# Unusual Pet Care

## VOLUME II

REVIEWED BY

JACK KOTTWITZ, DVM AND ROB COKE, DVM

26 SPECIES: Red-eared sliders, Spiny-tailed lizards, Bearded dragons, Day geckos, *Rhacodactylus* geckos, Basilisk lizards, Blue-tongued skinks, Gila monsters, Chuckwallas, Mole salamanders, Poison arrow frogs, Terrestrial hermit crabs, Madagascar hissing cockroaches, Hedgehogs, Mice, Raccoons, Coatimundis, Chipmunks, Kinkajous, Meerkats, Brushtail possums, Patagonian cavies, Two-toed sloths, Mynahs, Turacos, Domestic ducks

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# Volume II

Reviewed by Jack Kottwitz, DVM and Rob Coke, DVM
Creative and Project Director: Richard Larson

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# Red-eared Slider Pet Care*



## VITAL STATISTICS

| | | | |
|---|---|---|---|
| Average life span | 15-30 years | Clutch size | 4-25 eggs per breeding season (several clutches) |
| Adult size | 5-14 inches (35-13 cm) | Incubation time | 55-65 days at 80-82°F (26-28°C) |
| Adult body weight | varies | Sex of hatchlings | Temperature dependent |
| Sexual maturity | 3-8 years | | |

*Adapted from Exotic DVM Volume 7.6 © Zoolog

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## Red-eared Sliders (*Trachemys scripta elegans*)

By **Marc Kramer**, DVM

### ORIGIN

- Red-eared sliders are native to the Mississippi Valley area of the US from Illinois to the Gulf of Mexico and the Southeastern US through Texas. Red-eared sliders have established populations in non-native regions of the US, including Central Park in New York City, and in suitable habitats in Europe and South East Asia.

### FREE-RANGING RED-EARED SLIDERS

- During the day, sliders spend most of their time basking in the sun or foraging for food.
- They prefer to bask on objects projecting out of the water and they recede to the bottom of the water into the mud to spend the night.

### SEXING

- Red-eared sliders, especially juveniles, can be difficult to sex.
- Gender in adults is primarily determined by external physical characteristics.
- In comparison to females, males have longer foreclaws (which are used in courtship), a longer tail length, a longer distance from the body to the vent opening and a tail that is thicker at the base; generally males have a smaller body size and shell length.

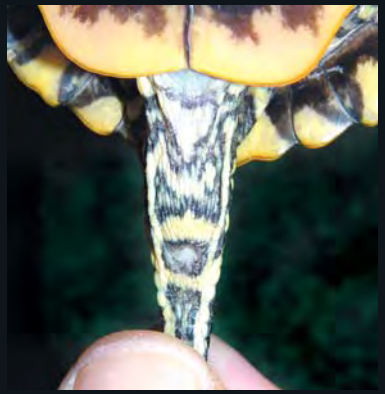
Red-eared sliders

## HOUSING

- The minimum-sized enclosure for a hatchling red-eared slider should be a 20-gallon aquarium (30” long x 12” wide x 12” high [76 x 30 x 30 cm]).
- This size will allow normal swimming and turning behavior, accommodate necessary cage furniture and equipment, and allow for a healthy temperature gradient across the enclosure.
- Various large plastic or fiberglass tubs can be considered if viewing the turtle from the side is not desired by the owner.
- As a general rule, the water depth should be at least 1.5-2 times the turtle’s carapace length with several extra inches of air space between the surface of the water to the top edge of the tank to prevent escapes.
- Hatchlings grow quickly and usually outgrow a 20-gallon habitat within 2 years.
- Recommended minimum enclosure size (in surface area) for 4- to 5-inch (10-12 cm) long adult sliders is 2.5 square feet (2.3 square km) with an extra square foot for each additional turtle.
- The size requirement doubles for large turtles 8 inches (20 cm) long or greater.
- Filtration systems should be upgraded to more powerful units for large turtles, and basking areas must be large and sturdy enough to accommodate a larger turtle.
- Live plants may assist with nitrate waste removal because the plants utilize these waste products as fertilizer—although turtles may eat the plants as well.

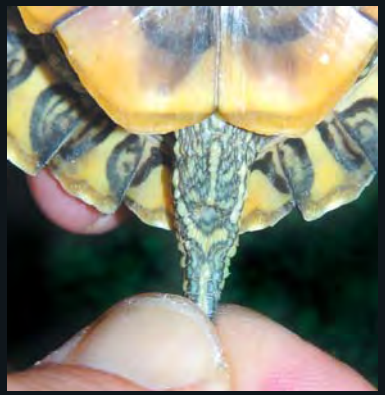
**MALE**





**FEMALE**





Males have longer foreclaws and tails than females.

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A properly equipped 20-gallon aquarium is ideal for a hatchling.



A digital thermometer helps maintain the proper temperature.



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## WATER

- Water quality is of paramount importance. Sliders are voracious feeders and tend to foul the water quickly with their messy eating habits and frequent defecation. Therefore, a system needs to be in place for management of water quality.
- Partial to full water changes can be performed (at a minimum, weekly) with a siphon or by pouring out tank water. The use of a filtration system will reduce (but not eliminate) the frequency with which water needs to be changed. The simplest for hatchlings is a canister filter, which is designed to be either internal (submersible and placed inside the aquarium) or external (fit on the outside of the tank).
- Undergravel filters are not recommended because they trap organic waste in the substrate.
- Another useful tip to optimizing water quality is to feed turtles in a container (such as a small aquarium or plastic tub) separate from their living accommodations.

## BASKING SITE

- The enclosure requires a basking area where the turtle can emerge from the water to bask with an appropriately placed basking light (a mercury vapor bulb is probably the best).
- Basking areas can consist of either islands or platforms established at the water line of the tank or areas built from the bottom of the tank (bricks or stones) and emerging to the surface.
- Floating cork bark and “turtle ramps” have also been used successfully.

## HEATING

- Hatchling sliders need to be maintained at warm temperatures to fare well.
- Sliders often die if kept at room temperature without a heat source; growth rate is dependent on temperature.
- The habitat should be heated to a water temperature of 82-85°F (28-29°C), with a basking spot at one end of the habitat where the air temperature reaches their preferred optimum temperature zone (POTZ) of 85-90°F (29-32°C).
- Water temperature for adults may be slightly cooler as compared to hatchlings; 70-80°F (21-26°C) is suitable. An aquarium thermometer is essential to confirm the water temperature.
- The habitat should ideally be heated in two ways: with a basking light and a submersible aquarium heater.
- The basking spot is created using an incandescent light in a reflector hood placed over one of the basking islands.
- The light fixture should be placed in such a way that there is no chance of it accidentally falling into the water (using a screen top on the aquarium and placing the fixture over it will prevent this).
- The basking light should be set on an automatic timer to simulate a natural photoperiod with 10-12 hours daylight in the fall and winter and 12-14 hours daylight in the spring and summer.
- The submersible water heater, a device used inside the aquarium that can be completely covered with water, should be set to 82-85°F (28-29°C) and placed in a secure location.

| HEMATOLOGIC REFERENCE RANGES* | |
|---|---|
| WBC ($10^3/\mu l$) | 6.879-19.021 |
| RBC ($10^6/\mu l$) | 0.19-1.43 |
| Hemoglobin (g/dl) | 8 |
| Hematocrit (%) | 21.8-35.6 |
| MCV (fL) | 245.7-575.1 |
| MCH (pg/cell) | 108.1 |
| MCHC (g/dl) | 29.6 |
| Nuc. RBC (/100 WBC) | 27 |
| Reticulocytes (%) | 0 |
| Heterophils ($10^3/\mu l$) | 1.468-8.682 |
| Lymphocytes ($10^3/\mu l$) | 1.214-5.166 |
| Monocytes ($10^3/\mu l$) | 0-0.643 |
| Eosinophils ($10^3/\mu l$) | 0-2.756 |
| Basophils ($10^3/\mu l$) | 0.551-5.525 |
| Azurophils ($10^3/\mu l$) | 0.139-0.909 |

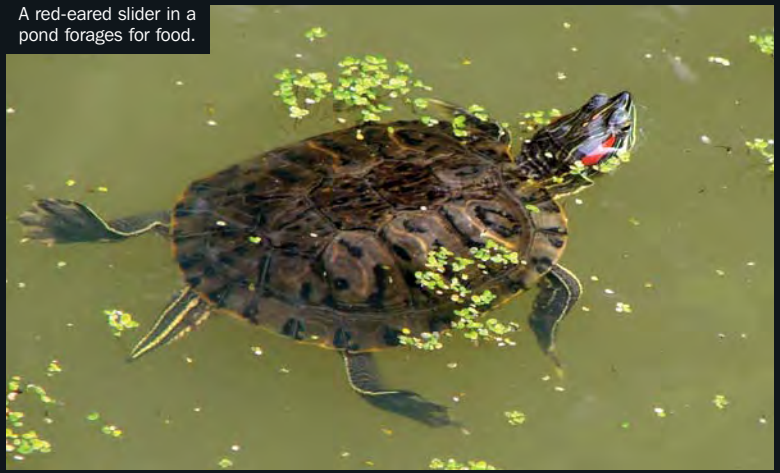
| BIOCHEMISTRY REFERENCE RANGES* | |
|---|---|
| Calcium (mg/dl) | 9.8-15.8 |
| Phosphorus (mg/dl) | 3.1-6.5 |
| Sodium (mEq/L) | 130-142 |
| Potassium (mEq/L) | 3-6.8 |
| Chloride (mEq/L) | 97-105 |
| BUN (mg/dl) | 8-38 |
| Creatinine (mg/dl) | 0.2-0.4 |
| Uric acid (mg/dl) | 0.5-1.9 |
| Total bilirubin (mg/dl) | 0-0.6 |
| Glucose (mg/dl) | 46-106 |
| Cholesterol (mg/dl) | 124-210 |
| Triglyceride (mg/dl) | 63-525 |
| CPK (IU/L) | 24-3880 |
| LDH (IU/L) | 77-3327 |
| AP (IU/L) | 134-542 |
| ALT (IU/L) | 0-38 |
| GGT (IU/L) | 0-14 |
| Amylase (U/L) | 437-549 |
| Lipase (U/L) | 0-14 |
| Total protein** | 3.4-5.6 |
| Globulin** (g/dl) | 1.7-3.5 |
| Albumin** (g/dl) | 1.3-2.3 |

* As reported for *Trachemys scripta* by International Species Information System, 2002

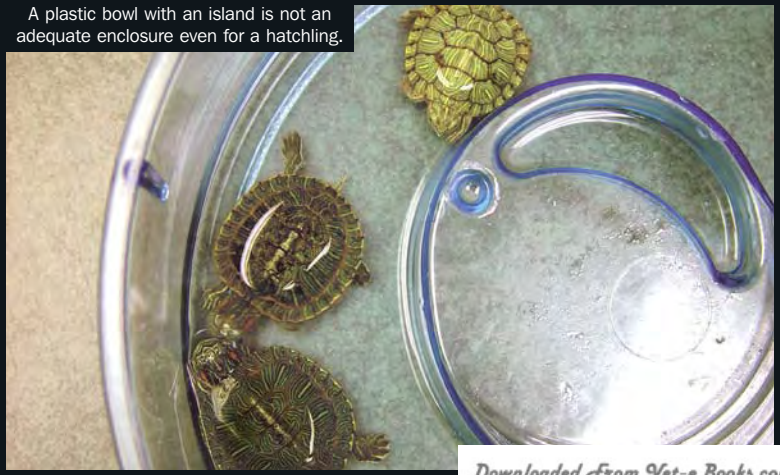
** Colorimetry

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A red-eared slider in a pond forages for food.



A plastic bowl with an island is not an adequate enclosure even for a hatchling.



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## OTHER LIGHTING

- Ultraviolet full spectrum lighting (UV-B) that is provided by a reptile bulb designed to emit UV-B radiation is probably beneficial for turtles and is strongly recommended.

## DIET

- Free-ranging red-eared sliders are omnivorous; however, juveniles are mainly carnivorous, becoming more herbivorous as they mature.
- The free-ranging juvenile diet consists of small fish, aquatic insects, tadpoles, frogs, crayfish, snails and other small pond life.
- Free-ranging adults will browse primarily on aquatic vegetation, and a smaller portion of their diet consists of pond life and carrion.
- The captive diet for juveniles should consist primarily of a commercial aquatic turtle pellet. Many brands are well accepted by turtles and do not require any preparation.
- Hatchlings and juveniles should be fed on a daily basis and fed no more than they will eat during a sitting to minimize water fouling.
- The diet may be supplemented with occasional live fish of an appropriate size (guppies, goldfish) and earthworms.
- Plant matter, in the form of chopped leafy greens or finely chopped mixed vegetables, may be offered weekly but may not be readily accepted until turtles are mature.
- Occasional feeding of the pelleted “color foods” for tropical fish may help turtles maintain their bright colors, as these sometimes fade in captivity.

- It is recommended that juveniles receive a minimum of 15 minutes of natural sunlight per week.
- Dried krill and muscle meats (beef, chicken, fish fillets) are not acceptable as a staple diet. They may be used sparingly as a treat only.
- As the primarily carnivorous hatchlings and juveniles mature, they consume significant plant matter.
- The adult diet may consist of 30% commercial turtle pellets and animal-based protein with the remaining 70% consisting of plant matter, including chopped leafy greens, such as kale, romaine, red leaf lettuce, mustard greens, dandelion, watercress, parsley, Swiss chard, shredded carrot and squash, thawed frozen mixed vegetables and miscellaneous fruits.
- Adults should be fed every 2-3 days.

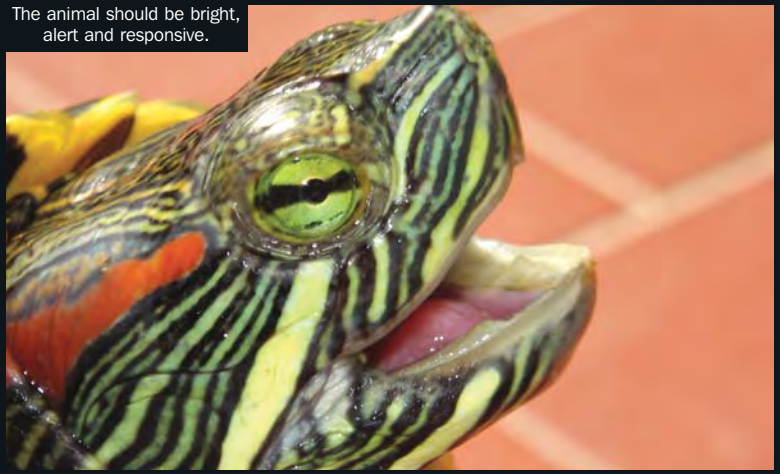
## PHYSICAL EXAMINATION

- Red-eared sliders are easily handled for examination, although some may act aggressively and can bite and scratch.
- The physical examination should proceed as with other animals, using a systematic approach.
- The animal should be bright, alert and responsive.
- It should have strong withdrawal responses if a foot is pulled.
- A soft pliable shell may be normal in a very young hatchling but is abnormal after the first few weeks of life.
- When floated in water, the turtle should be symmetrically buoyant and maintain normal equilibrium.




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The animal should be bright, alert and responsive.



Extension of head reveals focal ulceration on the neck of a slider.



## FECAL EXAMINATION

- A fecal examination should be a routine part of the annual examination.
- The owner should be instructed to bring in a fresh fecal sample in a sealed container.
- A direct saline wet mount should be performed to look for motile protozoans, and a flotation procedure should be included to diagnose parasite ova.

