

Abridged Husbandry Manual for

Ring-Tail Coati

Nasua nasua

(MAMMALIA: PROCYONIDAE)



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1 Introduction

The Procyonidae are a diverse and distinct family of carnivores (De La Rosa and Nocke, 2000). Included in the genus are the Raccoons, Ring-tail Cats, Olingos, Kinkajous and Coatis. These species are all found in the Americas and inhabit a wide variety of habitats from temperate forests to tropical regions. Within the genus, Coatis are unique. While most Procyonids are solitary and crepuscular, coatis exemplify a diurnal, social lifestyle. Groups, called bands, are made up of females and their offspring. Males are solitary, joining bands only for short periods during the breeding season. Individuals forage on the forest floor and up in the canopy during the day looking for fruits and invertebrates and occasionally consuming live prey (Alves-Costa *et al*, 2004).

The combination of their preferred diet and their relatively abundant population numbers make Ring-tail Coatis' a potentially significant contributor to the dynamics of the ecosystems they inhabit. Alves-Costa *et al* (2004) describe how in areas where other medium and large-sized mammals are absent, coatis fulfill the need for seed dispersal. Ring-tail coatis feed primarily on fruits bearing seeds. These seeds need to be distributed and fertilized in order to germinate and produce new plants. When coatis deposit the seeds in their feces they are promoting forest regeneration. Coati presence has also been correlated with predator numbers. Where they fluctuate, predator numbers show a marked change too (Gompper and Decker, 1998).

Zoos consider the significant role coatis play in ecosystem balance an important reason to keep them. Their diurnal, social and very playful nature makes them highly desirable for display. Overall, they make excellent ambassador species, especially for the neo-tropical forests, an area drastically affected by habitat destruction (WAZA, unknown).

In 2002 Campbell reported that in the US there were 22 (12.10.0) Ring-tail Coatis living in 13 institutions and 164 (70.93.1) White-nosed Coatis in 55 institutions. Currently at Melbourne Zoo alone there are twenty five Ring-tail Coatis. One solitary male and two bands made up of females and their offspring. It is hoped that this playful species will capture the hearts of visitors and encourage them to support campaigns aimed at saving their habitat.

Please note: Some of the information contained in this manual has been extrapolated from research known about other Coati species in order to fill in the gaps about Ring-tail Coatis; the "target" species of this manual. As such, this manual may be used as a guide for keeping other Coati species such as the White-nose Coati.

2 Taxonomy

2.1 Nomenclature

Scientists are currently divided on the correct classification of the *Nasua* genus. Decker (1991) recognizes only two species, the Ring-tail Coati *N. nasua* and the White-nosed Coati *N. narica*. More recently, researchers such as Bittner *et al* (2010), recognize a third species, the Cozumel Island Coati, *N. nelsoni*. This species is found only on Cozumel Island off the coast of Mexico.

A separate genus, *Nasuella*, refers to the Mountain or Little Coati (Glatston, 1994).

Class	Mammalia
Order	Carnivora
Family	Procyonidae
Genus	<i>Nasua</i>
Species	<i>Nasua nasua</i>

2.2 Subspecies

There are thirteen recognized subspecies of *Nasua nasua* (Wilson & Reeder, 2005). They are as follows:

N. n. nasua
N. n. aricana
N. n. boliviensis
N. n. candace
N. n. cinerascens
N. n. dorsalis
N. n. manium
N. n. molaris
N. n. montana
N. n. quichua
N. n. solitaria
N. n. spadicea
N. n. vittata

2.3 Recent Synonyms

Linnaeus was the first to describe *Nasua nasua* and *Nasua narica* in 1766 initially based on differences in pelage colouration (Gompper and Decker, 1998). Previous to this classification, Coati species were described by their behaviour. The common name Coati

and its scientific name *Nasua socialbilis* was used to describe the animals that lived communally in bands. While Coatimundi and *Nasua solitaria* described animals that were solitary. The problem with these descriptions was that the solitary animals were actually the adult males of the species and those living communally were the females with their young including juvenile males (De La Rosa and Nocke, 2000).

2.4 Other Common Names

Ring-tail Coati's are known by several other common names. These include Brown-nosed Coati, South-American Coati, Southern Coati, Red Coati and Coatimundi (Campbell, 2002). The name Coati is of Tupian Indian origin and refers to the way coatis sleep with their nose tucked into their belly. Translated it is broken down into 'Cua' meaning belt and 'ti' meaning nose (Gompper and Decker, 1998).

Coatis also have local names according to the countries where they are found. Some of these include (WAZA, unknown):

Brazil: Cuati, Cuatimundae

Columbia: Cuzumbo

Ecuador: Tejon

Peru: Achuni

Argentina: Cochinigo

3 Natural History

3.1 Morphometrics

3.1.1 Mass And Basic Body Measurements

Ring-tail Coatis have a head-body length between 41 and 67cm (WAZA, unknown). The tail is generally more than half of the total body length. Measurements from head to tip of tail range from 80 to 130cm (De La Rosa and Nocke, 2000). Weights are highly dependent on gender. Females weigh between 3.5 and 6kg whilst males weigh between 5 and 8kg (De La Rosa and Nocke, 2000).

3.1.2 Sexual Dimorphism

Generally the only sexual dimorphism shown by coatis, aside from the presence of testicles in males, is the difference in size. Males tend to be bigger, weighing between 25 and 30% more on average (Hass, 2002).

3.1.3 Distinguishing Features

The proliferation of *Nasua* species is due to taxonomic splitting based primarily on pelage colour variation, highly variable cranial characteristics and misunderstandings of the social structure (Gompper and Decker, 1998). *N. narica* and *N. nelsoni* are most similar in appearance and differ only slightly in their size. The latter being the slightly smaller of the two. The most distinguishable variation is between *N. nasua* and *N. narica*.

Coloration:

Coati pelage colouration is highly variable, even at the intra-population level (Gompper, 1995). Both species display anything from light orange/red to dark brown coats with a general tendency to have lighter under-parts. They also both have white facial markings (usually dots) around the eye. The most obvious differences are around the muzzle; *N. nasua* has a uniformly brown to black muzzle which is distinctly different from the white hairs of *N. narica* (Campbell, 2002). The non-prehensile tail of all species includes 6 or 7 yellow bands. These are generally most visible in *N. nasua* (Whitaker 1996 in Campbell 2002).

Physical characteristics:

The *Nasua* genus has the longest snout and claws of all the Procyonidae (Gompper and Decker, 1998). The snout terminates in a flexible rhinarium that protrudes beyond the end of the lower mandible (Gompper and Decker, 1998). The claws are blunt but powerful and slightly curved to aid in digging and climbing. They are non-retractable (Vaughn, 1986 in Campbell, 2002). The feet are plantigrade with naked soles and webbing extending to the proximal ends on the forefeet (Gompper, 1995). This characteristic makes them very capable swimmers when the need arises. Coatis walk in a plantigrade

fashion. They are fairly quick for their size and have been clocked at speeds up to 27.3km per hour in a rocking gallop (Kauffman 1962 in Campbell, 2002).

Coatis have small rounded ears with efficient auditory reception allowing them to receive a maximum sensitivity extending 7.4 octaves with an upper frequency limit of 95 kHz (Gompper and Decker, 1998). They have colour vision (Chausseil, 1992).

In general, the *Nasua* genus has shorter limbs and smaller teeth than those of the Raccoon (*Procyon lotar*). However their teeth are larger than those of the Mountain Coati (*Nasuella olivacea*). They have blade like canines, and high crowns and sharp cusps. The dental formula for all *Nasua* is i3/3, c 1/1, p 4/4, m 2/2 total 40 (Gompper and Decker, 1998). The radiation of the nape hairs differs between the two most distinct species. *N. nasua* has hairs facing in an anteriorly reversed position (Campbell, 2002 and Gompper and Decker, 1998) whilst *N. narica* has nape hairs which are in the normal posterior position (Gompper, 1995). Also, the baculum (penile bone) of *N. nasua* is shorter and the distal end is broad and rounded (Gompper and Decker, 1998).

According to Gompper and Decker (1998) and Gompper (1995) a number of cranial differences exist between *N. nasua* and *N. narica*, refer to Figure 1. Both authors describe *N. nasua* with a flat palate along the midline rather than concave as in *N. narica*. Also, the sides of the nasal bones converge posteriorly rather than being parallel and the postorbital process of jugal bone is present.

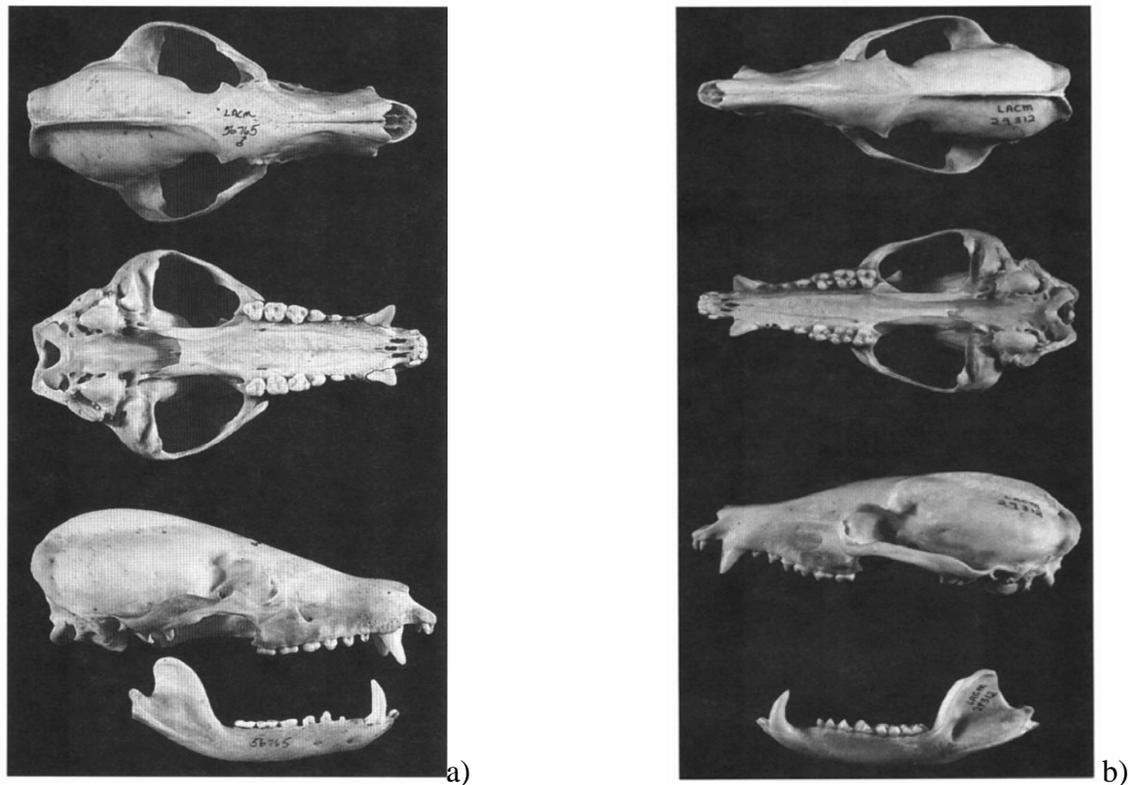


Figure 1. Skull morphology including dorsal, ventral and lateral views of a) *N. nasua* (Gompper and Decker, 1998) compared to b) *N. narica* (Gompper 1995).

