it; b) an environmental effect that is likely to or does reduce the Darwinian fitness of the organism; c) the alarm system in a homeostatic organism, d) a cumulative response, the result of an animal's interaction with its environment.

Eustress. The outcome when a stressor is met by effective coping strategies and is transformed thereby from distress (negative) to eustress (positive).

Distress. The state of being unable to defend against or control effects of an acute or chronic environmental stressor. A stressor may be either physical or emotional.

Suggested Reading:

ZOO STANDARDS FOR KEEPING CAVIES IN CAPTIVITY

Albers, P.C.H., et al. "Effects of Frequency and length of separation bouts between mother and offspring on later explorative behaviour of young guinea pigs," Behaviour 137 (2000): 1487-1502.

Cao, Y. "Phylogenetic position of guinea pigs revisited." Molecular Biology and Evolution 14 (1997): 461-464, illustr.

Colonnese, M.T. et al. "Ontogeny of action syntax in altricial and precocial rodents: grooming sequences of rat and guinea pig pups." Behaviour 133 (1996): 1165-1195, illustr.

Galante, M.L. et al. "Seasonal variation of a cavy population in the Pampa region, east-central Argentina." Mammalia 58 (1994): 549-556, illustr.

Guichon, M.L. et al. "Role of diet selection in the use of habitat by pampas cavies, *Cavia aperea pamparum*." Mammalia 62 (1998): 23-35, illustr.

Kiel, Anja. "Reproductive success of males in the promiscuous-mating yellow-toothed cavy (*Galea musteloides*)." Journal of Mammology 80 (1999): 1257-1263, illustr.

Kleiman, D.G., et al. "Reproductive parameters and productivity of caviomorph rodents." Vertebrate Ecology on the Northern Neotropics. Washington D.C., Smithsonian Institution Press. (1979).

Kunkele, Joachim. "Effects of litter size on the energetics of reproduction in a highly precocial rodent, the guinea pig." Journal of Mammalogy 81 (2000): 691-700, illustr.

- "Are precocial young cheaper? Lactation energetics in the guinea pig." Physiological Zoology 70 (1997): 589-596, illustr.

- "Communal suckling in the cavy *Galea musteloides*." Behavioral Ecology and Sociobiology 37 (1995): 385-391, illustr.

Kunzl, Christine et al. "The behavioral endocrinology of domestication: a comparison between the domestic guinea pig (*Cavia aperea* f. *porcellus*) and its wild ancestor, the cavy (*Cavia aperea*)." Hormones and Behavior 35 (1999): 28-37, illustr.

Lacher, Thomas E., "The comparative social behavior of *Kerodon rupestris* and *Galea spixii* and the evolution of behavior in the Caviidae." Bull. Pittsburgh: Carnegie Museum of Natural History, no. 17 (1981): 71.

- "Rates of growth in *Kerodon rupestris* and an assessment of its potential as a domesticated food source." Papeis Avulsos de Zoologia, San Paulo, 33, (1979): 67-76.

Roberts, M. et al. "The reproductive biology of the rock cavy, *Kerodon rupestris*, in captivity: A study of reproductive adaptation in a trophic specialist." Mammalia 48 (1984): 253-266.

Sachser, Norbert. "Of Domestic and wild guinea pigs: studies in sociophysiology, domestication, and social evolution." Naturwissenschaften 85 (1998): 307-317, illustr.

Trillmich, Fritz. "Effects of low temperature and photoperiod on reproduction in the female wild guinea pig (*Cavia aperea*)." Journal of Mammology 81 (2000): 586-594, illustr.

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