## ANESTHESIA

- For short medical procedures, general anesthesia with propofol (5-10 mg/kg IV) in the subcarapacial venipuncture site provides smooth induction and rapid recovery.
- The anesthesia takes effect whether it is injected directly into the blood vessel or into the adjacent lymphatic sinus.
- The tail vein may also be used. Isoflurane may be used in conjunction with propofol for longer procedures and may be delivered via endotracheal tube.
- Ketamine (10-20 mg/kg) combinations, i.e., used with medetomidine (0.2-0.5 mg/kg), which can be reversed with atipamezole, can also be used for induction but recovery periods are longer and the margin of safety is reduced.
- Analgesics may be added during induction.

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Red-eared sliders

## VENIPUNCTURE/BLOOD TESTING

- The subcarapacial venipuncture site is the preferred site for blood collection.
- In this technique, the needle is inserted cranially along the midsagittal line at an angle of up to 60° just caudal to the skin-carapace junction.
- The needle is advanced in a caudodorsal direction towards the cranial aspect of the eighth cervical vertebra, maintaining slight negative pressure.
- Placing the turtle on its back sometimes facilitates this technique.
- Pushing in the head with a wooden tongue depressor is also helpful (it limits interference from the head and extends the dorsal sinus into an arc for easier venipuncture).
- The site is the junction of the common intercostal veins and the caudal cervical branch of the external jugular veins.
- One problem with this technique is the inadvertent aspiration of lymph cranial to the recommended site. To avoid this, the needle must be advanced sufficiently caudodorsally before negative pressure is applied.
- Access to the jugular vein requires extension of the head and neck, which may not be possible without chemical restraint.
- Blood should be collected into Microtainer® tubes that are designed to hold small volumes of blood.
- A CBC and biochemistry panel can be performed on samples from sick animals or as part of annual wellness programs.



The subcarapacial venipuncture site is one possibility for blood collection. The tail vein, jugular vein or brachial vein may also be used.

Nuchal scute (before).

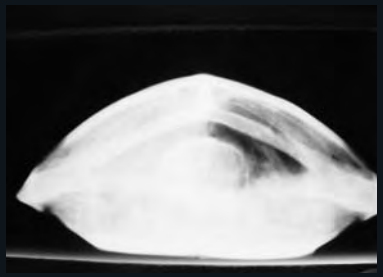


Nuchal scute, after smoothing with rotary tool



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The cranial-caudal projection is the most important view for diagnosing pneumonia in turtles. The abnormally opaque lung can also be seen in the dorsoventral projection.





Radiograph of a gravid female red-eared slider. The distal-most egg, while not abnormally large, would not pass with repeated doses of oxytocin.



Charles Innis, VMD

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## RADIOGRAPHY

- Aquatic turtles will often sit still for radiographs and typically do not require any sedation.
- A dorsoventral projection can be taken with the animal placed on top of the radiograph cassette.
- A cranial-caudal projection, important for evaluating the lung fields, can be taken by turning the x-ray tube 90 degrees and projecting the beam horizontally onto the cassette.
- A lateral view can also be obtained if desired.

## MEDICATION ADMINISTRATION

- Most sliders are sensitive around the head area and retract their head and neck when disturbed, thereby making oral medicating difficult.
- Sick patients that require antibiotic or other medical therapy will probably necessitate intramuscular injections.
- The preferred sites are the well-muscled areas of the limbs; the front limb proximal to the elbow and hind limb proximal to the knee work best.
- If oral medication or nutritional support is required, the turtle's head must be extended with manual restraint, and medication or food can be delivered either into the oral cavity or stomach using a metal feeding tube.
- The turtle's beak can be wedged open with a credit card, a small pair of hemostats or a beak speculum designed for birds or turtles.
- An alternative to repeated forced restraint of the head is the placement of an esophagostomy feeding tube (see Exotic DVM 2(6):27, 2000).

## COMMON DISORDERS

### Nutritional Disorders

- Hypovitaminosis A: Red-eared sliders frequently present with swollen eyes, nasal discharge, inability to eat (because they can't see), and in advanced cases, depression and respiratory distress. Affected animals should initially receive a parenteral dose of vitamin A (2000-5000 IU/kg) and then should be placed on a diet containing appropriate levels of vitamin A. Care must be taken not to over-supplement with vitamin A. Systemic antibiotic therapy and/or ophthalmic antibiotic drops are often used during the course of treatment.
- Hypervitaminosis A: This problem can be induced by over-administration of injectable vitamin A. Signs include skin sloughing and secondary bacterial infections of the exposed tissues or death.
- Metabolic Bone Disease (MBD): Turtles fed primarily dried krill, organ meats (liver, heart), or pure muscle (beef, pork, chicken, fish fillets) will develop metabolic bone disease, stunting and other nutritional problems. Clinical signs may include a soft shell, stunting, or deformed shell growth (excessively domed or pyramided). Treatment includes improving diet, providing UV-B light and administering medical therapy as for other reptiles.
- Ear Abscesses: Aural abscesses are not uncommon. The turtle will present with a swelling over one or both ears. Externally, there is no pinna or auditory opening in turtles; rather, the tympanic membrane is contiguous with the skin. Treatment involves a single dose of vitamin A and surgical drainage of the abscess.



Shell deformities are usually the result of nutritional disorders (e.g., calcium deficiency from an all-meat diet or inadequate vitamin D or UV-B exposure).

Dan Johnson, DVM



Ear abscesses in red-eared sliders may relate to immune suppression and/or hypovitaminosis A.

Denis Lefebvre, DVM

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The bilateral eye and adnexal swelling on this red-eared slider are due to changes in the eyelid and orbital glands caused by hypovitaminosis A.



Dr. Rogério R Lange (UFPR, Brazil)

Fuzz on a juvenile slider.



An esophagostomy feeding tube may be used for medical or food administration, as shown in this tortoise.



Stephen J. Hernandez-Divers, BSc (Hons), CBiol, MIBiol BVetMed MRCVS, Dipl RCVS Zool Med, RCVS Spec in Zoo & Wildlife Med

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## Red-eared sliders

### Parasites

- Internal: Sliders can harbor nematode, cestode, trematode, acanthocephalan and protozoan parasites. Diagnosis is made by fecal examination. Treatment should follow other anthelmintic protocols for reptiles, although ivermectin should not be used in turtles.
- External: Leeches should be manually removed.

### Shell Disorders

- Infections: Both bacterial and fungal organisms have been implicated in shell infections. Clinical signs include superficial or deep ulcerations of the keratinous shell. A disease syndrome known as septic cutaneous ulcerative disease (SCUD) has been documented to be caused by various gram-negative rods, including *Citrobacter fruendii, Pseudomonas* spp. and *Aeromonas* spp., and may present as ulcerative lesions on the shell and/or skin. Treatment is guided by culture and sensitivity testing, and systemic and topical antibiotic therapy is advised along with improvement of water quality.
- "Fuzz": Whitish "fuzz" growing on the shell of turtles (especially hatchlings) may be either a fungal or protozoal infection, usually due to poor water quality and husbandry. Treatment can include saline baths, improvement of water quality and gentle scrubbing of the shell.
- Aquatic turtles can be dry-docked for weeks at a time as long as hydration and nutrition are maintained; this often requires an esophagostomy feeding tube. If the injury is confined to the carapace, the turtle can be placed in shallow water every day.
- Fractures are uncommon in sliders (except when they are dropped by their owners or fall to a hard floor).

## Red-eared sliders

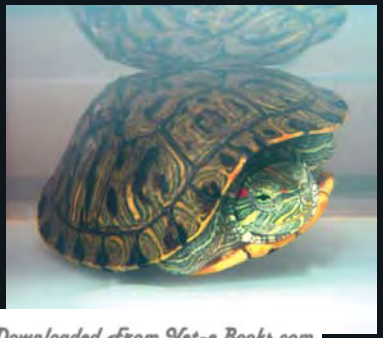
### Miscellaneous Disorders

- Respiratory Infections: Clinical signs of respiratory disease may include abnormal buoyancy, wheezing, open-mouthed breathing, nasal discharge, the appearance of frothy oral mucus and decreased appetite and activity. In cases of pneumonia, the affected lung may become congested; the affected side has a tendency to sink while the unaffected side remains aerated and buoyant. The turtle will appear to swim lop-sided or float in an asymmetrical fashion and may have trouble surfacing or submerging. Radiographs can help confirm the presence of a pneumonia (the lung fields are quite large and located in the dorsal portion of the coelomic cavity beneath the carapace). A cranial-caudal view is the best way to make this diagnosis.
- Prolapsed Phallus: Male turtles occasionally present with a prolapsed phallus. Prior to attempting replacement of the prolapse, the surface should be cleaned of dirt and debris and kept moist and lubricated. Several treatment strategies may be used to reduce phallic swelling prior to manual reduction: hyperosmotic solutions (e.g., sucrose), cold compresses, non-steroidal anti-inflammatory agents, and hyaluronidase injected directly into the prolapsed phallus. When reducing a prolapse, the use of anesthesia/analgesia should be considered. To replace the tissues, a non-sticky, smooth-surfaced instrument should be utilized, possibly followed by 2 simple interrupted sutures of monofilament nylon across the vent laterally on each side. If the prolapsed tissue cannot be replaced, amputation of the phallus should be considered.

Red-eared slider presented with wounds from a dog bite.



The lung affected with pneumonia loses buoyancy and the turtle appears to be “sinking” on that side.



A prolapsed phallus in a red-eared slider. The phallus is normally black and purple in color, but dry and crusty tissues are likely to be necrotic.



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# Spiny-tailed Lizard Pet Care*



Douglas Dix

## VITAL STATISTICS

| | | | |
|---|---|---|---|
| Average life span | 10-20 years | Sexual maturity | 2-5 years, varies with species |
| Adult size | 12-30 inches (30-76 cm) from nose to tail tip | Eggs per clutch | 8-20 eggs |
| Adult body weight | 125-1000+ g (<1-3 lbs) (depending on species) | | |

*Adapted from Exotic DVM Volume 8.4 © Zoologi

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## Spiny-tailed Lizards (*Uromastyx* spp.)

By **Jay D. Johnson**, DVM

- Spiny-tailed lizards are commonly referred to as "Uromastyx" in the United States and "mastigure" in Europe.

### COMMON SPECIES

- Moroccan (Bell's dabb) spiny-tailed lizard (*U. acanthinura*)
- Egyptian spiny-tailed lizard (*U. aegyptius*)
- Sudanese (Eyed dabb) spiny-tailed lizard (*U. ocellata*)
- Hardwick's (Indian) spiny-tailed lizard (*U. hardwickii*)
- Benti (rainbow) spiny-tailed lizard (*U. yemenensis* formerly *U. benti*)
- Ornate spiny-tailed lizard (*U. ornata*)
- Mali spiny-tailed lizard (*U. maliensis*)
- Saharan spiny-tailed lizard (*U. geyri*)
- Banded spiny-tailed lizard (*U. flavofasciata*)

### ORIGIN

- Spiny-tailed lizards are native to northern Africa and the Middle East where they live in desert and savannah-like areas.

### FREE-RANGING HABITAT

- Some species live in burrows and others in rocky crevices.

### PET APPEAL AND BEHAVIOR

- Spiny-tailed lizards can be social, both with cagemates and with owners, although the temperament varies

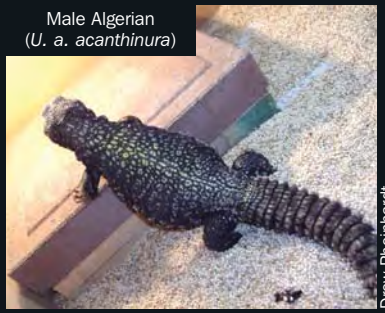
among individuals and species.
- Not all *Uromastyx* species can be tamed.
- They are diurnal and can be active during the hottest part of the day.
- Many spiny-tailed lizards sold as pets are wild-caught; these lizards often have parasite problems and may have difficulty adjusting to life in captivity.
- Captive-bred lizards do well as pets.
- Many *Uromastyx* species thrive in easily-set-up, warm, dry vivarium environments.

## SEXING AND REPRODUCTION

- In some species (*U. ornata, U. geyri* and *U. maliensis*), males and females have distinctly different coloration.
- Sexing may be difficult in many species, as both males and females have similar-sized femoral pores and body morphology.
- The presence of hemipene bulges in males may be visible in some species.

## HOUSING

- Spiny-tailed lizards can be housed individually or in pairs.
- Groups of a few females and 1 or 2 males may also be possible in large enclosures.
- Territorial aggression may be a problem and should be monitored. Aggression among males is likely unless very large enclosures with multiple basking areas are provided.
- Housing should consist of a large aquarium or an outdoor enclosure with good side and top ventilation to minimize humidity.


Male Algerian (*U. a. acanthinura*)

Drew Rheinhardt


Male (L) and female (R) banded (*U. flavofasciata*)

Drew Rheinhardt


Male Mali (fluorescent honey) (*U. maliensis*)

Douglas Dix


Female Mali (*U. maliensis*)

Douglas Dix


Male Mali (*U. maliensis*)

Drew Rheinhardt


Benti (rainbow) (*U. yemenensis*)

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Juvenile Mali (clown pattern) (*U. maliensis*)



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Male Moroccan (*U. acanthinuris*)



Drew Rheinhardt

Ornate (*U. ornata*)



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Male Saharan (red phase) (*U. geryi*)



Douglas Dix

Egyptian (*U. aegyptius*)



Adrian Pingstone

Sudanese (*U. ocellata*)



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## Spiny-tailed Lizards

- At a minimum the enclosure should be 4 times the length and width of the lizard. More space per animal would be required for colonies.
- Waste should be removed daily and the tank cleaned thoroughly at least monthly or as needed.
- Environmental temperatures should reach 100-115°F (43-46°C) in a basking spot at one end of the enclosure, with a gradient in the 90s°F (32-37°C) during the day.
- Nighttime temperatures should drop to the 70s°F (21-26°C).
- Enclosure humidity must remain low (15-30% humidity is probably best).
- The basking lamp should be placed out of reach of the lizards.
- Temperatures should be monitored with a thermometer at both the cool and hot ends of the enclosure.
- Tape thermometers should not be placed on the glass, because they frequently do not adequately represent the temperatures in the enclosure. Alternatively, laser thermometers may be used.
- Sand, dirt, gravel, alfalfa pellets or millet seeds are recommended bedding.
- Substrates to avoid are walnut shells, cat litter, cedar and other wood chips, silica sand and colored pebbles that can cause impaction.
- Areas for hiding and burrowing at the cool end of the enclosure (e.g., a hide box or rock cave) should be provided as well as rocks for basking at the other end.
- Heavy rocks should be placed directly on the floor of the enclosure, not on top of the substrate, so that digging will not displace them and cause crushing injuries.

## Spiny-tailed Lizards

- Plants (live or artificial) should not be included in the enclosure.
- Unfiltered high-output UV lighting (fluorescent bulb or mercury vapor lamp), such as ZooMed ReptiSun 5.0™, T-Rex Active UV Heat™ or ZooMed PowerSun™, should be positioned out of reach of the lizard with no glass or plastic between the bulb and the reptile.
- Fluorescent UV lights should be placed within 18-20 inches (45-50 cm) and mercury vapor bulbs can be (and in some cases should be) further away.
- Fluorescent bulbs used for juvenile lizards should be changed every 6 months and yearly for adults.
- The mercury vapor bulbs should be changed yearly.
- The photoperiod should be 12-14 hours of light (and heat) during spring and summer, decreasing to 8 hours through the fall and winter.
- Spiny-tailed lizards may eat less and sleep more during cooler months.