3.2 Distribution and Habitat

The Ring-tailed Coati ranges from Columbia and Venuzula to Uruguay and northern Argentina. It can be found in the Andes of Ecuador up to 2,500m altitude (Gompper and Decker 1998). Figure 2 shows a detailed map of the distribution of Ring-tailed Coatis' in South America.



Figure 2: *N.nasua* distribution map <http://maps.iucnredlist.org/map.html?id=41684>)

3.3 Conservation Status

Table 1: The current IUCN listings for the four recognized coati species.

Common Name	Species	IUCN Listing	Reason for Listing
Ring-tailed coati	<i>Nasua nasua</i>	Least Concern	Widespread. Habitat relatively intact. Population density varies by region. No major threats. (Emmons and Helgen, 2008)
White nosed coati	<i>Nasua narica</i>	Least Concern	Numbers unknown. Distribution limited, isolated or discontinuous. Habitat impacted. Origin of captive animals unknown and could be cross bred.
Cozumel Island coati	<i>Nasua nelsoni</i>	Least Concern	Same as above.
Mountain coati	<i>Nasuella olivacea</i>	Data Deficient	Ongoing uncertainty regarding effects from human impacts, specifically habitat loss and conversion to agriculture.

Whilst currently Ring-tailed coatis are of ‘Least Concern’ (see table 1), trends dictate that human impacts on their native habitat will increase and therefore population numbers will decline. Long term further studies will be needed to monitor the species and ensure viable future population numbers. *N. n. solitaria* is listed in CITES Appendix III for Uruguay.

N. narica are listed in Appendix III of CITES by Honduras. However, they are not afforded protection anywhere else. *N. nelsoni* is lumped under the survey results and recommendations for *N. narica*.

The Mountain coati is not included in the species lists of any protected area. The species is only protected by game species resolution in Venezuela. It is not protected in Ecuador or Colombia (Glatston, 1994).

3.4 Diet in the Wild

Coatis are omnivorous animals whose diet is seasonally variable and driven by resource abundance; primarily the availability of fruit (Hirsch, 2009). Smythe (1970) (in Clauss *et al*, 2006) observed that when fruits are abundant, coatis are almost exclusively frugivorous. One study found that coatis consumed the fruit from at least 53 different plant species which ranged in size, colour and seed number (Alves-Costa *et al* 2004). The types of plant species they feed from are both native and introduced. Hirsch (2009) found that coatis ate exotic fruits during lean winter months when native species did not fruit.

Their ability to adapt and feed on introduced species suggests that fruit is a preferred resource.

During winter when the availability of fruit is diminished, coatis increase their consumption of litter invertebrates. Clauss *et al* (2006) and Alves-Costa *et al* (2004) both found that the consumption of spiders and millipedes was positively correlated with rainfall. These findings suggest that coatis alter their consumption of invertebrates according to their availability. Alves-Costa *et al* (2004) also suggest that in fact availability of invertebrates dictates the seasonal diet of coatis rather than the availability of fruit. Either way, seasonal variation in food habits reflects fluctuations in resource availability for the coati with both fruit and invertebrates making up the majority of their diet.

It should also be noted that coatis will occasionally feed on vertebrates (Clauss *et al*, 2006). Whilst they make up a small percentage of the known diet, types of vertebrates consumed include birds, small mammals, rodents and reptiles. Interestingly, solitary males appear to hunt more frequently than females and juveniles in bands. Potentially the reward outweighs the energy investment for males who catch prey items because they do not have the advantage that group living affords. That is, animals who live in groups invest less time in the act of searching for food. Solitary males would need to spend significantly more time searching for food resources than animals living in groups.

4 Housing Requirements

4.1 Exhibit/Enclosure Design

The Department of Primary Industries provides a set of guidelines that should be followed when designing exhibits and enclosures for all captive animals (DPI, 2001). These can be obtained from their website (see DPI, 2001 reference for further information).

The main principles of these guidelines include the following:

1. Housing should provide protection from vermin, the elements including wind, rain and the sun and harassment from adjacent animals or zoo visitors.
2. A sprinkler system may be required for cooling in hot weather and heated rocks or pads should be available for warmth in cool weather.
3. Enclosures should enable the animals to move freely and engage in a wide range of natural behaviors including foraging, socializing, climbing, digging, resting and sleeping.
4. Physical barriers, including walls and fences should be designed and constructed to minimize traumatic injury to animals.
5. Visual barriers should be included to allow animals to avoid each other or to retreat from public viewing.
6. The enclosure must meet the minimum cage size standards for the number of coatis being displayed (see spatial requirements in section 4.3 of this manual).
7. The facility may be fully enclosed or include a moat to contain the animals.
8. Metal or timber supports are suitable and should be anchored securely into a concrete plinth around the entire periphery.
9. Additional holding facilities should be available for the separation of animals as required. This may include for the purposes of separating new or sick animals requiring quarantine. These cages are exempt from minimum cage sizes.
10. Dens should be weatherproof and provide dry comfortable sleeping quarters.
11. Enclosures should have adequate drainage to prevent flooding during rain.
12. Elevated benches, preferably wooden, should be provided to allow the animals to lie off the floor.

Coatis are curious and often destructive (personal experience). As such it is imperative that any fixtures in the exhibit are secured appropriately. This includes using metal guards on drinkers to prevent them from breaking the float, securing benches with materials that are not able to be chewed through and ensuring that the floor of the exhibit is mesh wire lined to prevent animals from digging out. An air lock is highly advisable for entry and exit from the exhibit as animal escapes are a likely event. Ease of access for daily maintenance in the exhibit should also be considered. Wide doors that allow for wheelbarrows, large wheelie bins and other equipment are a big advantage (personal experience).

4.2 Spatial Requirements

The World Association of Zoos and Aquariums (WAZA) recommend a minimum surface size of 40m² for a pair of coatis. For every additional animal they suggest this be increased by 10%. If the animals are kept in an enclosed mesh cage the minimum height requirement is 3m. If the animals are confined by a moat, walls or glass panels then they must be at least 1.4m high.

4.3 Enclosure Furnishings

Coatis are very energetic and active animals and so require an exhibit that is complex and stimulating (personal experience). Ideally it should be planted with live shrubs, trees and other plants. These will need to be hardy species as the animals will climb, chew on, scratch at and break branches from them. They must also be non-toxic. A combination of live and dead branches of various lengths, widths and textures should be provided throughout the entire enclosure affording ample climbing opportunities. Refer to Figure 3 below for an example. Whilst most of these can be permanent structures it is also recommended that some are able to be moved or that there is space to introduce new branches in an attempt to continually change the habitat and keep it interesting for the animals (personal experience).

Rocks or mock rock can also be used to create a diverse environment with small caves for shelter or flat surfaces that receive direct sunlight for basking. Wooden platforms should be used to serve the same purposes as well as to provide feeding platforms where the animals can be spatially separated from other animals in the same enclosure. Coatis do not like to share food and so multiple platforms are necessary (personal experience). Fresh water must be available to all animals at all times. This may be in the form of a drinker or a shallow stream or pond. Coatis are capable swimmers and enjoy playing in water and using it to bath. If a drinker is used it must be secured at an appropriate height on a wall and should not be in direct sunlight. It should be of a non-spill-able design that can easily be drained and cleaned and cannot cause injury to the animal (DPI, 2001).



Figure 3: Ring-tailed Coati exhibit at Melbourne Zoo (Photo by Beth Geraldene).

5 General Husbandry

5.1 *Hygiene and Cleaning*

Coati enclosures must be cleaned daily. Keepers should use a rake, shovel and bucket to remove feces and uneaten food from all areas including the display and off-limits. Old browse, leaf litter, pieces of rotting logs and other old enrichment items should be removed. New ones should be provided daily or as often as possible. Soiled bedding should also be removed and replaced daily. This material should be completely changed regularly (once or twice a week), more often in winter. At the same time the nest boxes should be hosed out and left to drain and dry well before new material is put back in. The water bowl should also be drained, cleaned and refilled every day. Any area that is concreted or any platform that is used regularly by the animals to defecate on or feed on should be scrubbed, cleaned and rinsed with a hose daily. Animal House disinfectant should be used at least once or twice a week in these areas. The holding areas should be well drained before animals are given access into them again. See section 8 with regards to daily health checks undertaken during routine cleaning.

Animal House and F10 are recognized as safe cleaning chemicals for use around animals (see Appendix A). Other strong smelling disinfectants such as bleach are not recommended as they can cause the animals discomfort and sickness (DPI, 2001).

The general husbandry routines listed above may need to be modified during the animals' breeding season. This is especially true if a female is pregnant or has recently given birth. During this time it is important to leave the female alone. This means that keepers will reduce the amount of cleaning in that animals exhibit until such a time when the young are confident and the mother is not stressed by the keepers' presence. See section 10 Breeding for more information.

6 Feeding Requirements

6.1 Captive Diet

Below, Table 2 describes the target nutrient ranges for Coati species. Also listed are the DDI (Daily Dietary Intake) values for coatis held at three zoological institutions worldwide. The Melbourne Zoo (MZ) dietary recommendations (Table 3) are based on veterinary advice and senior keeper experience over years of caring for coatis. The dietary sheets for Houston Zoo (Table 4) and Akron Zoo were provided by Stephanie Turner (Coati keeper) from Houston Zoo.