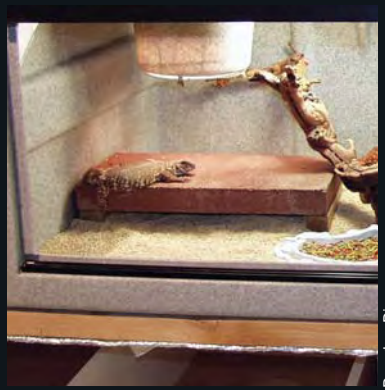
### DIET

- Juvenile spiny-tailed lizards are primarily herbivorous; however, juveniles will sometimes eat insects.
- Juveniles should be fed daily up to 1 year of age, and adults may be fed every 1-2 days.
- A dish with dry split peas, lentils, beans and millet should be available at all times. Calcium powder may be mixed in. For juveniles, the mix can be processed briefly through a coffee grinder to decrease the particle size.
- A mixture of greens, including collards, kale, romaine, dandelion and “spring mix,” should be offered every 24-48 hours.

Outdoor housing must include areas for hiding and burrowing and rocks for basking.



Indoor housing should consist of a large vivarium with proper ventilation.



Douglas Dix

An occellated spiny-tailed lizard (*U. occellatus*) housed in a large aquarium.



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| HEMATOLOGIC REFERENCE RANGES* | |
|---|---|
| PCV (%) | 27 (18-40) |
| RBC ($10^6$/ml) | 0.73 (0.46-0.99) |
| Hgb (g/dl) | 5.8 (3.6-8.2) |
| MCV (fl) | 308 (242-391) |
| MCH (pg) | 87 (78-95) |
| MCHC (g/dl) | 28 (20-36) |
| WBC ($10^3$/ml) | 11 (4-32) |

* Hematologic and serum biochemical values for the Egyptian spiny-tailed lizard *(U. aegyptius)* from ISIS as presented in Mader DL (ed): Reptile Medicine and Surgery. Saunders Elsevier, 2006, p 1108.

| BIOCHEMISTRY REFERENCE RANGES* | |
|---|---|
| AP (IU/L) | 98 (53-164) |
| ALT (IU/L) | 3 |
| AST (IU/L) | 37 (14-81) |
| Bilirubin, total (mg/dl) | 0.3 (0.1-0.7) |
| BUN (mg/dl) | 3 (1-4) |
| Calcium (mg/dl) | 11.3 (8.6-14.1) |
| Chloride (mEq/L) | 126 (111-135) |
| Cholesterol (mg/dl) | 317 (306-328) |
| Creatine kinase (IU/L) | 2003 (556-3454) |
| Creatinine (mg/dL) | 0.3 (0.2-0.4) |
| Glucose (mg/dL) | 184 (102-248) |
| LDH (IU/L) | 639 (197-1235) |
| Phosphorus (mg/dL) | 4.5 (1.3-10) |
| Potassium (mEq/L) | 3.7 (3-4.6) |
| Protein, total (g/dL) | 5.2 (3.1-8) |
| Albumin (g/dL) | 1.6 (0.9-2.4) |
| Globulin (g/dL) | 2.6 (2.2-4.6) |
| Sodium (mEq/L) | 173 |
| Uric acid (mg/dL) | 3.8 (2.6-5.6) |

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- Vegetables, such as green beans, carrots, baby lima beans and peas, may be chopped and fed weekly.
- Small berries may be given sparingly as treats.
- Occasional (weekly or less) feedings of gut-loaded insects (dusted with calcium) may increase growth and body condition in some juveniles.
- A reptile multivitamin supplement should be provided weekly.
- Because the diet should fulfill moisture requirements, an outside source of water is not required, although a small amount may be provided in a dish periodically.

## RESTRAINT

- For restraint, the lizard should be held around the neck and shoulders with one hand and around the pelvis and hind limbs with the other. The heavy spiny tail is used for defense and is capable of causing injury to the handler.

## VETERINARY EXAMINATION

- Following purchase, spiny-tailed lizards should have a general health check and fecal exam by a veterinarian. Regular visits are recommended annually after that.
- The jaws are very strong and an oral exam may be difficult. One must avoid trauma to the teeth and mouth in efforts to examine the oral cavity.

## PHYSICAL CHARACTERISTICS

- Spiny-tailed lizards have small scales over the head and body, and their characteristic large spike scales cover the tail.

- They have salt glands beneath the nares that allow them to excrete salt and survive in their arid environment.

## BLOOD COLLECTION

- The ventral caudal tail vein is located just ventral to the vertebral bodies of the tail.
- A needle can be passed between the ventral scales perpendicular to the tail until it meets resistance from bone.
- Negative pressure is applied and the needle is slowly withdrawn until blood is seen in the hub.
- Blood should be placed in lithium heparin tubes, not EDTA (which may cause hemolysis). Sample size can be approximately 0.5 ml/100 g body weight.
- Injection sites:
  - IM - Foreleg and hindleg muscles
  - SC - Under the front leg pocket and just in front of the chest
  - IV - Ventral caudal tail vein
  - IO - Distal femur

## ANESTHESIA PROTOCOLS

- Anesthesia is required for invasive procedures.
- The lizard may be induced with propofol (5 mg/kg IV) or inhalant isoflurane/sevoflurane via mask, which is then maintained after intubation.
- Sevoflurane is not as noxious as isoflurane and is often more successful for mask induction of reptiles. Intubation is easy because the glottis is visible at the base of the tongue.

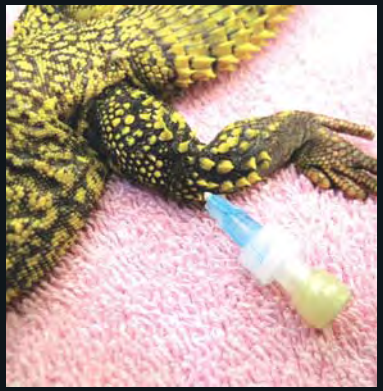
## FORMULARY

These dosages are those most commonly used by the author in this species and do not have pharmacokinetic studies to support them. Lizards should be hydrated, and dosages should be adjusted for some drugs based on the health status of the lizard.

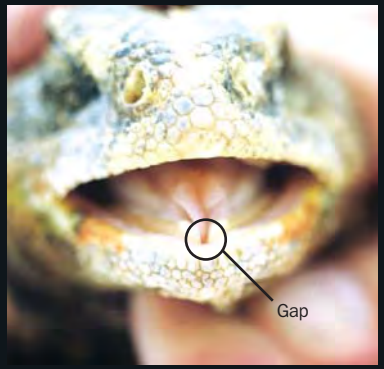
| | |
|---|---|
| **ANTIBIOTICS*** | |
| Enrofloxacin | 10 mg/kg PO q24h; 5.0 mg/kg IM q24h |
| Amikacin | 5.0 mg/kg IM q48h |
| Piperacillin | 50-100 mg/kg IM q24-48h |
| Ampicillin | 20 mg/kg SC/IM q24h |
| Chloramphenicol | 50 mg/kg PO q24h |
| Metronidazole | 20 mg/kg PO q24h |
| **Enrofloxacin and amikacin are often used in conjunction with metronidazole or ampicillin.* | |
| **ANTIPARASITICS** | |
| Fenbendazole | 50 mg/kg PO q10 days for 2-3 treatments |
| Metronidazole | 100 mg/kg PO q10 days for 2-3 treatments |
| **ANESTHETICS/ANALGESICS** | |
| Propofol | 5.0 mg/kg IV |
| Butorphanol | 0.5-1.0 mg/kg IM (lower dose when used in combination with ketamine) |
| Buprenorphine | 0.01 mg/kg IM |
| Meloxicam | 0.2 mg/kg IM once or PO q24h |
| Ketamine | 10-20 mg/kg IM (sedation, used most often in combination with butorphanol) |
| **MISCELLANEOUS** | |
| Silver sulfadiazine | Topical q24-72h (combined with enrofloxacin [Baytril® Otic] frequently for skin lesions) |

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Intraosseous catheters can be used to provide fluid therapy to critically ill lizards.



Oral administration can be performed by passing a small tube through the gap between the rostral fused incisors.




Skin problems are common with spiny-tailed lizards.



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- The heart rate is monitored using a contact Doppler device directed through the thoracic inlet between the shoulders.
- Adequate hydration can be ensured prior to surgery by providing subcutaneous or intraosseous fluids.
- Non-lactated fluids are preferred. Normasol® mixed 50/50 with 0.45% saline + 2.5% dextrose works well.
- Analgesia should be provided using butorphanol, buprenorphine, meloxicam or carprofen.

## SUPPORTIVE THERAPY

- For fluid therapy, non-lactated fluids are administered at the rate of 20 ml/kg/day for maintenance and up to 40 ml/kg/day for severe illness.
- Oral administration of food, fluids and medications can be performed by passing a small tube through the gap between the rostral fused incisors. Critical Care for Herbivores (www.oxbowhay.com) (10 ml/kg PO q24h) or green beans baby food mixed with a fiber source and NutriBac® (bacteria to limit bloating) can be used for nutritional support.
- The enclosure environment should be maintained at moderate temperatures above 90°F (32°C) during the day and 85°F (29.5°C) at night when the lizard is ill.

## RADIOGRAPHIC POSITIONING

- Radiographing the lizard through a box or bag may be necessary if the patient is not sedated.

- Otherwise, the lizard may be taped in position. Both dorsoventral and lateral views should be taken.
- Organs may be assessed by their position, shape, size, density and homogeneity, and the state of nutrition by the skeletal density, gastrointestinal organs and contents.
- The bone/soft tissue contrast in normal lizards is similar to that in mammals.

## COMMON DISORDERS

- Skin problems: bacterial, fungal, calcification
- Metabolic bone diseases (nutritional secondary hyperparathyroidism [NSHP] is most common)
- Parasites (pinworms/oxyurids [likely normal], flagellates, coccidia)
- Wounds (territorial aggression; males frequently bite females on the sides of the neck during copulation)
- Burns (due to basking light being too close to the basking rock)
- Respiratory infections
- Egg yolk coelomitis
- Hypervitaminosis
- Chelitis secondary to *Dermabacter*
- Lateral skin trauma from cage mate aggression

## ZOONOSIS

- *Salmonella* spp. is the primary agent implicated in potential zoonosis.

## FURTHER READING

Mader DL (ed): Reptile Medicine and Surgery 2nd ed. Saunders Elsevier, 2006.



## What to Look for in a Healthy Spiny-tailed Lizard




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# Bearded Dragon Pet Care*



Frank C. Müller

## VITAL STATISTICS

| | | | |
|---|---|---|---|
| Average life span | 10-15 years | Sexual maturity | 1-2 years |
| Adult size | Up to 18-22 inches (45-56 cm) from nose to tail tip | Length at sexual maturity | 12-16 inches (30-40 cm) |
| Adult body weight | 285-510 g (10-18 oz) | Eggs per clutch | Average 15-25 eggs; usually 3-5 clutches per breeding season |

*Adapted from Exotic DVM Volume 8.5 © Zoologi

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## Bearded Dragons (*Pogona vitticeps*)

By **Jay D. Johnson**, DVM

### ORIGIN

- Bearded dragons are native to central Australia.

### FREE-RANGING HABITAT

- They are semi-arboreal and live in a range of habitats from desert to dry forests and scrublands.

### PET APPEAL

- In the wild, they spend the mornings and afternoons foraging and the hottest part of the day in underground burrows. They are well adapted to cool desert nights.
- Bearded dragons usually thrive in captivity.

### BEHAVIOR

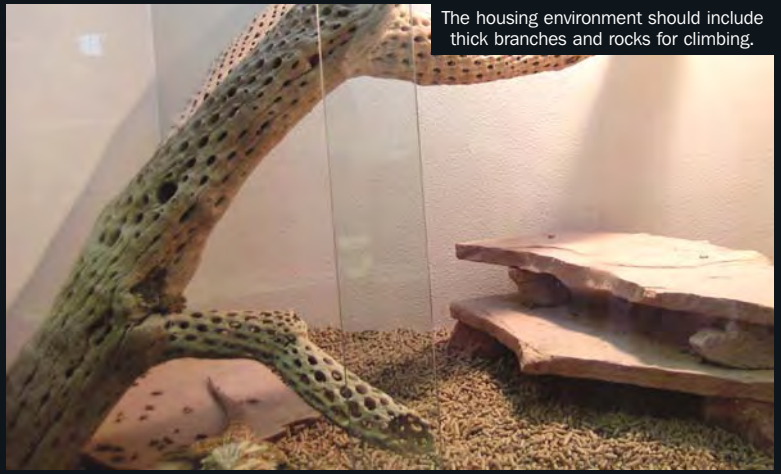
- In most cases they are calm and rarely bite, scratch or whip with their tails.
- They usually do not exhibit signs of stress from handling, and they may feed from the hand of their caretakers.
- They make good pets, even for children, due to their docile and social nature.
- Children must be taught to thoroughly wash their hands following every encounter to reduce the potential for salmonellosis.

### HOUSING

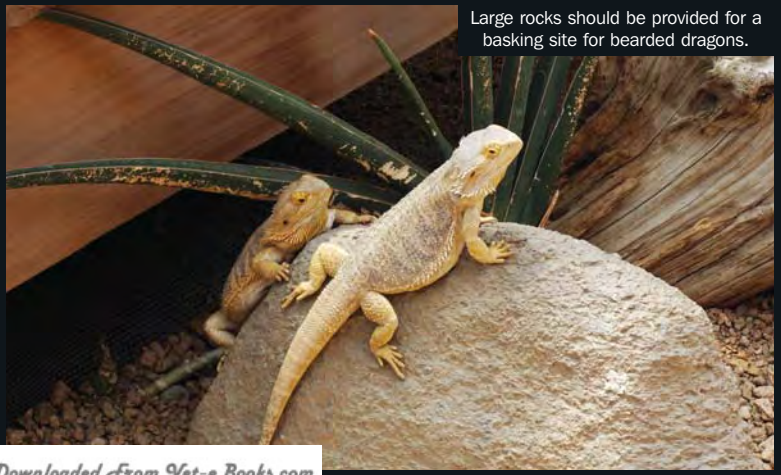
- It is best to house only 1 male bearded dragon per enclosure, but 1 or more females may be present.

## Bearded Dragons

- Breeders often house 2 males and 3 or more females together for the breeding season. Having more than 1 male present can stimulate male reproductive activity.
- Hatchlings should be maintained separately from adults.
- If multiple individuals are housed together, their body conditions should be monitored closely. Signs of stress include low body weight and poor condition. Dominance problems are not uncommon.
- Hungry juveniles housed together can bite off the toes and tail-tips of their cage mates.
- An enclosure for 1-2 adult bearded dragons should be at least 2 x 4 feet (61 x 122 cm) in size, be easy to clean and have smooth sides to prevent rostral abrasions.
- A 10-gallon aquarium is suitable only as short term housing for juveniles.
- Acceptable substrates include soil, newspaper, alfalfa pellets, cypress mulch and sand.
- Cat litter, corn cob, walnut shell and wood shavings are not suitable substrates.
- Care should be taken to avoid placing food items directly onto substrates that can cause impactions if ingested.
- Care should also be taken to ensure proper hydration if a substrate is used that results in lowered cage humidity, e.g., sand or newspaper.
- Burrows/hiding areas should be kept slightly more humid than the rest of the enclosure. This can be accomplished by using substrate that retains moisture, such as cypress mulch, or by using a wood shelter and periodically soaking it in water.
- A shallow water bowl may be provided for drinking; however, many bearded dragons get sufficient water from



The housing environment should include thick branches and rocks for climbing.



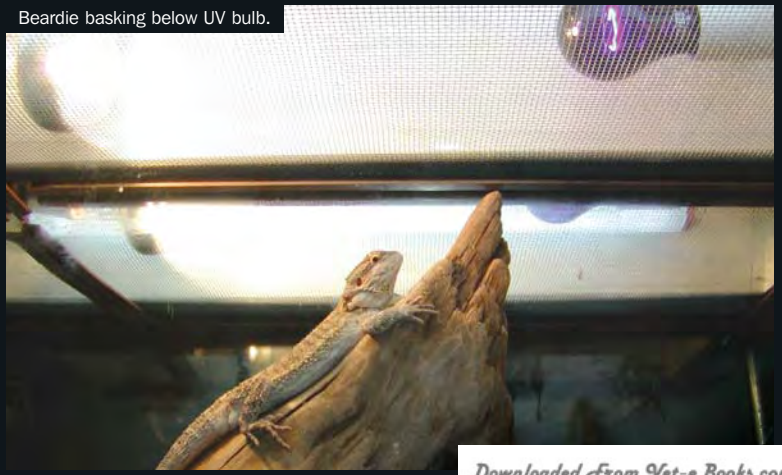
Large rocks should be provided for a basking site for bearded dragons.

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Temperature and humidity must be closely monitored in the enclosure.



Beardie basking below UV bulb.



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their diet and do not drink from bowls.

- They may soak and defecate in the drinking water, creating an unhealthy environment if the bowl is not cleaned frequently.
- Ways to successfully keep bearded dragons from becoming dehydrated while eliminating the need for water in the enclosure include: providing a shallow pan for soaking 1-2 times weekly as needed, ensuring increased humidity in a shelter/hiding area, and rinsing dietary greens with water prior to feeding.

## LIGHT AND TEMPERATURE

- Unfiltered sunlight or high-output UV lighting (fluorescent bulb or mercury vapor lamp), such as ZooMed ReptiSun 5.0,™ ZooMed PowerSun™ (www.zoomed.com) or T-Rex Active IV Heat™ (www.t-rexproducts.com), should be positioned out of reach of the lizard with no glass or plastic between the bulb and the reptile.
- Fluorescent UV lights should be placed within 18-20 inches (45-50 cm) and mercury vapor bulbs should be somewhat beyond that distance.
- Fluorescent bulbs should be changed every 6 months for juvenile lizards and yearly for adults. The mercury vapor bulbs should be changed at least yearly.
- Bearded dragons thrive in a well-ventilated, low humidity environment.
- A daytime temperature gradient, from 80°F (27°C) on the cool side of the vivarium to 90-95°F (32-35°C) at a basking site, should be maintained.
- Nighttime temperatures can drop to 70ºF (21°C).

- Dragons should be protected from coming into direct contact with heating elements.

## ENVIRONMENTAL ENRICHMENT

- Bearded dragons are most active during the day and are adept climbers.
- In addition to providing the basking site and shelter/hiding area, the housing environment should include thick branches or rocks for climbing.
- Bearded dragons should not be allowed free roam of the house in order to prevent chilling, trauma, escape, ingestion of foreign materials, such as potentially toxic live plants, and the risk of spreading *Salmonella*.

## DIET

- Bearded dragons are omnivorous as juveniles; adults are predominantly herbivorous with occasional insects in their diet.
- As they mature, the intake of greens increases as does the size of insect prey.

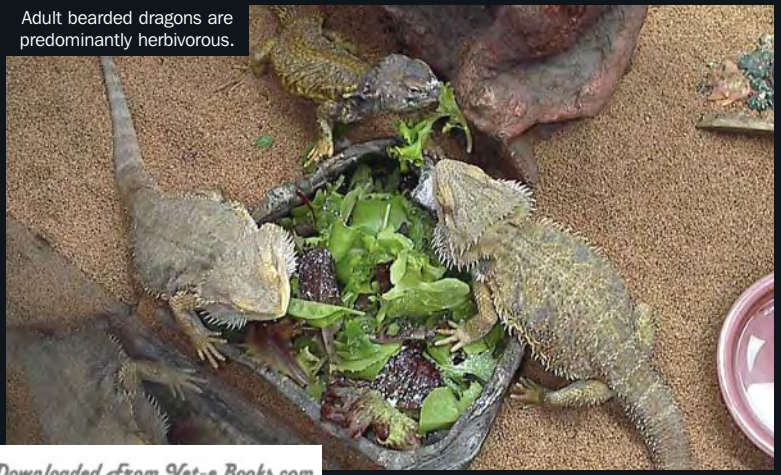
### Hatchlings

- Hatchlings should be fed daily with small insects, such as crickets, phoenix worms, mealworms or other nontoxic collected grasshoppers, grubs, flies and moths.
- Greens and some vegetables should be provided daily.
- Insects cultivated for feeding (e.g., crickets and mealworms) are deficient in nutrients and need daily dusting with mineral and calcium supplements.
- Vitamin supplementation is needed only weekly.

Housing should include thick branches or rocks for climbing.



Adult bearded dragons are predominantly herbivorous.



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| HEMATOLOGIC REFERENCE RANGES | | |
|---|---|---|
| Azurophils | % | 0-9 |
| | x $10^3/\mu l$ | 0-1.1 |
| Basophils | % | 2-18 |
| | x $10^3/\mu l$ | 0.2-3.2 |
| Hematocrit | % | 17-50 |
| Heterophils | % | 17-43 |
| | x $10^3/\mu l$ | 1.6-7.3 |
| Lymphocytes | % | 47-69 |
| | x $10^3/\mu l$ | 4-12 |
| Monocytes | % | 0-4 |
| | x $10^3/\mu l$ | 0-0.5 |
| Total solids | g/dl | 4.5-9.5 |
| WBC | x $10^3/\mu l$ | 6.7-19.9 |

| BIOCHEMISTRY REFERENCE RANGES | | |
|---|---|---|
| ALT | U/L | <3-5 |
| AST | U/L | 4-40 |
| BUN | mmol/L | <0.7-1.4 |
| | mg/dl | <1-2 |
| Calcium | mmol/L | 2.2-6.8 |
| | mg/dl | 8.6-27.2 |
| Calcium:phosphorus ratio | | 0.9-3.8 |
| Chloride | mmol/L or mEq/L | 80-140 |
| Cholesterol | mmol/L | 8.07-31.7 |
| | mg/dl | 312-1224 |
| Glucose | mmol/L | 7.72-16.2 |
| | mg/dl | 139-291 |
| Phosphorus | mmol/L | 1.1-3.2 |
| | mg/dl | 3.5-9.8 |
| Potassium | mmol/L or mEq/L | 1.0-6.5 |
| Sodium | mmol/L or mEq/L | 141-190 |
| Uric acid | mmol/L | 95-678 |
| | mg/dl | 1.6-11.4 |

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## Bearded Dragons

### Adults

- Adults may be fed every 24-48 hours.
- The diet should consist primarily of leafy greens, including romaine, dandelion, turnip greens, mustard greens, beet greens, kale, collard greens, bok choy, Swiss chard, escarole, spinach and cilantro.
- Other vegetables can provide nutritional variety but should be limited, as should occasional flower blossoms and leaves from nontoxic plants.
- Fruits can be fed sparingly as treats.
- Commercial bearded dragon pelleted diets are available and can be fed as part of the diet.
- Dog and cat foods are not recommended.
- Insects fed to adults may include crickets, superworms (*Zophobas*), mealworms, wax worms, locusts, grasshoppers and roaches.
- Lightning bugs may be toxic to bearded dragons and should not be offered.
- Pinkie mice may be fed in small amounts to breeding females.
- Insects, dusted with a mineral supplement containing calcium, are limited to twice weekly feeding for adults.
- To avoid over-supplementation, vitamins should be applied to the diet only every 1-2 weeks.
- Home-raised insects should be fed a “gut-loading” diet of fresh greens for several days before feeding out to bearded dragons.
- A wet sponge is the best water source for insects.

## SEXING AND REPRODUCTION

- Juvenile bearded dragons are difficult to sex.
- Morphologic differences become more apparent as they mature: males are usually larger and have a broader head, thicker tail with hemipenile bulges and enlarged femoral pores along the inner thighs.
- During the breeding season dominant males develop a large black “beard.”
- Females also have femoral pores and their beard can turn black when stressed, making them difficult at these times to differentiate from males.
- Reproduction usually occurs following a winter cool-down period of 2-3 months, known as brumation.
- Although most bearded dragons will breed without any type of brumation period, low fertility rates have been reported in both males and females that were not allowed to cool.
- Brumation can be accomplished by cooling temperatures to 75-80°F (24-27°C) and decreasing daytime light cycles to approximately 10 hours.
- Successfully bred gravid females will often develop a distended coelomic cavity and lose some body mass over the back, pelvis and tail.
- Eggs can be palpated during coelomic palpation of most gravid females.
- An appropriate nest site of deep, moist soil is necessary for the female to lay the eggs.
- Dystocia can occur due to improper nutrition and husbandry or other health-related issues.

A male bearded dragon has a hemipenile bulge on its tail and enlarged femoral pores along the inner thighs.



Females also have femoral pores.



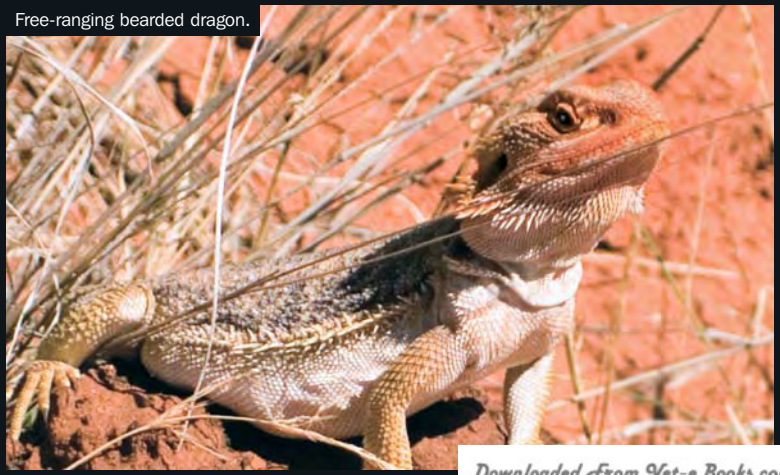


A female bearded dragon with her eggs.

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During handling, the body should be fully supported in the palm of the hand with fingers gently curled over the back.



Free-ranging bearded dragon.

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## RESTRAINT

- When holding or carrying a bearded dragon, the body should be fully supported in the palm of the hand with fingers gently curled over the back.
- Dragons should not be caught or lifted by the tail.
- Most bearded dragons are more tolerant of being restrained from the ventral rather than the dorsal aspect of their body.
- Simple procedures, such as blood sampling, radiography and general physical examination, may be performed without anesthesia.

## PREVENTIVE MEDICINE

- Newly acquired bearded dragons should be quarantined in a separate area from existing dragons for 3-6 months.
- Annual fecal examinations are necessary. Feces can often be obtained by swabbing the cloaca with a moistened cotton swab. This action will frequently induce defecation when feces are present.

## BLOOD COLLECTION

- The ventral caudal tail vein is located just ventral to the vertebral bodies of the tail.
- A needle is placed between the scales and perpendicular to the tail until it meets resistance from bone.
- Negative pressure is applied and the needle is slowly withdrawn and advanced cranially or caudally until blood is seen in the hub.
- Blood should be placed in lithium heparin tubes. The use of EDTA may cause hemolysis and should be avoided.

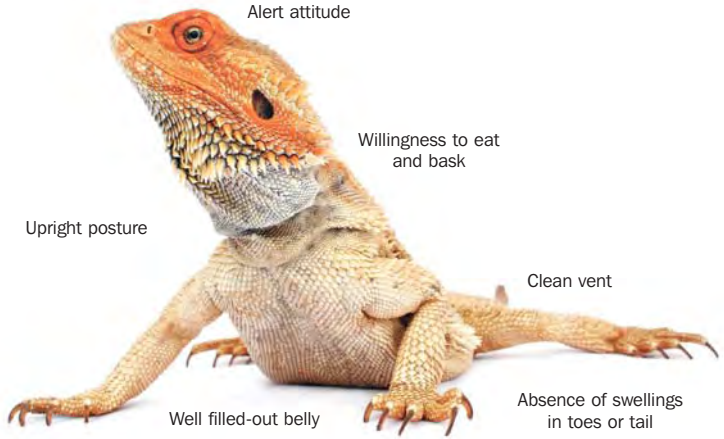
- Sample size may be up to 0.5% of the total body weight. On average 0.5 ml per 100 g BW can be collected.
- Blood smears can be evaluated in-house for parasites, estimated or total white cell counts or toxic changes in the white blood cells.
- Injection sites:
  - IM - Foreleg and hind leg muscles, tail muscles
  - SC - Under the front leg pocket and just in front of the chest
  - IV - Ventral caudal tail vein
  - IO - Distal femur

## ANESTHESIA PROTOCOLS

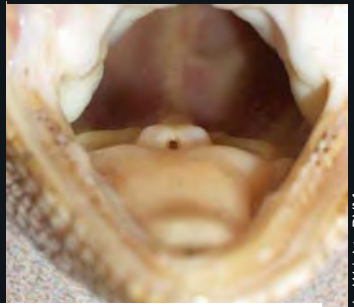
- Anesthesia is required for invasive procedures.
- The patient may be induced with IV propofol or with anesthetic gas via face mask, then intubated and maintained with anesthetic gas.
- Intubation is easy with the glottis highly visible at the base of the tongue.
- Isoflurane and sevoflurane are most commonly used. Sevoflurane has the advantage over isoflurane of being less noxious and more readily inhaled.
- The heart rate is monitored using an ultrasonic Doppler unit with the crystal positioned in the thoracic inlet towards the heart.
- Adequate hydration may be ensured prior to surgery by soaking the dragon or by administration of parenteral non-lactated fluids (see Veterinary Care section).
- Intraoperative fluid therapy may improve patient health and reduce anesthetic recovery time.



## What to Look for in a Healthy Bearded Dragon



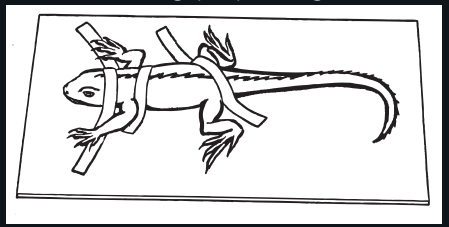

Intubation is easy with the glottis highly visible at the base of the tongue.

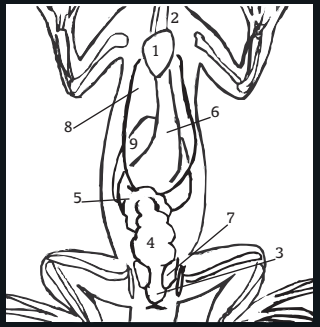


Kevin Wright, DVM

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Radiographic positioning






1. heart
2. esophagus
3. cloaca
4. large intestine
5. small intestine
6. stomach
7. kidneys
8. lungs
9. liver

## RADIOGRAPHIC POSITIONING

- A patient that is not sedated may be placed in a box or bag for radiography.
- Alternatively, the animal can be taped into position on the cassette.
- Dorsoventral and lateral views should be obtained.
- The organs may be assessed by their position, shape, size, density and homogeneity; the state of nutrition is evaluated specifically by the skeletal density and gastrointestinal organs and contents.
- The bone/soft tissue contrast in normal lizards is similar to mammals.

## COMMON MEDICAL PROBLEMS

- Clinical signs of illness in bearded dragons include depression, sunken eyes, poor body condition and weakness.
- Loss of appetite often indicates illness; however, some adults will have periods of anorexia due to seasonal or behavioral changes.