In the past captive coati diets have consisted primarily of meat, wet dog or cat food and dry dog kibble biscuits. This is especially true for those kept as private pets. Whilst they can be maintained on this type of diet it is not recommended as studies have shown that diets rich in iron can lead to significant health problems (see section 8 Health Requirements). Given what is now known about their diet in the wild more zoos are placing importance on the fruit, vegetable and insect components of their DDI. According to the dietary recommendations listed below MZ provides the greatest volume of these items. In terms of variety both MZ and Houston Zoo give their animals a combination of fruits, vegetables, dog kibble (chow), insects and meat daily. This diet best replicates their natural diet. In comparison, Akron Zoo focuses on a diet primarily made up of dog kibble which is supplemented with occasional fruits, vegetables and insects provided on selective days.

Table 2: Target nutrient ranges for Coati species (information extracted from the AZA SCTAG Procyonid manual, 2010).

Nutrient	Recommended Range
Protein (%)	17.5 – 26
Fat (%)	5 – 8.5
Linoleic Acid (%)	1 – 1.3
Vitamin A (%)	0.5 – 5.9
Vitamin D (%)	0.5 – 0.55
Vitamin E (%)	27 – 50
Thiamin (mg/kg)	1.0 – 2.25
Riboflavin (mg/kg)	1.6 – 10.5
Pantothenic Acid (mg/kg)	7.4 – 15
Niacin (mg/kg)	11.4 – 20
Pyridoxine (mg/kg)	1 – 1.8
Folacin (mg/kg)	0.18 – 0.5
Biotin (mg/kg)	0.1 – 0.12
Vitamin B ₁₂ (mg/kg)	0.022 – 0.035
Calcium (%)	0.3 – 1.2
Phosphorus (%)	0.3 – 1

Potassium (%)	0.4 – 0.6
Sodium (%)	0.04 – 0.3
Magnesium (%)	0.04 – 0.06
Iron (mg/kg)	30 – 90
Zinc (mg/kg)	50 – 120
Copper (mg/kg)	6.0 – 12.4
Iodine (mg/kg)	0.9 – 1.54
Selenium (mg/kg)	0.1 – 0.35

Melbourne Zoo Ring-tail Coati Diet Recommendations

Table 3: MZ dietary recommendations for captive coatis.

Daily Dietary Component	Adult Male	Adult Female	Juvenile
Fruits	300g	250g	125g
Vegetables	100g	100g	50g
Whole Prey	50g	50g	25g
Dry Dog Kibble	50g	50g	50g
Insects	1 handful	1 handful	1 handful
Wombaroo high protein supplement	35g	20g	10g

Fruits eaten: Pear, apple, nashi, banana, plums, rock melon, watermelon, honeydew, grapes, orange, passionfruit, berries, pineapple, mango – any other fruits in season.

Vegetables eaten: Carrot, sweet potato, potato, beetroot, sweetcorn, avocado, tomato, broccoli, celery, parsnip, zucchini, cucumber – most other vegetables.

Whole prey: Mice, rats, day old chicks, fish, quail, rabbit, lean meat.

Insects: Crickets, mealworms, grasshoppers, cockroaches.

A wide variety of fruits and vegetables should be offered as part of the daily diet. One type of whole prey and insect can be fed off each day however it is recommended that this is varied day to day, ie. Monday: Mice and crickets; Tuesday: quail and mealworms etc.

The diet recommendations above are based on non-breeding animals. It may be necessary to increase the DDI of females who are either pregnant or have given birth (personal experience). At MZ males have often displayed a stronger preference for whole prey items than females and so this may need to be taken into consideration when offering prey. It is recommended that the above values are used only as a guideline. Keepers should monitor the amount of food leftover daily, as well as the condition and health of the animals and gradually adjust the diet as needed.

Houston Zoo White-nosed Coati Diet Recommendations

Table 4: Houston Zoo dietary recommendations for captive coatis (Table supplied by Stephanie Turner of Houston Zoo).

M = maintenance T = training E = enrichment S = supplement G = growth						
Food Type	Diet Type	Individual		Group		Schedule
		Measure	Weight	Measure	Weight	
Chow, Pro Plan dog	M		45 g		90 g	Daily
Mazuri Omnivore	M		15 g		30 g	Daily
Fruit/Vegetable Mix	M/T		45 g		90 g	Daily
Grapes	M/T	6 each		12 each		Daily
Egg, hard-boiled	M/T	1 1/2 Each		3 each		3x/week
Mealworms/Waxworms	E/T	7 each	0.75 g	14 each	1.5 g	Tu/W/Sa
Chick, day-old	M	1 each		2 each		3x/week
Milliken Feline Meat	M/T		40 g		80 g	1x/week
Silversides	M/T		17 g		34 g	1x/week
Shrimp	E/T	4 each		8 each		1x/week
Earthworm	E/T	2 each		4 each		2x/week
Crickets, adult	E/T		5 g		10 g	2x/week
Juice, fruit	T	2 ml		4 ml		2x/week
Banana	M	1/4 each		1/2 each		Daily
Yogurt	?	1 T		2 T		2x/week

Houston Zoo recommends the following items to be given in equal proportions by weight by day.

- Sun: Carrot, frozen peas, apple, frozen blueberries
- Mon: Yam, butternut squash, cantaloupe, banana
- Tues: Carrot, zucchini, strawberries, pear
- Wed: Carrot, frozen blueberries, banana, broccoli
- Thurs: Frozen peas, apple, butternut squash, pear
- Fri: Frozen blueberries, yam, cantaloupe, zucchini
- Sat: Banana, yam, strawberries, broccoli

Akron Zoological Park White-nosed Coati Diet Recommendations

(Information provided by Stephanie Turner)

Daily (for group of 4):

- 848g (8 cups) Dog chow (PMI Nutrition high protein formula) when housed outdoors due to consumption by wildlife
- 424g (4 cups) Dog chow when housed indoors
- 266g (2 cup) Dr. Harvey What's Cookin'

Management Food Schedule (for group of 4):

- Sun 150g fish (capelin, herring, smelt, silversides)
- Mon/Thurs 184g (2 cup) grapes, apples or pears
- Tues/Fri 90g (3/4 cup) mealworms, frozen or live crickets, cockroaches, earthworms or grubs
- Wed/Sat 240g banana and/or melon

Enrichment Foods (for group of 4):

1/3c apple juice, 1 Greenie per animal, 1 hard-boiled egg, 2 Tbsp honey, 1/2c Jello, live trout, 2 Tbsp peanut butter, pumpkin, whole coconut.

Note: Enrichment foods are the choices and amounts available for the days that food enrichment is used. You can always use the maintenance and management foods in novel ways as enrichment also.

6.2 Supplements

Melbourne Zoo Ring-tail Coati Dietary Supplements

- | | |
|-----------------------------------|---|
| Wombaroo high protein supplement | Wombaroo Food Products
8 Oborn rd
Mt Barker, SA 5251
(Refer to Appendix B for product information) |
| Lactating females receive Calcium | 10ml Calcium Sandoz per animal per day (to finish when young are weaned) |

6.3 Presentation of Food



Variation in the presentation of food items will aid in stimulating natural foraging behaviors in captive coatis and help alleviate stress associated with boredom (personal experience). Fruits and vegetables can be cut into pieces ranging in size from small and diced to large slices, especially for melons. It is recommended, however, that the majority of food is cut into 4 to 5cm² pieces to ensure all animals (if kept in a group) have an opportunity to find and eat the food (see Figure 4).

Figure 4: Example of fruit and vegetable portion of coati diet (Photo by Beth Geraldene).

Whilst providing large chunks can be a novel and enriching way to present food, often it can lead to competition and aggression. Fruit and vegetables can be scattered around the exhibit, buried in mulch, smeared on branches, hidden in browse or inside of logs. Fruits especially can be skewered onto small branches so that that the coatis must climb to find the food. Many facilities also use feeding platforms, allowing one per animal and spatially separating them to ensure peaceful feeding times.

Live insects are easy to prepare and the value of using them in terms of behavioral enrichment is very high. Crickets, grasshoppers and cockroaches can be scattered around the exhibit randomly or hidden in logs and bamboo tubes requiring the animals to hunt using their sense of smell and eyesight. Mealworms can be scattered but burying them or hiding them will encourage the coatis to search for their food.

7 Handling and Transport

7.1 Timing of Capture and Handling

The easiest and least stressful way to capture coatis is to condition the animals to recall into a holding area or to crate train them. However, failing any previous training, the best time to capture an animal is in the morning before their first feed. Food from their pre-prepared diet or favourite food items such as grapes and mealworms can be used to entice the animals into the area where they are to be restrained.

7.2 Catching Bags

Figure 5 below shows three pieces of equipment that are essential when catching coatis. Thick leather gloves help to prevent injuries from scratches or bites, transport containers allow the animal to be moved easily and with little stress and nets aid in capturing the animal if it is not possible to get close enough to capture with hands. The box must be of suitable size to allow the animal to sit comfortably and turn around but should not be so big so as to allow excess movement. The net must be sturdy and large enough to fully capture the animal given its size.



a)



b)



c)

Figure 5: Equipment used when capturing and restraining coatis. a) Leather gloves, b) transport box, c) net (Photo's by Beth Geraldene).

7.3 Capture and Restraint Techniques

Capturing Adult Coatis

The best method for capture and restraint of adult coatis is often dependent on the purpose of the catch up. An animal which needs to be restrained for a hand injection can be isolated in box by using food rewards or a keepers physical presence (animals may run into a box to hide). Once confined to the box, a keeper, wearing thick leather gloves (as pictured above in Figure 5) can quickly grab the animal behind the neck with one hand and use the other to grab at the base of the tail pushing firmly down to keep the animal secured (refer to Figure 6 for placement of hands). The veterinarian can then administer the injection as needed and release the animal straight afterwards.

If an animal needs to be completely restrained and transported to another location (such as the veterinary clinic) then using a net to capture and box to contain and transport the animal may be the best approach (see Figure 5). A net such as the one in Figure 5 above needs to be strong and big enough to hold an entire adult coati. The handle can be of short or long length, however, the keeper must consider the amount of space they have to work in and any obstacles in the area whilst trying to net the animal. It is easiest to have the animal run head first into the net (personal experience). Once in, the keeper should attempt to twist the head of the net to ensure the animal cannot run out again. Once restrained by the net another keeper can manually restrain the animal further by using gloved hands and holding behind the head and at the base of the tail. The animal can be lifted that way into the transport box.