### Endoparasites

- Endoparasites are common, and veterinary visits should include fecal examinations.
- The most commonly seen intestinal parasites are oxyurids (pinworms), coccidia and flagellated protozoans.
- Oxyurids occur in most bearded dragons, are likely not pathogenic and are rarely treated.
- If clinical signs of illness are present and moderate-to-large numbers of coccidia are present, treatment should be initiated.

Clinical signs of illness in bearded dragons include depression, sunken eyes, poor body condition and weakness.



Anal probing should be performed on all ill bearded dragons.



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## Bearded Dragons

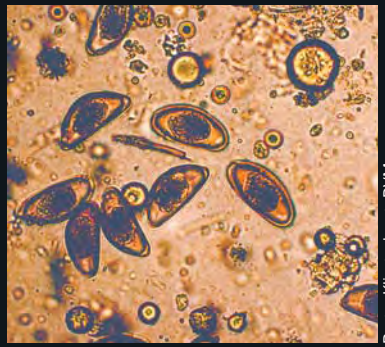
- Flagellated protozoan parasites in moderate-to-large numbers frequently cause gastrointestinal disease and should be treated. Low numbers of protozoans can also be “normal” if no clinical signs are present.
- It is often difficult to eradicate flagellated or coccidian protozoan parasites, but they should be monitored.
- Other diagnosed parasites should be treated according to usual standards for reptiles.
- Cleaning protocols should be stressed to clients in order to eradicate or minimize parasite infections.
- For differentials, other causes of gastrointestinal disease include cryptosporidium, microsporidium, fungal, viral and bacterial infections.

### GI Impactions

- Constipation/cloacal impaction is frequently encountered and is usually due to mild chronic dehydration. Most commonly, the cloaca becomes impacted with a large urate plug.
- Dragons frequently present for a distended caudal coelomic cavity, tenesmus and hyporexia. When mild, a few milliliters of warm water enema followed by cloacal swabbing will allow for passage of the obstructing urate or feces. In more severe cases, rehydration, multiple enemas, cloacal lubrication and physical breakdown of the blockage with a cotton swab may be required over several days. Changes in husbandry and routine soaking should be initiated when this problem occurs.
- Intestinal impactions can occur from ingestion of sand, gravel, walnut shell bedding or other substances. Treatment with fluids and laxatives may be successful; surgery may be necessary.

Coccidia and oxyurids are commonly diagnosed parasites.





Roger Klingenberg, DVM

Bearded dragon receiving an enema.



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Physical breakdown of constipated feces with a cotton swab may be required over several days.



Bearded dragon with a skin mass.



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## Nutritional Disorders

- Metabolic bone disease is most frequently caused by nutritional secondary hyperparathyroidism. Softened bones, weakness, anorexia, constipation, fractures, scoliosis and kyphosis are most commonly seen. Plasma chemistries, including calcium, phosphorus and uric acid, should be evaluated. In mild-to-moderate cases, treatment with parenteral and oral calcium supplementation, along with correction of the diet and husbandry, are usually sufficient to resolve the problem. In severe cases where renal failure is suspected euthanasia should be performed.

## Reproductive Disorders

- Dystocia and pre-ovulatory follicular stasis. Dragons often present anorexic and have a distended coelomic cavity. Eggs and large follicles can often be palpated in lean females. Dystocia can result from small or malformed pelvic bones, hypocalcemia, eggs larger than the pelvic canal, dehydration and lack of a proper nesting area. Pre-ovulatory follicular stasis is not fully understood but is likely the result of improper hormonal cycles secondary to stress or husbandry problems or infections.
- Dystocia should be differentiated from follicular stasis. The workup should include radiography, possible ultrasound, a complete blood count (CBC) and plasma biochemistries. Surgery is often necessary for anatomic causes of dystocia. Rehydration, improvement of husbandry, and providing a suitable nesting area may be successful if no abnormalities are found on workup. Calcium supplementation is necessary for dragons with

hypocalcemia. Aggressive antibiotic therapy and surgery are necessary for dragons with follicular stasis that show clinical signs of illness.

### Eye Problems

- Conjunctivitis and blepharospasm are common sequelae to infections or sand or foreign body irritation. If ulceration of the cornea is evident upon staining, topical antibiotic ophthalmic ointment should be applied. If no ulceration is present, frequent flushing with saline and application of an anti-inflammatory ophthalmic solution are recommended.
- Buophthalmus due to retrobulbar swelling may also be seen. The most common causes include abscesses and hypertension. Fluid aspirated from the retrobulbar space should be evaluated microscopically. A high number of heterophils in the blood or aspirate is suggestive of infection. If aspirates resemble peripheral blood, further evaluation, including radiographs of the heart, is indicated. Calcification of the greater vessels and muscles of the heart may be seen. Hypertension is often bilateral and retrobulbar abscesses are unilateral.

### Dermatitis

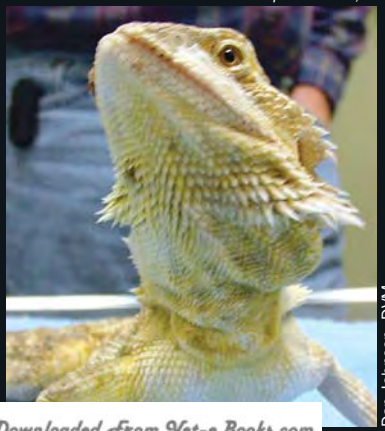
- Bacterial infections often respond well to topical antiseptic and systemic antibiotic therapy. Treatment of fungal dermatitis is usually successful with oral itraconazole and topical application of betadine and silver sulfadiazine.
- *Chrysosporium* anamorph of *Nannizziopsis vriesii*, or "yellow fungus disease" causes a severe, necrotizing, yellow-colored, granulomatous dermatitis. Prognosis is guarded to poor for this condition.

This bearded dragon has marked swelling of both eyelids and an exudate in the medial canthus associated with cryptosporidiosis involving the bulbar conjunctival mucosa.



Morgan Dawkins, DVM

One fungal disease is *Chrysosporium* anamorph of *Nannizziopsis vriesii*, or "yellow fungus disease."



Dan Johnson, DVM



Dan Johnson, DVM

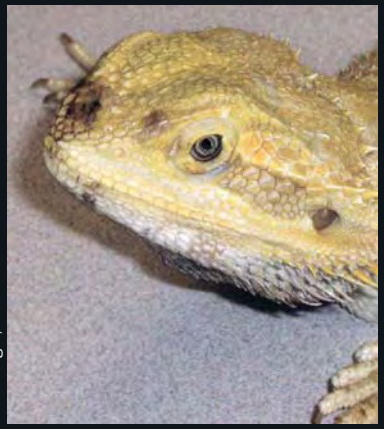
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Forelimb fractures often result from falls from branches or during handling.

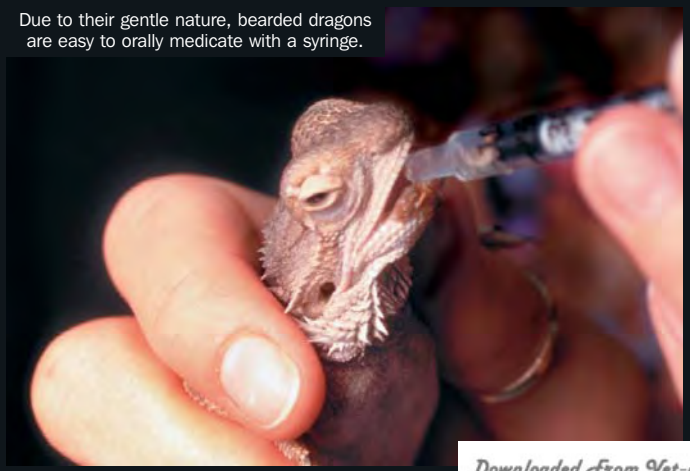


Kevin Wright, DVM

Bite wounds may occur from fighting between adults.



Due to their gentle nature, bearded dragons are easy to orally medicate with a syringe.



Roger Klingenberg, DVM

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## Bearded Dragons

### Trauma

- Rostral abrasions and burns from hot rocks and heating elements.
- Fractures may result from subclinical hypocalcemia, fighting or falls during handling.

## ZOONOSES

- *Salmonella* sp. is the most common organism of zoonotic concern in bearded dragons.

## VETERINARY CARE

- Along with proper medical and surgical treatments for illnesses, hydration and nutritional support must be addressed.
- A 50/50 mixture of Normasol/Plasmalyte and 0.45% saline + 2.5% dextrose is recommended for reptile fluid therapy. A maintenance guideline is 20-30 ml/kg/day.
- At-home soaking and/or administration of water per os can be performed.
- Nutritional support is critical for proper recovery. Oxbow Critical Care for Herbivores (www.oxbowhay.com), fed at 10 ml/kg/day, is recommended for adults.
- Juveniles should also be assist-fed crickets or cricket juice. To make cricket juice, place crickets in a 3 ml syringe and apply pressure to the plunger, pushing the liquid and smaller portions of the crickets through the tip.

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## FORMULARY

These dosages are those most commonly used by the author in this species and do not have pharmacokinetic studies to support them. Bearded dragons should be hydrated, and dosages should be adjusted for some drugs based on the health status of the lizard.

| | |
|---|---|
| **ANTIBIOTICS*** | |
| Amikacin | 5 mg/kg IM q48h |
| Ampicillin | 20 mg/kg SC, IM q24h |
| Chloramphenicol | 50 mg/kg PO q24h |
| Enrofloxacin | 10 mg/kg PO q24h; 5 mg/kg IM q24h |
| Metronidazole | 20 mg/kg PO q24h |
| Piperacillin | 50-100 mg/kg IM q24-48h |
| Trimethoprim/sulfa | 15-30 mg/kg PO q24h |
| **Enrofloxacin and amikacin are often used in conjunction with metronidazole or ampicillin.* | |
| **ANTIFUNGALS** | |
| Itraconazole | 23.5 mg/kg PO q24h x 3d, stop 6 d, repeat until resolved |
| Ketoconazole | 15-30 mg/kg PO q24h for 2-4 weeks |
| **ANTIPARASITICS** | |
| Fenbendazole | 50 mg/kg PO q10 d for 2-3 treatments |
| Metronidazole | 100 mg/kg PO q10 d for 2-3 treatments |
| Sulfadimethoxine | 50 mg/kg PO q24h x 5d then q48h until resolution |
| Trimethoprim/sulfa | 30 mg/kg PO q24h x 5d then q48h until resolution |
| **ANESTHETICS/ANALGESICS** | |
| Buprenorphine | 0.01 mg/kg IM |
| Butorphanol | 0.5-1.0 mg/kg IM (lower dose if combined with ketamine) |
| Ketamine | 10-20 mg/kg IM (sedation, used most often with butorphanol) |
| Meloxicam | 0.2 mg/kg IM once or PO q24h |
| Propofol | 5 mg/kg IV |
| **MISCELLANEOUS** | |
| Silver sulfadiazine | Topical q24-72h (combined with enrofloxacin [Baytril® Otic]) |
| | q24h |

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# Day Gecko Pet Care



## VITAL STATISTICS

| | |
|---|---|
| Life span | 3-15 years |
| Adult size | 2.5-12 inches (6-30 cm) depending on species |

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## Day Geckos (*Phelsuma* spp.)

### COMMON SPECIES

- Giant day gecko (*P. madagascariensis grandis*)
- Gold dust day gecko (*P. laticauda*)
- Standings day gecko (*P. standingi*)
- Peacock day gecko (*P. quadriocellata*)
- Neon (yellow-headed) day gecko (*P. klemmeri*)
- Dull day gecko (*P. dubia*)
- Alabra Island day gecko (*P. abbotti chekei*)

### ORIGIN

- Islands and coastal areas of the southwestern Indian Ocean and Andaman Islands

### FREE-RANGING HABITAT

- Arboreal

### CAPTIVE HOUSING

- A 20-gallon aquarium or equivalent with a wire mesh top for ventilation is the minimum size for an enclosure.
- Enclosures for pairs: minimum 10-gallon aquarium for small species and 30-gallon aquarium for larger species.
- Enclosure should be vertically-oriented for most day geckos with a screen or wire mesh top for adequate ventilation and UV light.
- Substrate should be leafy soil, vermiculite-free potting soil, peat moss, or fine grade well-washed orchid bark placed over ½ inch (1.25 cm) small pebbles.

## Day Geckos

- Full-spectrum lighting with a 14-hour day length in the summer and 10-hour day length during the winter must be used.
- A basking lamp is necessary above one end of the enclosure.
- A small dish of cuttlebone, eggshell or calcium powder should be available at all times.
- Daytime temperature should be 79-89°F (25-30°C), and nighttime temperatures may drop to 64-71°F (18-22°C).
- The temperature should be decreased slightly for 3-4 months during winter in order for the geckos to breed in the spring.
- 50-85% humidity can be maintained by misting twice daily.
- Live plants may help maintain humidity.

### ENVIRONMENTAL ENRICHMENT

- Several stiff-leafed live plants (e.g., sansevieria, orchids, bromeliads) should be provided for hiding.
- Bamboo stalks will allow for climbing and basking.
- Walls can be covered with cork bark to support epiphyte plants.

### RESTRAINT

- Handling should be minimized as handling can severely damage gecko's fragile skin.
- Geckos will shed their tail (autotomy) if frightened.


Giant day gecko (*P. madagascariensis grandis*)


Gold dust day gecko (*P. laticauda*)

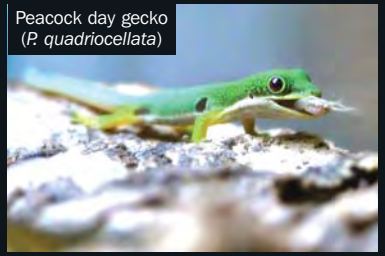
Max Lewis


Neon (yellow-headed) day gecko (*P. klemmeri*)


Standings day gecko (*P. standingi*)

Kimon Berlin


Dull day gecko (*P. dubia*)


Peacock day gecko (*P. quadriocellata*)

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Several stiff-leafed live plants and tree branches should be provided for climbing and hiding.



Enclosure should be vertically-oriented.

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## Day Geckos

### DIET

- Free-ranging day geckos eat insects, spiders, sweet fruits and nectar.
- In captivity, day geckos may be fed crickets, wingless fruit flies, flies, waxworms, wax moths, fruit (e.g., mango, papaya), fruit baby food and honey.
- Gut-loaded prey, dusted in phosphorus-free calcium and vitamins, should be fed daily.
- Water should be provided in a shallow container that is not easily overturned and cleaned regularly.

### BEHAVIOR

- Diurnal
- Territorial
- Most vocal of all lizards
- Day geckos are amazing climbers with powerful legs and feet.

### SEXING AND REPRODUCTION

- Adult males have well-developed femoral pores above the the cloaca with very defined “dots” within them. These pores are usually in a V-shaped arrangement. They are either not developed in females or are less developed. Males also usually have a slight hemipenal bulge below the cloaca.
- One to two eggs are often laid inside the hiding crevices or on the aquarium glass. Once the shells are fully dried, they may be difficult to remove, thus they can be incubated in place. Or, if a section of the enclosure can be moved, the eggs can be relocated to an incubator.