When confronted with keepers bearing nets and gloves coatis may move quickly about the exhibit making loud vocalizations. This agitation can lead to the animals taking risks when jumping and climbing and can result in self-harm. It is important for keepers to remain calm and make swift movements only when lunging for the animal (personal experience). Once the animal has been caught the keeper must take particular care to gently pull the animal away from whatever structure they were last holding onto. A common problem encountered is keepers pulling the animal too quickly or with too much force resulting in the animal tearing a claw. During restraint keepers must take care to avoid the head and mouth area of the animal as they have very large canine teeth and can cause serious injury if they bite. It should also be noted that coatis have very long, powerful claws which can easily scratch. Care should be taken to avoid this area.

Capturing Juvenile Coatis

When capturing and restraining juvenile coatis, keepers should follow the basic principles as listed above for adults. However, given their smaller size it is possible for keepers to use only their hands (preferably whilst wearing gloves) to capture and restrain juveniles. Animals should first be confined to a small holding area preferably with minimal fixtures. The keeper should then be able to quickly grab the coati behind the neck or at the base of the tail. They should then use their free hand to hold whichever end they did not grab to begin with. Figure 6 shows a juvenile being manually restrained. Keepers should note that whilst their teeth are smaller juveniles will still try to bite when being caught up.

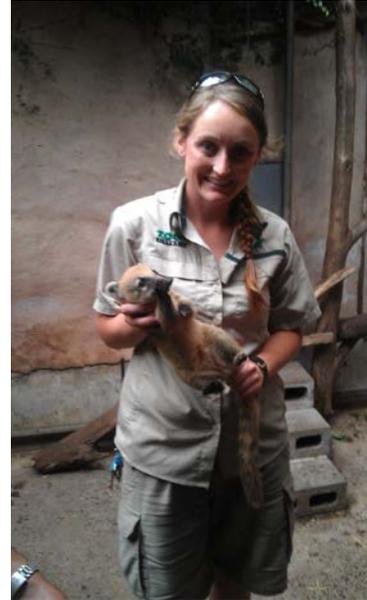


Figure 6: Restraint of juvenile coati (Photo by Adrian Howard).

7.4 Release

Coatis that have undergone any medical procedure should be released into a recovery area that is isolated from other animals. This principle should also apply to any new animal being received into a collection. The transport box can be left inside the holding area until the animal appears to have settled in. This can be determined by maintaining visual checks on the animal's behavior over a period of hours after its release. Given this need to monitor the animal it is best to release the animal at least an hour or so (minimum) before the end of the working day (personal experience).

7.5 Transport Requirements

The transportation of animals must always be conducted in such a way as to adhere to all laws, be appropriately documented and be safe so as to minimize risks to the animal, employee and general public (AZA SCTAG (2010)). When preparing to transport animals it is important to ensure they are in good health and are fit to travel. Sick, injured, pregnant or animals that have recently given birth and are still lactating should not be transported except in circumstances where they are being moved for better veterinary care. AZA SCTAG (2010) states that safe transport also requires an adequate number of appropriately trained staff who are equipped and prepared to handle contingencies and emergencies that may occur. The number of staff recommended is two. During transportation these staff should monitor the comfort and well-being of the animal every two hours.

For air transportation of coatis, Container Note 78 of the International Air Transport Association (IATA) Live Animals Regulations should be followed (WAZA, unknown).

7.5.1 Box Design

Transport containers should be constructed in a way that meets the health, safety and general needs of the animal being shipped. For coatis, this means that they must be strong, easily cleaned and disinfected, made of weatherproof non-toxic materials and be adequately ventilated. The box must also provide protection from direct sunlight, heat, wind, rain and other temperature extremes. Transportation enclosures should comply with IATA 1989 Container Regulation 11. This states that it must be of sufficient size to allow the animal to stand or lie down as required but should not be so large as to allow the animal excessive movement, hence risking injury (DPI, 2001). The container should be cleaned and disinfected using appropriate chemicals (Animal House or equivalent) and all residues thoroughly washed away prior to the animal being placed inside. The door or opening to the box must be secured in such a manner that the animal will not be able to escape during transport. Figure 5b in Section 7.2 is one example of a suitable transport container for coatis.

7.5.2 Furnishings

Although coatis are mostly arboreal they do not require branches or other furnishings during transportation. They will, however, require bedding that is absorbent to line the base of the container. The type of substrate used will be dependent on where the animal is being shipped to. Some countries have restrictions due to strict quarantine rules.

7.5.3 Water and Food

AZA SCTAG (2010) state that Procyonid species being shipped should be fine without food and water for a 24 hour period. Shipments that take longer than this will require the provision of food and water instructions and appropriate containers. Transportation duration longer than 4 hours and in air temperatures above 25°C will also require spill proof water containers (DPI, 2001). As a general rule it is advisable to always provide food and water dishes that can be securely attached to the box regardless of the shipping time frame. This way keepers have a contingency plan, allowing for any changes or delays during transportation. Foods that are water-heavy, such as apples or oranges are good sources of hydration and can be placed inside the crate for shipments of long duration.

7.5.4 Animals per Box

Coatis should always be shipped individually (AZA SCTAG, 2010). Placing animals together in a transport crate risks aggressive interactions which can result in serious injury.

7.5.5 Timing of Transportation

Given coatis are diurnal; shipping them overnight may be the least stressful method as they will naturally want to sleep. Animals should not be placed in transport enclosures more than two hours prior to departure and transport times should always be kept to a minimum (DPI, 2001).

7.5.6 Release from Box

Please see Section 7.4 Release as the same principles apply.

8 Health Requirements

8.1 Daily Health Checks

Whilst servicing the coatis' exhibit keepers should pay attention to physical and behavioral changes in the animals. This often requires an eye for subtle differences as animals will naturally hide any health problems. Aside from visually inspecting the animals themselves, it is also important for the keeper to look over the exhibit for traces of blood, vomit, diarrhea or clumps of fur.

Below is a list of general observations that should be made daily (See Figure 7).

SWELLING

Bulging Limbs
Extended abdomen

WOUNDS

Puncture bites
Cuts
Abrasions

HAIR LOSS

General condition of coat
All over loss
Clumps missing

LIMBS

Limping
Minimal movement



EYES

Cloudiness
Discharge
Redness
Squinting
Light sensitivity

APETITE CHANGES

Loss of appetite
Selective feeding (only soft foods etc.)

MOUTH

Broken teeth
Missing teeth
Cuts on gums
Swelling of lips and gums
Excessive salivation

a)



CLAWS

Missing
Broken

BEHAVIOURS

Pacing
Withdrawn
Unusually flighty
Un-natural behaviors
Excessive fighting
Self-mutilation

b)

Figure 7: Monitoring the health of coatis. a) Adult Coati with list of observations keepers should make. b) Coati with missing claw (Photo's by Beth Geraldene).

8.2 Detailed Physical Examination

8.2.1 Chemical Restraint

Zoo veterinarians should be consulted and their advice followed where an animal needs to be examined under anesthetic (EUA).

At MZ it is standard to hand inject with metomidine or ketamine intra-muscular (IM) immediately following capture and restraint of the animal. Once the animal has been safely transported to the clinic the animal is given either isoflurine or sevoflurane gas mixed with oxygen via a mask. Respiration and heart rate are closely monitored while the animal is under. An endotracheal tube is used to keep the airways clear and allow for efficient administration of the anesthetic as well as to keep the airways clear and allow the animal to breathe easily. While knocked out the animal is also given intravenous fluids.

Once the exam is completed the animal is given 100% oxygen to begin the recovery process. In this state the animal may be transported to its recovery area where it can be given a reversing agent IM.

8.2.2 Physical Examination

While under anesthetic veterinarians will routinely check the following:

- Weight and body condition
- Teeth and gums
- Eyes
- Ears
- Skin, coat and nails
- Muscular and skeletal system: including joints
- Abdomen
- Blood and urine routine screening
- Genitals, anus and rectal examination
- Mammary glands in females
- Heart and lungs (chest)
- Lymph nodes

8.3 Routine Treatments

At MZ coatis are vaccinated against feline respiratory virus and parvo virus with the F3 vaccine. In juveniles this is done at 8, 12 and 16 weeks of age. During the second and third vaccinations animals are usually also wormed. However, it is more general practice

to take fecal samples routinely and only treat for worms on an as needed basis. In the U.S. and other countries where it is available coatis are also routinely vaccinated against distemper. However, currently in Australia there is no safe vaccine available.

8.4 Known Health Problems

Canine Distemper:

Coatis are most susceptible to canine distemper. It is a virus and is generally spread by liquid aerosol droplets from infected animals. Signs and symptoms of this disease range from nasal and eye discharge to shaking, vomiting and diarrhea. In most countries animals can be vaccinated against it at a young age. In Australia there is currently no safe vaccine for coatis. However, its occurrence is rare and the chances of zoo animals coming into contact with animals carrying the virus are small. Strict quarantine protocols and rules preventing contact with domestic animals limit the chance of the virus infecting collections. If an animal does contract canine distemper, there is no single specified treatment recommended. Among other treatments, animals will need to be quarantined and placed on a course of antibiotics, anticonvulsants, analgesics, and be given fluids, electrolytes and dietary supplements in conjunction with good nursing care.

Heartworm:

Coatis have been known to test positive to heartworm. Heartworm is a parasitic roundworm that is carried by an intermediate host, the mosquito. Coatis can become infected when they are bitten by the mosquito. Often there are no signs or symptoms that an animal has been infected, especially in the initial stages. The first visible signs are usually a cough, especially after exercise and exhaustion. In more severe cases where worms have gone untreated signs include weight loss, fainting, coughing up blood and finally heart failure. In Australia, adult heartworms are usually treated using Melarsamine, while Moxidectin, Ivomectin or Milbemycin are used to treat the larvae. Animals are generally opportunistically tested for heartworm, usually while under anesthetic for another procedure. Currently, MZ does not use any preventive medication as the chance of contracting heartworm is very low.

Iron storage disease (less common):

There have been several cases documented of excessive iron deposition in the liver of captive held coatis (Clauss *et al* 2006). The suggested cause of the disease is a diet high in meat. One study showed that animals with iron storage disease were kept on a diet consisting of day old chicks, chicken throats, canned dog food, rice, pasta, fruits and mealworms only as treats (Clauss *et al* 2006). Treatment is generally a change in their diet to one which mimics their more natural fruit and insect preferences. It can be prevented by providing an appropriate diet to begin with.