Day Geckos

## MOST COMMON DISORDERS

- Calcium deficiency
- Ectoparasites
- Endoparasites
- Eye disorders
- Shedding problems

## SPECIAL CONSIDERATIONS

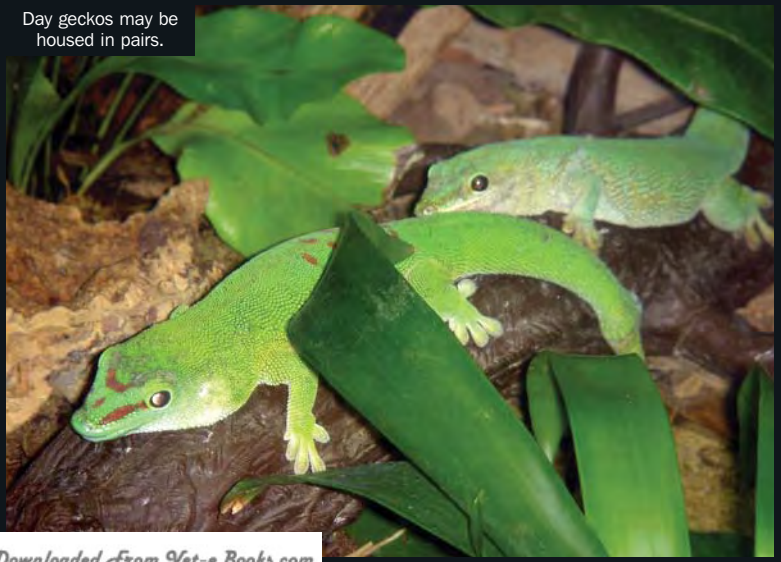
- All *Phelsuma* spp. are CITES Appendix II listed (restricted international trade).

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Humidity must be maintained to avoid shedding problems.



Day geckos may be housed in pairs.

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# *Rhacodactylus* Gecko Pet Care



Philippe de Vosjoli

## VITAL STATISTICS

| | |
|---|---|
| Life span | 10-15 years |
| Adult size | 7-9 inches (18-23 cm) including tail<br>4-5 inches (10-13 cm) snout to vent |

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## *Rhacodactylus* Geckos (*Rhacodactylus* spp.)

### SPECIES

- Crested gecko (*R. ciliatus*)
- Gargoyle (bumpy) gecko (*R. auriculatus*)
- Bavay's giant gecko (*R. chahoua*)
- New Caledonia giant gecko (*R. leachianus*)
- Roux's giant gecko (*R. sarasinorum*)
- Tough-snouted giant gecko (*R. trachyrhynchus*)

### ORIGIN

- New Caledonia

### FREE-RANGING HABITAT

- Arboreal

### CAPTIVE HOUSING

- A 20-gallon aquarium or equivalent with a wire mesh top for ventilation is the minimum size for an enclosure.
- The enclosure should have vertical orientation to accommodate branches and/or plants for climbing.
- Males are territorial and should be housed individually.
- Substrate should be moss, newspaper, paper towels, or a mixture of potting soil (without pearlite) with sand and orchid bark or short coconut fiber. Ensure substrate will not be accidentally ingested when diving for prey.
- UV lighting is not necessary, but a low level UV light for 1-2 hours per day with hiding spots might be beneficial.
- Daytime temperatures should be 78-82°F (25-28°C), and

nighttime can drop to 70-77°F (21-25°C).
- The winter temperature can be 5-10°F (3-5°C) cooler.
- A 40-watt basking lamp should be provided for supplemental heat in cold climates.
- Relative humidity between 60-80% can be maintained with daily misting.

## ENVIRONMENTAL ENRICHMENT

- Dry branches, cork bark, driftwood or bamboo tubes should be provided for perching and climbing.
- Tall silk or live plants (e.g., *Ficus benjamina*, dracaenas, ferns and other broad-leaf plants) should be provided to give geckos adequate room for leaping.

## RESTRAINT

- Geckos should be handled gently.
- Geckos will drop their tail if stressed.

## SEXING / REPRODUCTION

- *Rhacodactylus* geckos are sexually dimorphic once they are mature.
- Males have a distinct hemipenile bulge that becomes obvious between 4 and 8 months of age.
- With the exception of *R. auriculatus*, males tend to be stockier than females.
- *Rhacodactylus* geckos are egg layers with the exception of *R. trachyrhynchus,* which gives live birth.

Gargoyle gecko (*R. auriculatus*)



LA Dawson

Roux's giant gecko (*R. sarasinorum*)



Bavay's giant gecko (*R. chahoua*)



Alfeus Liman

New Caledonia giant gecko (*R. leachianus*)



Alfeus Liman

**MALE**



**FEMALE**



Philippe de Vosjoli

erentiated from females by their hemipenile bulge

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Broad leaf plants are necessary for the gecko's enclosure to provide places to climb and jump.



Crested geckos will feed on puréed baby food mixes consisting of 8-9 parts fruit and 1-2 parts chicken, supplemented with calcium carbonate and a reptile vitamin $D_3$ supplement.



Photo by: Philippe de Vosjoli

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## Crested Geckos

- Crested geckos (*R. ciliatus*) are the most commonly kept *Rhacodactylus* gecko. The following information pertains specifically to this species.

### DIET

- Free-ranging crested geckos are omnivores; their diet consists of fruits, nectars and insects.
- Crested geckos should be fed 3-4 times a week.
- A formulated diet is commercially available.
- Diet composition should be 50% fruit (mashed fruit [e.g., peach, nectarine, mango, apricot, banana, passionfruit, pear] or baby food) and 50% small insects (e.g., live crickets, silkworms, waxworms).
- Dietary calcium and vitamins (vitamin $D_3$) should be supplemented weekly by dusting prey.
- Water should be provided in a shallow container that is not easily overturned and cleaned regularly.

### BEHAVIOR

- Geckos are nocturnal and hide in foliage during the day.
- Very territorial
- Geckos jump and dive for prey.

### PHYSICAL CHARACTERISTICS

- Ciliated crests lining the eyes and running along the sides of the head, neck and middle of the back are the distinguishing features of crested geckos.
- Crested geckos have lamellae on their toes and a prehensile tail, which allow them to climb on glass and jump between branches.

## MOST COMMON DISORDERS

- Metabolic bone disease
- Egg binding
- Tail injury
- Shedding problems (e.g., remains of skin can constrict and cause loss of digits)
- Calcium deficiency
- Floppy-tail syndrome
- Substrate impaction

## SPECIAL CONSIDERATIONS

- Crested geckos do not regrow their tail following autotomy but regenerate a pointed tip. This must be taken into consideration, because most owners do not want crested geckos without tails, even though it is the norm in wild populations.

## REFERENCES AND FURTHER READING


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Floppy-tail syndrome is a condition in which the tail flops over the back and/or to the side when a gecko rests upside down. There is no treatment for this syndrome.



Philippe de Vosjoli

Crested geckos will not regrow their tail following autotomy and instead will regenerate a pointed tail tip.



Philippe de Vosjoli

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# Basilisk Lizard Pet Care

Striped/brown basilisk (*B. vittatus*)



## VITAL STATISTICS

| | |
|---|---|
| Life span | 15-20 years |
| Adult size | 2-2.5 feet (61-76 cm) including tail |
| Body weight | 90 g (avg) |

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## Basilisk Lizards (*Basiliscus* spp.)

### COMMON SPECIES

- Striped or brown basilisk (*B. vittatus*)
- Emerald, green, plumed or double-crested basilisk (*B. plumifrons*)
- Red-headed (western) basilisk (*B. galeritus*)

### ORIGIN

- Tropical Mexico to northern South America

### FREE-RANGING HABITAT

- Arboreal; humid rainforest; areas near water

### CAPTIVE HOUSING

- A 55-gallon glass aquarium or larger enclosure with locked screen cover may be used.
- One male per enclosure with up to 3 females.
- Substrate should be peat or sphagnum moss or mulch.
- Full-spectrum lighting is necessary; outdoor exposure to natural sunlight is beneficial.
- Water should be provided in a dish large enough to fit the entire lizard for soaking.
- Water should be changed frequently.
- Ideal temperature gradient is 75-85°F (24-29°C).
- A basking site of 90-95°F (32-35°C) should be provided at one end of the enclosure and shade at the other. A basking lamp or a heating element suspended above the cage may be used.

- Humidity (>60%) can be maintained with daily misting.
- Temperature and humidity requirements vary according to species and reproductive status.

## ENVIRONMENTAL ENRICHMENT

- Provide large, sturdy branches for climbing and a basking site.
- Live potted plants, such as pothos, dracaena or philodendron, may be included.

## DIET

- Omnivores
- The diet of free-ranging basilisk lizards includes plants (including flowers and fruits), insects and small vertebrates.
- In captivity, a diet of crickets, mealworms, *Zophobas* worms, wax worms, grasshoppers and spiders is sufficient. A pinkie mouse may be fed occasionally.
- Food should be dusted weekly with calcium and vitamin $D_3$ supplements.
- Crickets should be fed a vitamin-enriched diet ("gut loading") to benefit the basilisk.

## BEHAVIOR

- Territorial
- Males often head-bob.
- Basilisks are easily frightened.
- Basilisks are skilled climbers, swimmers, and jumpers.
- Basilisks enjoy soaking in their water dish.



Emerald basilisk (*B. plumifrons*)

**MALE**



**FEMALE**



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Water should be provided in a dish large enough to fit the entire lizard for soaking



A basilisk lizard after shed.



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## Basilisk Lizards

- Called “Jesus lizard” for their ability to run on water at speeds greater than 7 mph (11 km per hour).

### PHYSICAL CHARACTERISTICS

- The teeth of basilisks are fused to the sides of their jaws.
- The toes have long scales that help it walk on water.
- A flat crest adorns the back of the head.

### MOST COMMON DISORDERS

- Rostral or snout wounds and infections (from bumping against aquarium walls)
- Metabolic bone disease (vitamin $D_3$ or calcium deficiency)
- Stomatitis/mouth rot
- Ectoparasites (especially mites and ticks)
- Endoparasites (protozoa, nematodes)

### CAUTIONS

- Frightened basilisks are prone to biting.
- Basilisk lizards may be aggressive.

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# Blue-tongued Skinks (*Tiliqua* spp.)

## COMMON SPECIES

- Pygmy blue-tongued skink (*T. adelaidensis*)
- New Guinea blue-tongued skink (*T. gigas*)
- Central blue-tongued skink (*T. multifasciata*)
- Blotched blue-tongued skink (*T. nigrolutea*)
- Western blue-tongued skink (*T. occipitalis*)
- Shingleback blue-tongued skink (*T. rugosa*)
- Eastern blue-tongued skink (*T. scincoides scincoides*)
- Northern blue-tongued skink (*T. scincoides intermedia*)
- Tanimbar blue-tongued skink (*T. scincoides chimaerea*)

## ORIGIN

- Australia; Papua, New Guinea; Indonesia

## FREE-RANGING HABITAT

- Terrestrial; open woodlands, margins of forest and field, less arid areas of the interior

## CAPTIVE HOUSING

- Enclosure should be at least a 40-55 gallon aquarium or equivalent, with a secure top to prevent escape.
- An outdoor enclosure may be best if located in a warm climate with access to sunlight, shade and a dry area.
- Outdoor enclosures should include a fence 50 cm below ground and 80 cm above to prevent escape.
- Skinks should be housed separately to avoid risk of injury due to fighting.



# Blue-tongued Skink Pet Care

Northern blue-tongued skinks are one of the most common *Tiliqua* spp.



## VITAL STATISTICS

| | |
|---|---|
| Life span | 20-25 years |
| Adult size | 12-27 inches (30-69 cm) snout to tail (average 17 inches [43 cm]) |
| Body weight | 10-18 ounces (283-510 g) |

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Male northern blue-tongued skink (*T. scincoides intermedia*)



Female northern blue-tongued skink (*T. scincoides intermedia*)



Eastern blue-tongued skink (*T. scincoides scincoides*)



Shingleback blue-tongued skink (*T. rugosa*)



Sean McClean

Central blue-tongued skink (*T. multifasciata*)



Miklos Schiberna

Western blue-tongued skink (*T. occipitalis*)



Miklos Schiberna

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## Blue-tongued Skinks

- Substrate should be clean dust-free pine shavings, aspen shavings, shredded paper products (Yesterday's News) or cypress mulch (not cedar).
- An area of slightly damp substrate, a humidity retreat box filled with damp sphagnum moss or a loosely piled damp towel should be provided.
- Blue-tongued skinks will soak in their water bowls, especially before shedding; water must be changed often.
- Exposure to UV light is necessary and may be provided by fluorescent or reptile bulbs, or if outdoors, direct sunlight.
- The lizard must be able to retreat to a cool area.
- The temperature gradient should be 75-85°F (23-30°C). Nighttime temperature should not fall below 70°F (21°C).
- A basking site with temperatures of 90-105°F (32-40°C) (depending on species) should be provided using a basking lamp above and, in cooler rooms, a heating pad beneath one end of the enclosure. If the skink burrows in its substrate and lies on a glass tank bottom directly over a heating pad there is a risk of thermal burn, so careful monitoring is necessary if heating pads are used.
- Heat rocks should not be used because of the risk of thermal burns.
- The lizard should be monitored for signs of stress and the temperature adjusted accordingly (too cold it will become lethargic; too warm it will spend most of its time hiding).
- A stronger heat lamp may be required in winter.

### ENVIRONMENTAL ENRICHMENT

- Hide boxes, rock caves or half logs for hiding, as well as branches and logs of different levels for climbing, should be provided.

## RESTRAINT

- The skink should be handled gently.
- The use of leather gloves may be helpful in preventing painful bites.
- A skink should not be restrained by the tail; it may drop the tail if frightened. The tail will regrow, but will never be the same as the original.

## DIET

- Omnivorous
- In captivity, the diet should consist of roughly 60% plant and 40% animal matter.
- Diet may include mixed vegetables (e.g., beans, summer or winter squash, carrots, parsnips) mixed with thinly sliced greens (e.g., collards, dandelion, escarole).
- Frozen vegetable mixes (e.g., corn, carrots, cauliflower and broccoli) should be avoided.
- Meat portions may include worms (e.g., mealworms), slugs, snails, insects (e.g., crickets) and pinkie mice.
- Berries and fruits (e.g., cherries, peaches, nectarines, pears, bananas) may be given.
- The addition of a calcium/vitamin D supplement twice weekly is recommended.
- Adults should be fed ad lib, which is usually 2-4 times per a week.
- Some blue-tongued skinks stop eating for 3-4 months during the winter period.
- Water should be provided in a large shallow container that is not easily overturned and cleaned regularly.

The enclosure should provide both dry and damp areas for the skink.



Hollow logs for hiding and rocks of different levels for climbing, should be provided.



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Blue-tongued skinks will open their mouths and show their blue tongue in an attempt to frighten predators.



Carole Saucier - www.reptilecare.com

Water bowls should be large enough for the skink to soak.



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## BEHAVIOR / SUITABILITY AS PETS

- Diurnal
- Free-ranging skinks spend most of the day foraging for food and basking.
- If threatened, the skink will puff up and hiss loudly.
- It is docile and easily tamed in captivity.
- When hungry, the skink will often fixate on any movement with an open mouth, ready to pounce.

## MOST COMMON DISORDERS

- Ectoparasites (especially mites and ticks)
- Endoparasites
- Dysecdysis (particularly around the distal digits)
- Respiratory infections
- Thiamine deficiency (from a frozen diet)
- Metabolic bone disease
- Trauma from cagemate aggression

## SPECIAL CONSIDERATIONS AND CAUTIONS

- Blue-tongued skinks have a strong bite.
- Hands must be washed before and after handling.
- Export from Australia is prohibited; blue-tongued skinks sold for the pet trade must be captive-bred.

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# Gila Monsters (*Heloderma* spp.)

## SPECIES

- Gila monster (*H. suspectum*)
  - Subspecies: Reticulated gila monster (*H. s. suspectum*)
  - Subspecies: Banded gila monster (*H. s. cinctum*)
- Mexican beaded lizard (*H. horridum*)

## ORIGIN

- Southwestern US and northwestern Mexico (from southern Sonora north through southwest Arizona and adjacent portions of New Mexico, California, Nevada and Utah)

## FREE-RANGING HABITAT

- Terrestrial
- Arid areas, usually with scattered cacti, shrubs, mesquite and grasses. Often rocky slopes, arroyos and canyon bottoms (mainly with streams).
- Dens or burrows are often in rock crevices or boulder piles.

## CAPTIVE HOUSING

- Should be housed individually in an aquarium or large enclosure with at least 8 square feet (0.75 $m^2$) in floor area for an adult.
- A substrate mix of playground sand, peat moss and bark chips is ideal as it allows animals to dig and construct hiding areas. Newspaper is also acceptable.



# Gila Monster Pet Care



### VITAL STATISTICS

| | |
|---|---|
| Life span | 20-25 years |
| Adult size | 18-24 inches (45-60 cm) |
| Body weight | 1.36 kg (3 lbs) |

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Gila monster (*H. suspectum*)



Mexican beaded lizard (*H. horridum*)



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## Gila Monsters

- Eight hours of light and 16 hours of dark should be provided during hibernation. Light period should be increased during the summer to 14 hours. Full-spectrum lighting is beneficial.
- A temperature gradient must be maintained from 75-80ºF (24-27ºC) to 85-90ºF (29-32ºC) in a warm spot (measured on the substrate over the heat source). Temperature may drop to 70-75ºF (21-24ºC) at night.
- A plastic humidity box should be provided with an opening large enough to fit 1 gila monster and half filled with damp peat or sphagnum moss.
- Hide boxes or rock caves should be available so the animal can choose the preferred environmental conditions.

### RESTRAINT

- Handling should be minimized.
- Thick leather gloves should be worn.
- Grasp around the neck gently but securely to restrict lateral movement of the head. Body weight is supported with the other hand.

### DIET

- Free-ranging gila monsters eat newborn rabbits, rock squirrels, woodrats, other animals that can't escape easily, and reptile and ground-nesting bird eggs.
- In captivity, several prey items (mice or young rats, freshly killed or frozen and thawed) should be fed once or twice a week.

## Gila Monsters

- It is possible for gila monsters to survive for months without food, living off the fat in its tail.
- After hibernation, twice as much food can be fed to the gila monster to prepare for reproduction.
- Domestic chicken eggs or chicks should not be used because of the risk of *Salmonella*.
- Water should be provided in a shallow container that is not easily overturned and cleaned regularly.

### BEHAVIOR

- Diurnal
- Generally solitary animals
- Slow moving or inactive
- Docile and typically non-aggressive
- Gila monsters spend up to 98% of their time in underground burrows or under rocks.
- Gila monsters are most active in the spring, when searching for prey, and mate and return to underground burrows in late May or June (onset of hot weather).
- Gila monsters' tails will not separate from their body like some other lizards.

### MOST COMMON DISORDERS

- Obesity
- Cryptosporidiosis
- Gastrointestinal disease
- Dystocia
- Anorexia

Rock caves should be available for the gila monster.



Grasp around the neck gently but securely to restrict lateral movement of the head.



Gila monsters may not readily let go after biting.



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Gila monsters may sometimes sleep above ground.



Gila monsters spend most of their time inactive.



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## SPECIAL CONSIDERATIONS AND CAUTIONS

- Bites are venomous; their bite is rarely fatal, but may be very painful.
- Gila monsters may not readily let go after biting. They can be removed by sedation (propofol or Telazol) or by pouring undiluted vinegar in their mouths and over their heads.
- Gila monsters do not inject their venom like snakes. They have poison glands along their jaws. They bite hard, leaving a deep wound. The venom empties in a groove on the teeth, then into the wound. They hang on tight so that the venom flows into the wound.
- Treatment for bites can be found at: www.herpetology.com/helobite.txt
- Protected in the US and Mexico. State and local regulations on trade and possession apply.

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# Chuckwallas (*Sauromalus* spp.)

## SPECIES

- Common (Western) chuckwalla (*S. ater* formerly *obesus*)
- Peninsular chuckwalla (*S. australis*)
- Angel Island chuckwalla (*S. hispidus*)
- Chuckwalla de montserrat (*S. slevini*)
- San Esteban (painted) chuckwalla (*S. varius*)

## ORIGIN

- Southern California, southern Nevada, southwestern Utah, western Arizona

## FREE-RANGING HABITAT

- Terrestrial
- Desert regions, rocky elevations

## CAPTIVE HOUSING

- Males should be housed alone or in harem groups.
- A 100-gallon or larger aquarium is suitable as an enclosure.
- The ideal substrate is a 3-inch (7-cm) layer of clean play-ground sand mixed with larger rock particles.
- Rocks should be placed directly on the enclosure floor, building the substrate up around them.
- Secure mounds or caves can be made by affixing rocks together using aquarium silicone cement.
- At least one hiding area should be created in the cool end of the enclosure and one in the warm end to allow



# Chuckwalla Pet Care



Common chuckwalla

## VITAL STATISTICS

| | |
|---|---|
| Life span | 20-25 years |
| Adult size | 11-18 inches (30-46 cm) |
| Body weight | 1-4 pounds (0.45-1.8 kg) |

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Rocks should be placed directly on the enclosure floor, building the substrate up around them.



Raimond Spekking

A collared lizard (dotted skin) and a Western common chuckwalla



an Pingstone

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## Chuckwallas

behavioral thermoregulation and reduce the stress of captivity.

- UVB-producing fluorescent lights (not filtered through glass, plastic or dense mesh) must be installed no farther than 12" from the lizard and extending across the enclosure.
- A white light/basking lamp should be added to the warm end of the enclosure, mounted close to the UVB tube so that basking lizards get both heat and UVB exposure.
- The light cycle should be 12-14 hours light, 10-12 hours dark.
- A thermal gradient from around 80-100°F (26-37°C) with a basking area up to 110°F (43°C) should be provided in the enclosure. Nighttime temperatures may drop to 60-78°F (15.6-25°C); this thermal gradient can be maintained using a nocturnal reptile light or a ceramic heating element.
- Temperatures must be monitored with a thermometer, as hyperthermia and hypothermia may be lethal.

### ENVIRONMENTAL ENRICHMENT

- A flat rock for basking, cholla cactus skeleton and other plants and rocks for climbing and hiding should be provided for chuckwallas.
- A live potted creosote bush (chaparral, greasewood) may be planted into the sand and covered with gravel or rock. This plant functions as food (leaves and flowers) and shelter (the chuckwalla burrows around the roots and rocks at the base).

## Chuckwallas

### RESTRAINT

- As for other lizards
- Special care should be taken with its sharp claws.
- Habituate to human handling.

### DIET

- Free-ranging chuckwallas are vegetarian but may be slightly omnivorous in captivity.
- In captivity, leafy dark greens (e.g., collards, mustards, dandelions, escarole, parsley, pesticide-free grasses, shredded green and orange vegetables, soft fruits, flowers (e.g., hibiscus, roses, dandelions, geranium [leaves and flowers]), trimmed cactus pads, prickly pear. Insects (e.g., worms, crickets) provide occasional animal-based protein.
- Water should be provided in a shallow container that is not easily overturned, in the coolest corner to minimize humidity, and should be cleaned regularly.

### SUITABILITY AS PETS

- Require large amounts of space, have sharp claws.
- Wild-caught chuckwallas should be avoided.

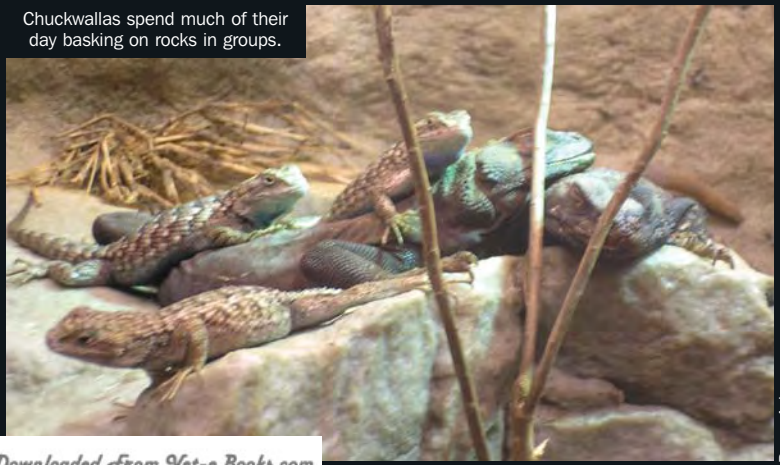
### BEHAVIOR

- Chuckwallas bask on exposed boulders or rocks, often in groups, and retreat to cool burrows, caves or deep rocky crevices during the hottest part of the day.
- If threatened, chuckwallas will crawl into a tight crevice and inflate their body to wedge it firmly.
- Femoral pore plugs are used to mark territories.

*Sauromalus varius* is native to Isla San Esteban and a few nearby islands in Mexico.



Chuckwallas spend much of their day basking on rocks in groups.



Deror Avi

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an Pingstone

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## MOST COMMON DISORDERS

- Parasites
- Tail autotomy
- Mycotic infections of the skin and respiratory system
- Trauma (bite wounds)
- Shed skin retention

## SPECIAL CONSIDERATIONS AND CAUTIONS

- Chuckwallas hibernate (or brumate) through the coldest winter months (November to February/March).
- To promote hibernation in captivity, enclosure temperatures can be gradually decreased to 50-55°F (10-12.8°C) through fall and early winter with concurrent shortening of day length. If the ambient temperature outside the enclosure falls below this range, supplemental heating must be provided.
- Chuckwallas should not hibernate with food still in their digestive system.
- The light cycle and temperature in late winter/early spring should gradually be increased. Fresh water and food should be offered daily. If the chuckwalla has not eaten for 3 days after emerging from hibernation, offering a pungent herb or creosote leaves may stimulate feeding.
- Chuckwallas are federally listed as an endangered species; state and federal regulations must be observed.

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# Mole Salamanders (*Ambystoma* spp.)

## COMMON SPECIES

- Tiger salamander (*A. tigrinum*)
- Barred tiger salamander (*A. mavortium*)
- California tiger salamander (*A. californiense*)
- Mexican tiger salamander (*A. velasci*)
- Spotted salamander (*A. maculatum*)
- Blue-spotted salamander (*A. laterale*)
- Axolotl (*A. mexicanum*)
- Ringed salamander (*A. annulatum*)
- Reticulated flatwoods salamander (*A. cingulatum*)
- Northwestern (brown) salamander (*A. gracile*)
- Jefferson salamander (*A. jeffersonianum*)
- Long-toed salamander (*A. macrodactylum*)
- Marbled salamander (*A. opacum*)
- Mole salamander (*A. talpoideum*)
- Small-mouthed salamander (*A. texanum*)

## ORIGIN

- North America: ranging from southeastern Alaska and southern Canada throughout the continental United States to Mexico

## FREE-RANGING HABITAT

- Larvae are aquatic animals for several months to years, eventually losing gills and becoming terrestrial adults.
- They live in forests, grasslands and marshy areas with soil suitable for burrowing and near ponds or other water for breeding.



# Mole Salamanders Pet Care



Barred tiger salamander (*A. mavortium*)

## VITAL STATISTICS

| | |
|---|---|
| Life span | 12-15 years |
| Adult size | 3-13 inches (7-33 cm) varies per species |

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Tiger salamander (*A. tigrinum*)



John White

Axolotl (*A. mexicanum*)



Stan Shebs

Spotted salamander (*A. maculatum*)



Stan Shebs

Blue-spotted salamander (*A. laterale*)



Northwestern salamander (A. gracile)



Jan Tik

Jefferson salamander (*A. jeffersonianum*)



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## Mole Salamanders

### CAPTIVE HOUSING

- A semi-aquatic vivarium setup with both land and water (required for larval tiger salamanders) is ideal.
- A 10-15 gallon aquarium with a secure wire mesh cover for ventilation and holes in the bottom for drainage is adequate for 1 adult animal, or a 30-gallon aquarium for an adult pair.
- Base substrate can be a 2-inch (5 cm) layer of coarse sand or aquarium gravel. Salamanders may also be housed in bare bottom aquariums.
- Sterile potting soil (without vermiculite), ground coconut, ground cypress or sphagnum or peat moss are acceptable top substrates.
- Top substrates should hold humidity and be 3-4 inches (7-10 cm) deep to allow for burrowing.
- A pump and filter will keep the water clean.
- Full-spectrum light must be available during the day (adjust photoperiod to match native habitat).
- Salamanders often produce much waste, which requires frequent cleaning.
- If not housed in a vivarium, water should be provided in a shallow (1-2 inches [2-5 cm] deep) container with a ramp. This water must be cleaned regularly.
- Daytime temperature should be 65-75°F (18-24°C) with nighttime temperature dropping to 50-60°F (10-15°C) with approximately 70% humidity for most species.
- A temperature gradient should be provided if using supplemental heating (place heat lamp, heat pad under the tank or submersible heater in a jar of water at one end of the enclosure).

## Mole Salamanders

- A vivarium environment will help to stabilize humidity.
- The salamander and enclosure should be misted several times a day.
- Live potted plants, a large shallow water dish and substrate that holds moisture will ensure a humid environment.
- Driftwood, cork bark or rocks should be provided for places to hide.

### RESTRAINT

- Handling should be minimized, as handling may damage the salamander's skin, or use a powder-free latex glove rinsed with water.
- Their skin is sensitive to salt, oil and other products (such as household cleaners) on hands.
- It is necessary to thoroughly wash hands with hot soapy water and rinse well before and after handling the salamander and any cage accessories.
- Use a fish net to capture and manipulate the animal.
- If holding is necessary, the animal can be supported with one hand with the other hand used to ensure the salamander does not fall.

### DIET

- Healthy salamanders have excellent appetites.
- Salamanders are attracted to prey by movement.
- A variety of live prey may be given to ensure a complete and balanced diet. Prey can include crickets, pillbugs, beetles, earthworms, wax worms, night crawlers, small millipedes, small moths and other night-flying insects.



Reticulated flatwoods salamander (*A. cingulatum*)



Long-toed salamander (*A. macrodactylum*)



Mole salamander (*A. talpoideum*)



Small-mouthed salamander (*A. texanum*)



Marbled salamander (*A. opacum*)



Ringed salamander (*A. annulatum*)

Patrick Coin

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Blue-spotted salamander larvae, aquatic stage



Eastern tiger salamander larvae, semi-terrestrial stage



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Occasionally pinky mice may be offered to larger animals.

- Live prey may be purchased or homegrown (e.g., fruit flies, mealworms, beetles, earthworms, whiteworms, crickets). Note that wild-caught insects may contain harmful pesticides.
- Aphids should be fed to newly metamorphosed larvae.
- Salamanders should be fed daily only as much as will be consumed at one time. Do not offer new food until leftovers are consumed.
- Food for non-hibernating species may be dusted in vitamins 2-3 times a week during winter months.

## SUITABILITY AS PETS

- Mole salamanders are hardy animals and interesting creatures to observe.

## BEHAVIOR

- Nocturnal, spend a large amount of time underground
- Cooler climate salamanders hibernate underground.
- Salamanders can be cannibalistic; a small salamander should not be housed with a large one.