Hair Loss:

MZ and Houston Zoo have each recorded cases of hair loss in their coatis. For both, stress was a major contributing factor, however the ultimate cause was shown to be associated with an underlying medical problem. Interestingly, at Houston Zoo, animals showed seasonal hair loss twice yearly. The loss was located mainly around the hip, rump

and tail. Further testing confirmed that allergies to fleas, ant's, pollen and even human dander were causing the hair loss (Stephanie Turner, personal correspondence). The case at MZ was somewhat more perplexing. Two adult females suffered from seizures caused by a spike in an unknown toxin in their systems. Following prompt treatment one of the females made a slow recovery during which she exhibited a loss of under hairs evenly over her body. Hair loss is generally not treatable and will usually correct itself over time given the original stress is removed.

8.5 Quarantine Requirements

The MZ veterinary department recommends a minimum 30 day quarantine period following any animal acquisition. During this time standard quarantine protocols must be followed. This includes keepers wearing protective clothing and using strong disinfectants when working within the quarantine area and limiting their contact with non-quarantine animals. Keepers should refer to their veterinary department for further restrictions.

Where a second animal is acquired and placed into quarantine with the first animal the original 30 day period must start again.

At MZ, it is standard for vets to run two routine fecal floats in house, one week apart during the quarantine period. This is designed to test for parasites, however does not include a heartworm test as it is a pathogen carried in the blood of the animal. During the 30 day period vets will anaesthetize the animal and perform a full clinical examination including a blood draw to test for heartworm.

9 Behaviour

9.1 Activity

The Procyonides are typically nocturnal. Coatis, which still possess nocturnal traits such as a reflective tapetum in the eye are an exception and exemplify diurnal, social carnivores (Chausseil, 1992 and Eisenberg, 1989). During daylight hours they forage on the ground and in the trees, sleeping at night amongst the branches which provide safety and protection (Gompper and Decker, 1998). In captivity, they follow a similar pattern and will also periodically nap during the day, especially after feeds or around the warmest part of the day (personal experience). At night, they prefer to sleep inside nest-boxes, especially those equipt with heat pads and bedding.

9.2 Social Behaviour

Coatis are both highly sociable and solitary. In the wild, female coatis generally remain with their natal group for most of their lifetime (Hass, 2002). Bands usually consist of 5 to 12 individuals, although some groups of up to 30 have been recorded (De La Rosa and Nocke, 2000). Once males reach 2 to 3 years of age they are expelled from the group and so begin a solitary existence. After this time they will only enter bands for breeding purposes. Interestingly, males exhibit social but not locational dispersal (Waser, 1996). Once they leave, males will usually establish a home range that overlaps with their natal group (Hass, 2002). Gompper and Wayne (1996) suggest that males benefit from this arrangement because of familiarity with the area allowing them to locate specific resources easily. They also suggest that males are tolerated by the related group because of their close kinship. Generally, males will only leave their home range temporarily during the breeding season to pursue other matings returning to the same area once they are successful or the season is over (Gehrt, 2003).

Home range size is usually dependent on the bands geographic location, size and the season; which determines resource availability (Valenzuela and Ceballos, 2000). Hass (2002) described White-nosed coati home-ranges to be approximately 1 to 2km². With relatively small ranges, bands often encounter each other. These interactions generally have two possible outcomes. The most obvious is that the two groups show aggressive behavior towards each other with one eventually chasing the other away. However, surprisingly the other outcome is that the groups merge or divide creating new dynamic families (De La Rosa and Nocke, 2000). This helps to explain why observations of wild populations have shown that groups mostly consist of extended families and occasional unrelated individuals of females and their offspring (Gompper and Wayne, 1996 and De La Rosa and Nocke, 2000).

Although coatis are not strictly territorial and group structure is somewhat malleable, they still rely on the collective individuals cooperating to benefit from group living. Within bands are patterns of complex behaviours such as cooperative grooming, nursing,

vigilance, anti-predator behaviour and coalition support (Gehrt, 2003). Individuals will mutually groom each other using their teeth, as opposed to the forepaws (Campbell, 2002) whilst an array of vocalizations are used to communicate the presence of any threat. At night, the group will locate a roost tree and together curl up and sleep. The benefits of all of these behaviours are numerous and include protection from predators, reduced harassment from males and increased access to food patches.

One of the greatest challenges for coatis is maintaining contact with their group whilst travelling through dense vegetation (Maurello, Clarke and Ackley, 2000). Individuals search independently for food, foraging on the ground and up in the trees. Their highly attuned sense of smell helps them to locate it. Visual and vocal displays alert other group members when a lucrative source has been found. Visual communication involves nose-up, head-down, and tail-switching displays (Gehrt, 2003), while vocalizations are numerous and have been labeled as barking, chirps, chitters, chop-chops, chuckles, growls, grunts, hiss's and squeals (Kaufmann 1962 in Maurello, Clarke and Ackley, 2000). The consumption of some food items is preceded by a ritual involving intense prey manipulation. Tarantulas, venomous frogs and millipedes are rubbed against the ground probably to empty the noxious contents of the glands (Alves-Costa *et al* 2004).

Scent marking, urine rubbing and penile dragging are all behaviors displayed by coatis both in captivity and in the wild. They suggest that smell and territory marking are important in determining and maintaining social structure (Gehrt, 2003 and Gompper and Decker, 1995).

The majority of behaviours described above are displayed by both wild and captive animals.

9.3 Behavioural Problems

Captive coatis are known for exhibiting stereotypic, self-destructive or abnormal behaviours. These behaviours can include over activity, inactivity, pacing, head swinging and over grooming (Grams, unknown). Problem behaviours in coatis normally stem from a lack of novelty enrichment which leads to boredom. Other common causes are expectations of food and once a day feedings. Coatis are natural foragers and so want to spend the majority of their day searching for and eating food. If they are not afforded this opportunity they will almost certainly begin to show signs of stereotypical pacing. Pacing will often begin with an animal waiting by the entrance to their enclosure and will slowly manifest into the animal walking back and forth in the same area for long periods of time. This is typically a problem seen in adult male coatis and in part is a consequence of their solitary life style.

9.4 Signs of Stress

Coatis can exhibit stress in a number of ways. Aggression amongst group members is a common problem and is usually augmented in instances where group sizes have rapidly increased due to births or acquisitions. The cause of the aggression may be related to

increased competition for food, a decrease in available space or frustration at the inability to disband or seek solitude.

Stress caused by anxiety or fear may result in animals exhibiting escape behavior. Common causes of this are loud noises, surprising and unpredictable movement especially associated with construction work nearby and confinement to small quarters.

Self-mutilation may also be a sign that an animal is stressed but can also often be associated with a medical skin condition. Testing should be done to rule out this possibility.

9.5 Behavioural Enrichment

Implementing a behavioural enrichment program will encourage coatis to display natural behaviours and will help interrupt any stereotypic patterns. When developing the enrichment program it is important to look at the natural history of the species. Social structure, habitat use, feeding strategy, diet, primary senses and activity cycles should all be taken into consideration (Grams, unknown). Typical coati behaviours that can be targeted in the program are foraging, digging, nesting, scent marking, scent rubbing and social aspects such as courtship and play. Any new enrichment item should be approved of by veterinarians, supervisors and senior staff before being trialed. It is important that the animals are observed during their first interaction with any new enrichment offered. Coatis can easily ingest or become entangled in foreign items causing serious risks to the animal's health. In cases where live plants are being offered, horticulturalists should be consulted with regards to toxicity (Gram, unknown). Likewise, if feces from other animals are being used, it must be checked for parasites prior to use.

Visual and Tactile Enrichment

Enrichment opportunities should be considered from the initial design phase of any animal exhibit. Creating complexity in the environment by arranging multi-level fixed and moveable perches encourages animals to climb, leap and jump. Items can be hung or be designed to move to stimulate activity. Visual barriers will allow for the animals to hide and will provide a sense of security (Grams, unknown). Variable substrates and fixture types and textures will encourage exploration and provide multiple opportunities for keepers to hide food. Even interactions between keepers and the animals themselves can provide enriching opportunities that may be beneficial.

The following is a list of possible visual and tactile enrichments that can be used in a coati exhibit.

- Visual barriers for privacy: hollow logs, trees, live vegetation, termite mounds, mounds of dirt, large rocks and other topography.
- Climbing structures: trees, logs (natural or artificial), platforms, mock rock, real rock, rope, vines, furniture that can easily be moved

- Natural substrates: mulch, sand, gravel, soil, moss, leaf litter.
- Water features: shallow pools, streams.
- Plants: grasses, herbs, live trees, shrubs, flowers (see Figure 8).
- Heat/cold/mist: heated rocks, sprinkler system, shaded areas, exposed sun drenched areas
- Shelter: natural holes and dens created by rocks or trees, nest-boxes, crush boxes
- Feeding structures: holes in rocks or logs, feeding platforms
- Training: target, station and other behavioral exercises



Figure 8: Ring-tail Coatis' displaying normal foraging behavior with new browse (Photo by Beth Geraldene).

Dietary Enrichment

Coatis will generally respond with enthusiasm to any dietary enrichment item. They are highly motivated by food making it one of the easiest ways for keepers to encourage natural behaviors. Coatis can be challenged and excited by not only varying the types of food but also by presenting them and delivering them in different ways.

The following are a list of dietary enrichment examples that can be used with coatis.

- Live prey items: mealworms, crickets, grasshoppers, cockroaches
- Carcass foods: chicken, rabbit, rats, mice, quail, beef or horse meat
- Bones: ribs, chicken necks, horsetail
- Hides: rabbit fur, beef or horse hide
- Schedule: varied feeding schedule and multiple feedings per day
- Brush pile feeder: food items hidden in branches

- Feeder logs: holes drilled into logs
- Ice blocks: containing fruit, meat, vegetables, juice
- Frozen fruit: grapes, berries
- Scatters: food randomly placed
- Food appearance: variety; chopped or whole foods, different textures and colours
- Eggs: raw and hardboiled (see Figure 9).
- Bamboo dispensers: mealworms or crickets inside
- Coconuts



Figure 9: Hard-boiled egg enrichment (Photo by Beth Geraldene).

Olfactory Enrichment

Coatis have a highly developed sense of smell. It is the main sensory organ they rely on to find food in the wild. As such, providing olfactory enrichment encourages coatis to investigate, scent mark and rub.

The following is a list of olfactory enrichment items that can be used with coatis.

- Fur from other animals
- Other species urine and feces
- Substrates from other animals exhibits
- Bedding from other animals exhibits
- Extracts: such as peppermint and vanilla
- Spices: such as cumin, paprika and Italian spice mix
- Herbs: fresh mint, coriander, lavender
- Perfumes
- Aromatic oils

Novel Enrichment

Often the more novel an enrichment item is the more value it has in eliciting certain desired behaviors. The idea is to use these items rarely so that when they are introduced the animals have a strong reaction.

- Palm tree trunk pieces (see Figure 10).
- Coconut
- Popped popcorn
- Kong toys
- Tires
- Barrels
- Pine cones
- Snake sheds
- Feathers
- Sounds: from same species, recording of natural environment.



Figure 10: Ring-tail coatis displaying natural scratching behaviors with palm tree trunk pieces (Photo by Beth Geraldene).

9.6 Introductions and Removals

Any new introductions should almost always be done in stages so that the compatibility of the animals can be evaluated prior to giving them full physical access to each other. Prior to beginning introductions staff should assess the outcomes and plan for all eventualities. At all times the safety and health of the animals and the staff involved should be of the highest priority. For the animals this means conducting the introductions in an area large enough to allow for avoidance of each other as well as escape routes into

holding areas that can be isolated from each other. For the staff this means being prepared and having the appropriate equipment at hand if the animals need to be separated. Keepers should also know the normal behaviors of their animals and be able to identify changes that might indicate stress or discomfort. The animals should firstly only be given visual and olfactory access through a mesh wire. Keepers should monitor their interactions and note their behaviors. Following this the animals can be given access to a neutral area one at a time. This gives them each an opportunity to explore the habitat and become familiar with it. Eventually the animals can be released into the same neutral area together and should continue to be monitored. It may be necessary in some cases to use a distraction such as perfume which may confuse or preoccupy the animals lending less time for aggressive behaviors. After any first physical interaction the animals should always be separated at night.

Given female coatis naturally live in groups, housing several animals together should pose no problem. Introductions should also be relatively straight forward although animals should always be monitored closely in the hours following release.

Quarantine procedures should be followed where a new animal has been acquired from outside of the institution. In cases where an animal is being moved in-house from one exhibit to join another, that animal should not have to undergo quarantine so long as they have recently been checked by veterinarians and were shown to be healthy.

9.7 Intraspecific Compatibility

Almost all combinations of gender, age and reproductive ability have been trialed and deemed successful at varying degrees according to the AZA SCTAG(2010) Procyonidae husbandry manual. Table 5 is a list taken from the manual that describes the intraspecific compatibilities of coatis.

Table 5: Intraspecific compatibilities of coatis.

Combination	Compatibility
Adult male kept solitary	Successfully kept in captivity. Live this way in the wild.
Several same age adult females	Successfully kept in captivity. Naturally live in bands in the wild.
Adult females and juvenile animals	Must have ample space to reduce competition aggression.
Multigenerational groups of females	Can do well.
Multiple-male and non-breeding (neutered) mixed-gender groups	Can do well.
Multi-generational groups of males	Higher success rate if neutered.
Non-breeding (neutered) mixed gender groups	Hierarchies will develop with females being the dominant animals. See below.
Single adult male in female group	Male will be subordinate and therefore most likely to be injured during intra-group social disputes.
Two mature, breeding adult males	Can result in aggressive behavior and injury.

9.8 Interspecific Compatibility

There are several factors to consider before any mixed-species exhibit is constructed. The potential for disease transmission is a serious threat to the health of the animals and so veterinarians should be consulted as a precaution. Behavioral compatibility including the potential for aggression which could result in injury should also be considered. In order to minimize the possibility of negative interactions each animal should have their needs catered for. This means providing appropriate sleeping areas, feeding and drinking areas, enrichments, and arboreal or terrestrial space. The social needs of the animals should also be considered.

AZA SCTAG (2010) lists the following as possible interspecific combinations with coatis:

Raccoons (both species neutered)
 Striped skunks
 Capybara
 Spectacled bear

10 Breeding

10.1 Mating System

Coatis have a polygynous mating system. Typically a single adult male is accepted into a band for a short period of time during the breeding season. During this time he monopolizes breeding rights with the females, fighting with rival males in order to maintain his position. Once mating is complete the male is once again rejected and forced back into solitude.

10.2 Reproductive Condition

10.2.1 Females

During the breeding season females will be more tolerant of males. They will also become more active at night and will display more allo-preening with band members.

10.2.2 Males

The timing of males readiness to mate is associated with the females coming into oestrous.

10.3 Techniques Used to Control Breeding

The easiest and most effective form of contraception for coatis is separation of the sexes. There are no side effects associated with this technique and stress is minimized as they would naturally occur this way in the wild. Spaying or neutering the animals is also an option where they are not required for breeding purposes in the future.

Keepers should seek the advice of veterinarians in cases where contraceptive implants must be used in order to control breeding.

10.4 Age at First Breeding and Last Breeding

Female coatis usually become sexually active at two years of age (De La Rosa and Nocke, 2000). While this might be the norm; some individuals may not breed until they reach 46 months (Gehrt, 2003). In terms of last breeding, females will usually become post-reproductive after seven years of age; after this time they will continue normal band activities (Gehrt, 2003).

Male coatis will usually not reach sexual maturity until three years of age (De La Rosa and Nocke, 2000). Their testes descend at 24 or 25 months, around about the time they

become solitary. Although during the following year they are capable of reproducing, breeding opportunities in the wild are normally rare because of high intra-sexual competition (Gehrt, 2003). There was no information available regarding last breeding age for males at the time this document was written.

Keepers should bear in mind that often in captivity seasonal cycles and breeding ability are disrupted causing animals to come into season at unpredictable times, often becoming sexually active earlier in life than expected (personal experience).

10.5 Ability to Breed Every Year

Coatis are very successful seasonal breeders (Campbell, 2002). In a study on the natural history of coatis, Valenzuela (1998) documented how females in the wild can breed year after year, and in some cases litters are born almost at the same time, within a week or two, each year. In captivity, age, health and number of previous litters may affect the future reproductive success of females and so consideration should be given to these factors before making the decision to breed an animal.

10.6 Ability to Breed More than Once Per Year

Coatis can only breed once per year. See section 10.9 Oestrous Cycle and Gestation Period for further information.

10.7 Nesting, Hollow or Other Requirements

In the wild, pregnant females will leave the band prior to the birth and re-join at 40 days post-partum (Gehrt, 2003). Given this, in captivity, it is advisable to separate a pregnant female from the main group as soon as she is confirmed as being pregnant (Campbell, 2002). Females that are not separated will fiercely defend their nest and will often become very aggressive towards other band members. This behavior can result in serious injury or abandonment of the litter. If an exhibit is deemed large enough to accommodate the spatial requirements of the pregnant female, at minimum, the breeding male must be removed prior to birth. Again, the female will become highly aggressive towards the male and injury is likely to occur. Once separated the female should be provided with a private space that is both quiet and accessible for monitoring, cleaning and feeding by the keeper. This space should include at minimum one nest-box that is 61cmx46cmx61cm (Campbell, 2002). It is advisable to also provide alternative nesting sites where the female can move her young to if she becomes nervous (AZA SCTAG, 2010). Nesting materials should also be made readily available to the female as she will naturally want to prepare the nesting site for the birth. Appropriate materials include straw, hay, grasses, leaves, twigs and sticks. Following the birth the female and her litter should be left alone. Keepers should only enter the area when absolutely necessary. Female coatis that have a litter to care for can become easily stressed and will abandon them if disturbed too often (AZA SCGAG, 2010).

10.8 Breeding Diet

Alves-costa *et al* (2004) found that in wild populations, lactation and litter growth coincided with an increase in consumption of spiders and millipedes. Millipedes in particular, contain 100 times more calcium than any other arthropod. They suggested that this food type was a significant source of calcium for females that were lactating. In captivity, lactating females must also increase their calcium intake in order to supplement their own needs whilst meeting the demands of her litter. The easiest and most efficient way to do this is by injecting a liquid calcium supplement into the prey food of the female. At MZ females are given 10ml of Calcium Sandoz daily until the litter is weaned. The DDI of the pregnant female will need to be monitored closely and increased when necessary. The young should be weaned by about 3 months of age, at which time the diet for the group will need to be significantly increased.

10.9 Oestrous Cycle and Gestation Period

Female coatis will enter into oestrous between one and three times a year (AZA SCTAG, 2010). In the wild, they usually only cycle once and it is normally timed to coincide with the availability of resources. In zoos, the seasonal timing is often lost. Oestrous is usually marked by an increase in mutual grooming within the band and decreased hostility between bands and solitary males (Campbell, 2002). Nocturnal activity also increases while there is more resting during the day (Campbell, 2002).

11 Artificial Rearing of Mammals

11.1 Housing

Neonates being hand raised do best when kept inside an incubator (AZA SCTAG, 2010). The heat produced by lamps is generally too intense, causing dehydration and potentially serious burns if touched. Wrapping the baby in towels will also help to make it feel safe and secure.

11.2 Temperature Requirements

Currently, there is no specific temperature guideline suggested for coatis, however, AZA SCTAG (2010) recommends ringtails and cacomistles (also Procyonids) are kept in an incubator with a floor temperature of 38°C.

11.3 Diet and Feeding Routine

The following information was taken from the AZA SCTAG (2010) Procyonidae manual.

Coati neonates should be given a hydrating formula starting from day 1. The formula of choice in the US is Esbilac® which is prepared by adding water at a 1:2 ratio. The nutritional composition of Esbilac® is listed in Appendix C. An Australian equivalent should be available from Wombaroo (see Section 6.2 Supplements). It is advisable to consult them for the most appropriate available equivalent. When feeding, the formula should be warmed to approximately 35-37.8°C. If it is not at the appropriate temperature the coati will most likely refuse it. Nipples used should all be of equivalent size, shape and colour. Feedings should take place every 2 hours until the pup is two weeks old and then every 3 hours during the following week.

The pups' formula should gradually be reduced to a 1:1 ratio over the days following birth. The goal is to eventually have them down to just formula as soon as can be tolerated. It should then be thickened with rice cereal after they reach 3 weeks of age. At this time pups can begin to be fed at 4 hour intervals with a mixture of 1 part formula, 2 parts water, 1 part cereal and 1 part baby peaches (pureed) until they reach 5 weeks of age.

At five weeks, the pups can go 6 hours overnight without being fed. Coatis are lactose intolerant, and so also at this time Lactaid pills should be added to their formula mix (if you are using one that contains lactose). 2 pills should be crushed and added for every 12 scoops of formula.

Weaning can begin at 8 weeks of age with foods such as mashed banana, soaked puppy food, kibble and scrambled eggs being offered. Final weaning should not occur before 16 weeks of age.

The chart below (Table 6) is helpful in determining the maximum volume of formula per individual based on their progressive weight.

Table 6: Values for determining stomach capacity based on juvenile Coati body weights.

Weight (grams)	Stomach capacity (ml/feeding)
5.0	0.25
6.0	0.3
7.0	0.35
8.0	0.4
9.0	0.45
10.0	0.5
11.0	0.55
12.0	0.60
13.0	0.65
14.0	0.7
15.0	0.75
16.0	0.8
17.0	0.85
18.0	0.90
19.0	0.95
20.0	1.0
25.0	1.25
30.0	1.5
35.0	1.75
40.0	2.0
45.0	2.25
50.0	2.5
55.0	2.75
60.0	3.0
65.0	3.25
70.0	3.5
75.0	3.75
80.0	4.0
85.0	4.25
90.0	4.5
95.0	4.75
100.0	5.0
125.0	6.25
150.0	7.5
175.0	8.75
200.0	10.0
250.0	12.5
300.0	15.0
350.0	17.5
400.0	20.0

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15 Glossary

Allo-preening:	A behavior where animals mutually clean each other.
Enrichment:	A dynamic process used to improve or enhance animal welfare by encouraging natural and normal behaviors.
Gestation period:	The time it takes for a fetus to develop from fertilization to birth.
Home Range:	The area that an animal lives and travels in.
Neonate:	Another name for a newborn.
Nomenclature:	Refers to the principal of naming things.
Oestrous cycle:	Oestrous is a regularly occurring period of heightened sexual receptivity to males in most female mammals. During this time females are ovulating and so if copulation is successful fertilization can take place.
Plantigrade:	A form of locomotion where the podials and metatarsels are flat on the ground.
Polygynous:	A mating system involving one male with one or more females.
Rhinarium:	The hairless, moist nose of an animal.
Sexual Dimorphism:	A phenotypic difference between males and females.
Stereotypic behavior:	Constant and repetitive behaviors generally not displayed by the animal.
Territorial:	Any socio-graphical area that an animal of a particular species consistently defends against conspecifics.

16 Appendix

See Attached

F10

Veterinary Disinfectant



PROPRIETARY NAME ,SIZES & REGISTRATION NUMBERS

• F10SC VETERINARY DISINFECTANT

(liquid, dilute as directed, in 25L, 5L, 1L, 200ml, 100ml)

Reg No: G3070(A), GNR529/29990/040/150(B), (C), (D), 54149(E), L78846(F), 6848(G), H1280(H),  

• F10SCXD VETERINARY DISINFECTANT/CLEANSER

(liquid, dilute as directed, in 25L, 5L, 1L)

Reg No: G3073(A), GNR529/29990/040/150(B), L78846(F), H1280(H),  

• F10CL GENERAL FARM DISINFECTANT

(liquid, dilute as directed, in 25L, 5L,)

Reg No: G2934(A), GNR529/29990/040/150(B),  

• F10 SKIN PREP SOLUTION

(liquid, use as is, in 5L)

Reg No: G3105(A), 

• F10 ODOUR ELIMINATOR

(liquid, use as is in 500ml, dilute as directed in the 5 L)

Reg No: GNR529/29990/040/150(B), 

• F10 AEROSOL DISINFECTANT

(500ml aerosol pressurised dispensing canister, use as is)

Reg No: GNR529/29990/040/150(B), 

• F10 DISINFECTANT SPRAY WITH INSECTICIDE

(liquid, use as is, in 5L and 1L)

Reg No: GNR529/29990/040/150(B), 

• F10 WIPES

(100 impregnated cellulose tissues)

Reg No: GNR529/29990/040/150(B), 

REGISTRATION AUTHORITIES

- | | |
|--|----------------------------|
| A Department of Agriculture, Act 36/1947 (SA) | E APVMA (AUS) |
| B DTI, Act 29/1993 (SA) | F TGA (AUS) |
| C Department of Agriculture Uruguay | G AQIS (AUS) |
| D DEFRA (UK) | H AGRICULTURAL (NZ) |

COMPOSITION

The core actives of all the disinfectant products are quaternary ammonium and biguanide compound, with non toxic ampholytic surfactants and sequesterants.

LEVEL OF ACTIVES	OTHER	pH*
F10SC VETERINARY DISINFECTANT		
QAC and biguanide 5,8%	Ampholytic surfactants and sequesterants Water to balance	7.5
F10SCXD VETERINARY DISINFECTANT/CLEANSER		
QAC and biguanide 5,8%	Ampholytic surfactants, sequesterants/detergents Fragrance Water to balance	7.5
F10CL GENERAL FARM DISINFECTANT		
QAC and biguanide 1,2%	Ampholytic surfactants, sequesterants/detergents Water to balance	4.6
F10 SKIN PREP SOLUTION		
QAC and biguanide 0,05%	Ampholytic surfactants and sequesterants Alcohol 20% Water to balance	6.5
F10 ODOUR ELIMINATOR		
QAC and biguanide 0,12%	Ampholytic surfactants and sequesterants Fragrance Water to balance	5.9
F10 AEROSOL DISINFECTANT		
QAC and biguanide 0,058%	Ampholytic surfactants and sequesterants Alcohol 80% Dimethyl ether (propellant)	7.5
F10 DISINFECTANT SPRAY WITH INSECTICIDE		
QAC and biguanide 0,44% Cypermethrin 0,25%	Ampholytic surfactants and sequesterants	7.5
F10 WIPES		
QAC and biguanide 0,05%	Ampholytic surfactants and sequesterants	7.5

* The pH value refers to the packed concentration

INDICATIONS

A broad spectrum biocide effective against bacteria, fungi, viruses and bacterial and fungal spores is indicative of those shown below:-

BACTERIA (gram positive and gram negative (spp))	FUNGI, YEASTS and MOULDS (spp)	VIRUSES (enveloped and non-enveloped)	SPORES (bacterial and fungal) spp	
Acinetobacter	Listeria	Aspergillus	Adenovirus	Aspergillus
Campylobacter	MRSA	Candida	Avian Influenza H5N2 HPA1	Bacillus
Chlamydia	Mycobacterium	Mycrosporium	Canine parvovirus	Mycrosporium
Clostridium	Mycoplasma	Penicillium	Circovirus	Penicillium
Cholera	Micrococcus	Trichophyton	Enterovirus	Trichophyton
Corynebacterium	Omitobacterium Rhinotracheale		Foot and Mouth Disease*	
Citrobacter	Pasteurella		Feline Herpesvirus	
Enterococcus	Proteus vulgaris		Hepatitis B	
Enterobacter	Pseudomonas		HIV	
Escherichia coli	Salmonella		IBD	
Klebsiella	Staphylococcus		Newcastle Disease	
Leptospira	Streptococcus		Rabies	

* FMDV is effectively eliminated with the pH buffered product F10CL General Farm Disinfectant

APPLICATIONS

The core product **F10SC VETERINARY DISINFECTANT** is a high performance surface acting biocidal compound and due to its inherently low toxicity and low irritation characteristics is widely used within the veterinary profession in companion and large animal practices, referral hospitals, zoo's, laboratories, and various other institutions. It is used in numerous applications, i.e. cold sterilisation of instruments and equipment including endoscopes, intravenous catheters, and endotracheal tubes; high level disinfection of hard surfaces and air spaces, water treatment, and as a sanitising rinse for solid food and fruit. Fogging with F10SC VETERINARY DISINFECTANT, (a spray of fine mist-like droplets) has been shown to be 100% effective in eliminating airborne micro-organisms.

F10SCXD VETERINARY DISINFECTANT/CLEANSER is used for hard surface disinfection and cleaning of lightly soiled areas such as kennels and cages.

F10SC VETERINARY DISINFECTANT has been successfully used in aerosol fogging applications in the presence of animals as well as a number of clinical applications including nebulising in respiratory tract *Aspergillus* infections, wound irrigation, and nasal flushing.

F10CL GENERAL FARM DISINFECTANT is specifically buffered to eliminate Foot and Mouth Disease Virus.

F10 SKIN PREP SOLUTION is a pre-op skin decontaminant.

F10 ODOUR ELIMINATOR is a hard surface and aerosol high level disinfectant with a masking pine fragrance.

F10 AEROSOL DISINFECTANT is available with on/off and total evacuation actuators for use as a hard surface and air space disinfectant. Tests have shown that aerosol disinfection is an effective method of carrying out high level disinfection of air spaces.

F10 DISINFECTANT SPRAY WITH INSECTICIDE combines biocidal and insecticidal efficacy. The insecticidal target species are *Lucilia cuprina*, commonly distributed blow fly in South Africa. Tests have shown that the product is effective in the egg, larvae and adult stages. Available with or without a water soluble marker.

F10 WIPES are a disinfectant impregnated surface wipe for use on equipment such as thermometers, and for hand decontamination when washing facilities are unavailable.

ANTIMICROBIAL ACTION

The antimicrobial action mechanism of the F10 branded disinfectants is taken from each component separately but in addition is due to the additive synergistic action of all components combined.

Bactericidal tests have been carried out in accordance with SANS 636-2001 - Standard (South African) having a performance pass criteria of >log⁷ reduction in microbial counts, the AFNOR Standard (French) which is a >log⁷ reduction in microbial counts, the European Union EN Standard which is a >log⁷ reduction in microbial counts, and the AOAC Standard (USA) which is a >log⁶ (1,000,000 times) reduction in microbial counts. MIC in-vitro tests have shown significant depth of performance as indicated. Generally testing was carried out at ambient temperatures with the exception of EN Standard tests where some were carried out at low temperatures 10°C and some DEFRA tests at 4°C. The EN Standard for low temperatures is 10°C and at this temperatures bactericidal performance was equal to that at ambient temperatures, however there was a significant fall off in performance at 4°C. Other tests carried out at elevated temperatures of 45°C showed a significant increase in performance.

FIGURE A: THE F10SC MIC VALUES

Test organism	Concentration of F10SC (dilution) that resulted in complete visual inhibition of the test organism = MIC value
<i>Pseudomonas aeruginosa</i> - ATCC 27853	A dilution of 1/1000 or 0,1 % F10SC
<i>Escherichia coli</i> - ATCC 25922	A dilution of 1/4000 or 0,025 % F10SC
<i>Staphylococcus aureus</i> - ATCC 25923	A dilution of 1/16000 or 0,00625 % F10SC
<i>Klebsiella pneumoniae</i> - ATCC 10031	A dilution of 1/4000 or 0,025 % F10SC
<i>Staphylococcus aureus</i> - MRSA Local isolate	A dilution of 1/16000 or 0,00625 % F10SC
<i>Pasteurella multocida</i> - Local isolate	A dilution of 1/16000 or 0,00625 % F10SC
<i>Enterococcus faecalis</i> - ATCC 29212	A dilution of 1/16000 or 0,00625 % F10SC
<i>Salmonella choleraesuis</i> , Serotype typhimurium - ATCC 13311	A dilution of 1/8000 or 0,0125 % F10SC

Fungicidal tests have been carried out in accordance with SANS 636-2001, AFNOR and EN Standards which require a log³ and log⁴ reduction in microbial counts respectively.

Virucidal tests have been carried out in accordance with various internationally accepted protocols by the UP Faculty of Veterinary Science's Department of Poultry Diseases, and the Department of Veterinary Tropical Diseases; the ARC - Onderstepoort Veterinary Institute. The FMDV test was carried in accordance with the DEFRA (UK) Standard (F10CL General Farm Disinfectant only). Test requirements called for log³ and log⁵ reduction in microbial counts.

Sporicidal tests have been carried out in accordance with EN 13704-2002, 13697-2001, and 1650-1997 Standards which required a log⁵ reduction in microbial counts.

CONCENTRATIONS AND CONTACT TIMES

Concentrations and contact times are indicated on each product label. It should be noted that additional tests were carried out to determine various speed of kill rates to meet varying application demands.

Bactericidal test standard contact times are generally 5 minutes. However it was found that a log³ reduction in gram positive bacteria was achieved in 30 seconds and similarly 60 seconds for gram negative bacteria all at a concentration of 1:500 of the F10SC Veterinary Disinfectant. In the AOAC test a log⁶ reduction was achieved in both gram positive and gram negative bacteria in a 10 minutes contact time.

Fungi in the vegetative state, yeasts and moulds were eliminated in 30 seconds at a concentration of 1:500 of F10SC Veterinary Disinfectant.

Enveloped viruses were inactivated at 1:500 in 10 minutes whereas the more resistant non-enveloped viruses required a concentration of up to 1:125 with a contact time of 20 minutes to achieve the same reduction. The F10CL General Farm Disinfectant is also used against Foot and Mouth Disease Viruses.

Bacterial and fungal spores log⁵ reduction could be achieved in 5 minutes at a concentration of 1:100 or using 1:250 in 15 minutes with F10SC Veterinary Disinfectant.

DOSAGE AND DIRECTIONS FOR USE

For F10SC VETERINARY DISINFECTANTS clear away debris and rinse surfaces, then apply as below:

- Environmental general disinfection dilute 1:500
- High level disinfection (including fungal spores) dilute 1:250
- Resistant viruses (e.g. parvovirus) dilute 1:125
- Sterilisation of instruments/equipment dilute 1:100

Additional information is available in application user guidelines. Other products refer to each specific product label.

TOXICOLOGY

Studies were carried out by a GLP laboratory in accordance with OECD and EPA guidelines.

Acute oral and dermal toxicity

PRODUCT	CONCENTRATION	ORAL	DERMAL
F10SC and F10CL products	2% solution	>5000mg/kg	>5000mg/kg
F10 Disinfectant with Insecticide	As is	>2000mg/kg	>2000mg/kg

Acute eye and dermal irritation

PRODUCT	CONCENTRATION	OCULAR	DERMAL
F10SC and F10CL products	2% solution	score 0 at 24 hrs	score 0 at 24 hrs
F10 Disinfectant with Insecticide	As is	score 0 at 24 hrs	score 0 at 24 hrs

Acute inhalation toxicity

After taking account of the relative volatility, acute oral toxicity, dosage form and direction for use the inhalation toxicity of F10 disinfectant products will not be greater than the values shown for acute oral toxicity

Residual toxicity

Five-week supervised trial using day-old broiler chicks restricted to 1:1000 and 1:250 solutions of F10SC in drinking water showed no F10 residual build-up in muscle meat, liver or kidneys.

CORROSION

The F10 Veterinary Disinfectants are non-corrosive at the recommended dilutions (complies with SABS test 1615 on polished aluminium strip after 30 days).

FREE RINSING

All F10SC Veterinary Disinfectants are free rinsing at recommended dilutions (complies with SABS test 1593 6.11)

WATER INSOLUBLE MATTER CONTENT

The water insoluble matter content of F10SC Veterinary Disinfectants and F10 Skin Prep Solution is 0,3g/litre (complies with SABS 1593 6.12)

BIODEGRADABLE

The F10SC Veterinary Disinfectants when used at recommended dilutions have a zero rating in terms EU standards.

PRECAUTIONS

Ingestion: Do not induce vomiting, give milk or water to drink. *Eye contact:* Rinse eyes with water, seek medical advice if necessary. In spraying and aerosol applications it is advisable to wear a disposable mask over mouth, nose and eye protection.

WARNINGS

Do not mix with soap or other chemicals. Avoid contact with eyes. Keep out of reach of children, uninformed persons and pets (F10 Aerosol Disinfectant is a highly flammable aerosol) (Avoid contact with felines when using F10 Disinfectant Spray with Insecticide).

PRESENTATION

HPE bottles of varying sizes except for the F10 Aerosol Disinfectant which is in a pressurized metal canister and the F10 Wipes which are packed into a sealed plastic bag.

STORAGE INSTRUCTION

Store below 30°C in dry conditions, out of direct sunlight.

REGISTRATION HOLDER

Health and Hygiene (Pty) Ltd. - Unit 2, Marvil Park, 84 Ratchet Avenue, Stormill, Rodepoort - PO Box 347, Sunninghill, 2157, South Africa.

MANUFACTURED BY

Health and Hygiene (Pty) Ltd in accordance with GMP (Good Manufacturing Practice) license reference 58543/33571 issued by APVMA and SABS 636 Permit 6656/9863.

Distributed in the UK by:

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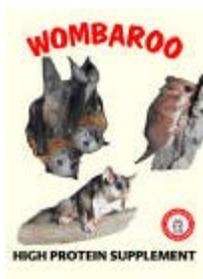


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HIGH PROTEIN SUPPLEMENT

With twice the protein than high protein cereals, this is ideal as a protein booster in the diet of many fruit and nectar eating animals such as flying foxes and sugar gliders.

Available in 250g, 1kg and 5kg packs

Analysis

Min Crude Protein	52%
Min Crude Fat	12%
Max Fibre	5%
Max Salt	0.8%

Ingredients

Whey protein, soy protein, ground cereals, maltodextrin, dextrose, lysine, methionine, vegetable oils, omega-3 and omega-6 fatty acids, vitamins A, B₁, B₂, B₆, B₁₂, C, D₃, E, K, nicotinamide, pantothenic acid, biotin, folic acid, choline, inositol, calcium, phosphorus, potassium, sodium, magnesium, zinc, iron, manganese, copper, iodine, selenium.

Product Data



PetAg, Inc.
255 Keyes Ave. Hampshire, IL 60140
800-323-0877 (Technical Service)
800-323-6878 (Customer Service)
www.petag.com

Science • Nutrition • Research • Service

Esbilac® Powder

Number 1 Selling Puppy Milk Replacer

Recommended as a complete food source for orphaned or rejected puppies or those nursing, but needing supplemental feeding. Also recommended for growing puppies or adult dogs that require a source of highly digestible nutrients.

- ◆ For puppies newborn to six weeks of age.
- ◆ Formulated to provide a caloric pattern similar to bitch's milk in protein, fat and carbohydrates.
- ◆ Supplies necessary vitamins and minerals to ensure proper development and growth.
- ◆ Easy to digest, highly palatable, easy to mix formula.
- ◆ Ideal supplement for post-surgery and convalescence.

MIXING DIRECTIONS: Gently shake or stir one part powdered Esbilac into two parts warm water. A part is any measuring device you use: teaspoon, tablespoon, or cup. Do not use a blender.

DIRECTIONS FOR USE: All puppies should receive their mother's milk for at least 2 days, if possible. This colostrum milk gives extra nutrition and temporary immunity against some diseases. **Warm reconstituted Esbilac to room or body temperature. Feed puppies 2 tablespoons of liquid (30 mL) per 4 oz. (115 g) of body weight. The daily feeding rate should be divided into equal portions for each feeding.** Puppies' needs will vary and this amount may have to be increased or decreased, depending on the individual. Small or weak puppies may need to be fed reconstituted Esbilac every 3 to 4 hours, while larger and/or older puppies do well when fed reconstituted Esbilac every 8 hours. Weigh the puppies daily to assure adequate feeding. **Consult your veterinarian for additional advice. Not for human consumption.**

When a food supplement is desired for growing post-weaned puppies, show dogs, supplementing large litters, and old, or convalescent dogs, Esbilac powder should be fed at the rate of 1 teaspoon per 5 lbs. (2.2 kg) body weight.



PREGNANT AND LACTATING BITCHES: Mix Esbilac powder into the daily ration at the rate of 2 teaspoons per 5 lbs. (2.2 kg) of body weight until 2 weeks after whelping.

Reconstituted Esbilac must be kept refrigerated for up to 24 hours. Opened powder must be refrigerated for up to 3 months or can be frozen for up to 6 months.

GUARANTEED ANALYSIS

CRUDE PROTEIN, min	33.0%
CRUDE FAT, min.....	40.0%
CRUDE FIBER, max.....	0.0%
MOISTURE, max.....	5.0%

The calorie content (ME) is 900 kcal/kg or 13.5 kcal/Tbs when reconstituted 1:2

INGREDIENTS: Vegetable oil, dried skimmed milk, casein, butterfat, DL-methionine, L-arginine, calcium carbonate, choline chloride, lecithin, magnesium sulfate, potassium chloride, monopotassium phosphate, salt, tricalcium phosphate, carrageenan, dipotassium phosphate, taurine, ascorbic acid, ferrous sulfate, zinc sulfate, vitamin A supplement, vitamin E supplement, niacin supplement, calcium pantothenate, copper sulfate, thiamine hydrochloride, pyridoxine hydrochloride, riboflavin, manganese sulfate, vitamin D3 supplement, potassium citrate, potassium iodide, folic acid, vitamin B12 supplement, biotin.

12 oz. can of powder makes approximately 60 oz. of liquid when mixed 1:2. 28 oz. can of powder makes approximately 140 oz. of liquid when mixed 1:2. 5 lb. pail makes approximately 400 oz. when mixed 1:2.

PACKAGING

- 3/4 ounce pouch, 12 per case, Product# 99523
- 12 ounces, 12 per case, Product #99500
- 28 ounces, 6 per case, Product #99501
- 5 lb., 4 per case, Product #99498
- 10kg (22lb) Bag, Product #99504