## MOST COMMON DISORDERS

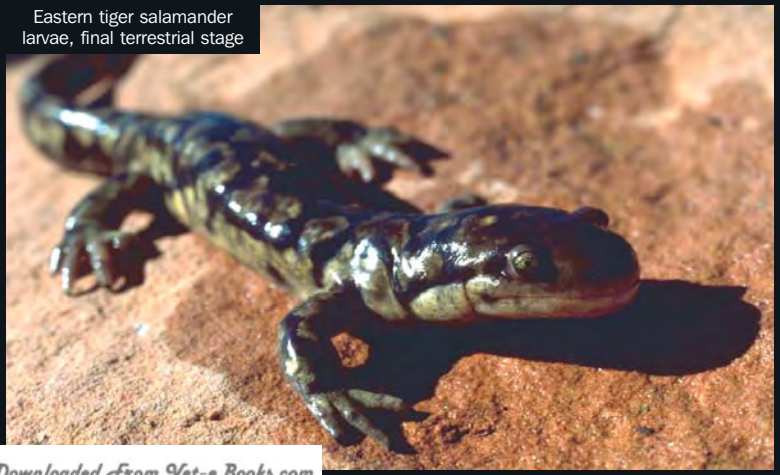
- Vitamin and mineral deficiencies (dietary) affecting growth, nervous system, eyes and gastrointestinal tract
- Obesity
- Infections (wounds), particularly fungal
- Metabolic bone disease
- Parasites

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Eastern tiger salamander larvae, beginning terrestrial stage



Eastern tiger salamander larvae, final terrestrial stage

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# Poison Arrow Frog Pet Care



Blue poison dart frog (*D. azureus*)

## VITAL STATISTICS

| | |
|---|---|
| Life span | 6-10 years |
| Adult size | 15-75 mm (0.5-3 inches) snout to vent |

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## Poison Arrow (Dart) Frogs (*Dendrobates* spp.)

### COMMON SPECIES

- Green and black poison dart frog (*D. auratus*)
- Blue poison dart frog (Okopipi) (*D. azureus*)
- Splash-backed poison dart frog (*D. galactonotus*)
- Mimic poison dart frog (imitator) (*D. imitator*)
- Yellow-banded poison dart frog (*D. leucomelas*)
- Strawberry poison dart frog (*D. pumilio*)
- Rio Madeira poison dart frog (Amazon) (*D. quinquevittatus*)
- Red-backed poison dart frog (*D. reticulatus*)
- Dyeing dart frog (*D. tinctorius*)
- Amazonian poison dart frog (*D. ventrimaculatus*)
- Pasco poison dart frog (*D. lamasi*)
- Many color morphs are known for most species.

### ORIGIN

- Central America, northern and central South America

### FREE-RANGING HABITAT

- Tropical rainforest
- Mostly terrestrial (e.g., *D. auratus, D. azureus, D. leucomelas, D. tinctorius*);
- Some arboreal (e.g., "thumbnails," *D. ventrimaculatus, D. pumilio, D. fantasticus*)
- Some semi-arboreal (e.g., *D. galactonotus*)
- Areas with high temperature, humidity and sunlight (tropics)

## Poison Arrow (Dart) Frogs

### CAPTIVE HOUSING

- Terrestrial species require more ground space than height.
- Arboreal species require tall enclosure with multiple platforms and plant levels.
- Semi-arboreal species prefer a combination.
- 1 male and 1 or 2 females can be housed in a 10-gallon aquarium.
- Multiple frogs may be housed together, but aggression may occur and require separation into pairs.
- Substrate should be gravel or leca balls, covered by moss or a layer of leaf litter.
- An alternative substrate is a mixture of vermiculite-free potting soil, peat and moss free of fungicides.
- 12 hours of full spectrum fluorescent light (no direct sunlight) is necessary each day.
- Temperature should be 70-85°F (21-30°C).
- 60-100% humidity (varies according to species).
- Humidity should be ensured by misting 2-3 times daily, placing live plants in the enclosure and covering the aquarium with plastic.
- An air stone should be provided to help maintain the high humidity.
- Dechlorinated water should be provided in a shallow dish and changed regularly.
- A biological filter is necessary to keep the water clean.
- Air circulation must be maintained.

### ENVIRONMENTAL ENRICHMENT

- Hiding places (e.g., plant leaves, coconut shells or driftwood) and plant cuttings should be provided.



Yellow-banded poison dart frog (*D. leucomelas*)



Green and black poison dart frog (*D. auratus*)



Strawberry poison dart frog (*D. pumilio*)



Splash-backed poison dart frog (*D. galactonotus*)

Clinton and Charles Robertson



Dyeing dart frog (*D. tinctorius*)



Pasco poison dart frog (*D. lamasi*)

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Rocks can provide the needed hiding spots for poison arrow frogs.



Live plants help keep the humidity level high.



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## Poison Arrow (Dart) Frogs

- Live plants that tolerate low light and high humidity enhance the enclosure.

### RESTRAINT

- Handling should be minimized.
- If required, use of powder-free latex gloves rinsed with water would facilitate handling.

### DIET

- In captivity, frogs may be fed live termites, small crickets, green aphids, ants and wingless fruit flies (purchased or home-grown).
- Food should be dusted with vitamin (especially vitamin A) and mineral supplements weekly.

### SUITABILITY AS PETS

- Not recommended for beginners.

### BEHAVIOR

- Diurnal
- Often territorial
- Usually found in groups

### MOST COMMON DISORDERS

- Wounds, especially rostral abrasions
- Chytridiomycosis
- Hypocalcemic tetani (after stress or hypothermia)
- GI problems
- Internal parasites

- Hypovitaminosis A
- Bacterial infections
- Spindly leg syndrome
- Nutritional secondary hypoparathyroidism

## SPECIAL CONSIDERATIONS AND CAUTIONS

- There are several species, each with slightly different care requirements.
- Poison arrow frogs secrete a toxic substance from their skin, which can kill or harm animals and may harm humans.
- Toxicity levels decrease in captivity.
- All species of poison arrow frogs are protected under CITES Appendix II.

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Free-ranging poison arrow frogs are usually found in groups.



Humidity should be ensured by misting 2-3 times each day.

Rolf Kolasch

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# Terrestrial Hermit Crab Pet Care



Australian land hermit crab (*C. variabilis*)

## VITAL STATISTICS

| | |
|---|---|
| Life span | 10-15 years |
| Adult size | From the size of golf balls to tennis balls |

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## Terrestrial Hermit Crabs (*Coenobita* spp.)

### COMMON SPECIES

- Caribbean (purple pincher) hermit crab (*C. clypeatus*)
- Ecuadorian (Pacific) hermit crab (*C. compressus*)
- Rug ("ruggy") hermit crab (*C. rugosus*)
- Red hermit crab (*C. cavipes*)
- Australian land hermit crab (*C. variabilis*)
- Strawberry land hermit crab (*C. perlatus*)
- Purple land hermit crab (*C. purpureus*)

### ORIGIN

- Costal areas of the Caribbean, eastern Pacific and Australopacific regions

### FREE-RANGING HABITAT

- Warm, tropical climates

### CAPTIVE HOUSING

- A 10-gallon glass aquarium with a solid glass lid is an ideal enclosure to maintain a high humidity environment and provide enough room for several small crabs.
- Small plastic containers sold in pet stores as hermit crab kits are generally too small.
- Marine aquarium coral rock sand and gravel are the recommended substrates and may reduce the risk of molting problems.
- A finely ground coconut fiber-based bedding for reptiles (e.g., Forest Bedding) may be used during molting.

- Wood shavings should be avoided.
- Many hermit crabs prefer to dig in moist substrate.
- Full spectrum light and basking lights are beneficial.
- Land hermit crabs need a warm, humid environment to survive: the temperature should be no lower than 72°F (22°C) with humidity of at least 70-80%.
- A natural sponge may help disperse humidity in the aquarium.

## ENVIRONMENTAL ENRICHMENT

- Owners must provide progressively larger shells as the hermit crab grows.
- Dried choya wood, driftwood, coral and barnacles provide stimulating toys for crabs.
- Hiding places, such as half logs, are necessary additions.

## RESTRAINT

- To pick up a crab, grasp the back of its shell.
- Use of thin gloves may reduce the chance of being pinched.

## DIET

- Free-ranging hermit crabs are omnivorous.
- Commercial crab diets are available.
- Fresh fruits and vegetables may be given as treats.
- A bowl of fresh dechlorinized water and a bowl of salt water (using commercial marine aquarium salt) should be available at all times. Water should be changed often.
- Water must not be deeper than the smallest crab (no deeper than 1" [2.54 cm]).


Ecuadorian hermit crab (*C. compressus*)


Caribbean hermit crab (*C. clypeatus*)


Rug hermit crab (*C. rugosus*)


Purple land hermit crab (*C. purpureus*)


Red hermit crab (*C. cavipes*)


Strawberry land hermit crab (*C. perlatus*)

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A finely ground coconut fiber-based substrate may be used during molting.




Bark and driftwood should be provided for hiding places.



Hiding places are necessary for crabs.



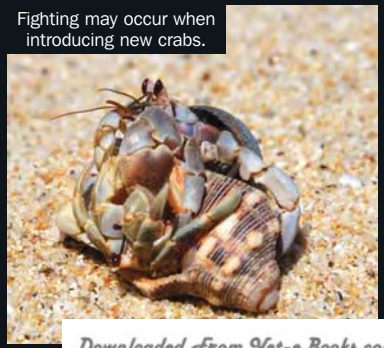
Various sized shells should be provided for growth.



A hermit crabs changing shells.



Fighting may occur when introducing new crabs.



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## SUITABILITY AS PETS

- Land hermit crabs are interesting, active and curious and have distinct personalities.
- Their unique characteristics and low maintenance make them good pets.

## BEHAVIOR

- Nocturnal
- Land hermit crabs are gregarious and like to be around other hermit crabs; however, introducing a new individual must be done with care because fighting may occur between different sized crabs.

## MOLTING

- Most hermit crabs molt (shed their skin) at least once every 18 months.
- A smaller isolation tank with at least 6” (15 cm) of coconut fiber-based substrate may be set up for the crab before molting occurs.
- Signs that a molt is about to happen include: healthy crabs digging more than usual, missing limbs and new claws behind the old skin.
- Molting food should be rich in calcium (e.g., cuttlebone, sand dollars, sea biscuits, Calci-Sand®).
- A molting crab should be left undisturbed.
- A molting crab may appear to be dead, because the exoskeleton falls from the shell.
- The crab will usually eat its old skin.
- The crab may be returned to its original home, once it is walking around and has eaten some of his exoskeleton.

## PHYSICAL CHARACTERISTICS

- A healthy land hermit crab has 3 pairs of walking legs, an undamaged shell covering the head and thorax, a lively attitude and no evidence of parasites.
- A musty smell and discharge of a brown liquid may indicate an environment that is too hot.

## MOST COMMON DISORDERS

- Slow growth due to inadequate shells to move into
- Parasites
- Problems caused by bacteria, toxic algae and fungi
- Dehydration

## SPECIAL CONSIDERATIONS AND CAUTIONS

- Crabs are very sensitive to metal, chlorine and ivermectin.
- Crabs may pinch if frightened.
- Crabs might benefit from weekly bathing.

## REFERENCES AND FURTHER READING

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# Madagascar Hissing Cockroach Pet Care



## VITAL STATISTICS

| | |
|---|---|
| Life span | 2-5 years |
| Adult size | Up to 10 cm (4 inches) |
| Body weight | 24 g (0.8 oz) |

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## Madagascar Hissing Cockroaches (*Gromphadorhina portentosa*)

### ORIGIN

- Madagascar

### FREE-RANGING HABITAT

- Madagascar hissing cockroaches live on the ground in rotting logs of tropical forests.

### CAPTIVE HOUSING

- A 15-20 gallon all-glass aquarium is suitable for several pet hissing cockroaches.
- A secure glass or mesh lid should cover the aquarium to protect them from other pets or to prevent escape. A heavy (1" [2.54 cm]) layer of petroleum jelly can be applied around the top inside edge of the aquarium to help prevent escape; cockroaches can easily climb vertical glass walls but they will not walk through the jelly.
- Because the adults won't eat the young nymphs, all ages can live together in the same enclosure.
- Vermiculite, aspen or pine shavings should be used at a depth of 1½ inches (4 cm) in order to absorb water and feces. Cedar chips should not be used as a substrate.
- Because their feces do not have an odor, individuals raised for food can be housed together in one enclosure.
- Hissing cockroaches prefer warm temperatures of 75-85°F (24-30°C) and high relative humidity (75-80%).
- High humidity can be maintained by daily misting.

## ENVIRONMENTAL ENRICHMENT

- Hissing cockroaches need hiding places in the enclosure, such as non-toxic plants, rocks, branches, driftwood, logs or cork or paper towel tubing.
- Stacked paper egg crates can be used for hiding and climbing.

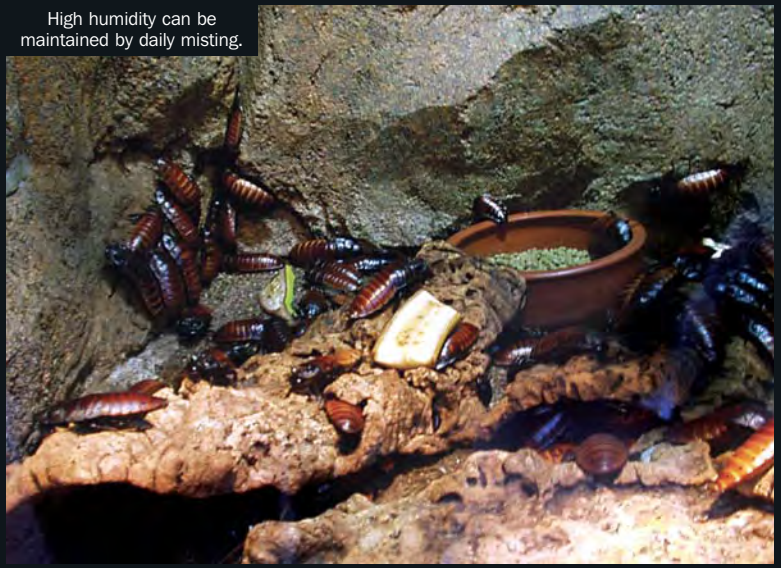
## DIET

- Cockroaches are omnivores and eat almost anything organic.
- Free-ranging roaches eat fruit and dead animal matter.
- In captivity, they thrive best on fresh dark leafy green and dark yellow vegetables and dry dog biscuits or chicken or fish food.
- Water must be available at all times but provision must be available to prevent drowning. Options include wet paper towels changed daily, a crock bowl with rocks or a synthetic material (to reduce mold) or a chick waterer with a circular piece of sponge.

## SUITABILITY AS PETS

- Hissing cockroaches are unique and interesting pets that can be handled by children because they are docile and don't bite.
- They are also raised as food items for some reptiles.
- While being handled, they may hiss loudly (but harmlessly), which accounts for their name.
- They are slow-moving and easy to handle.
- They are hardy and resilient and won't die quickly if left without food.

High humidity can be maintained by daily misting.



Branches and rocks provide great hiding places for hissing cockroaches.



Aspen or pine shavings can be used to absorb water and feces.

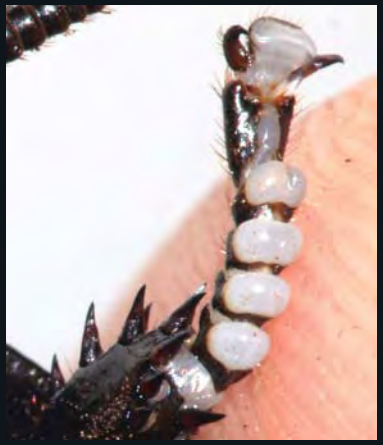


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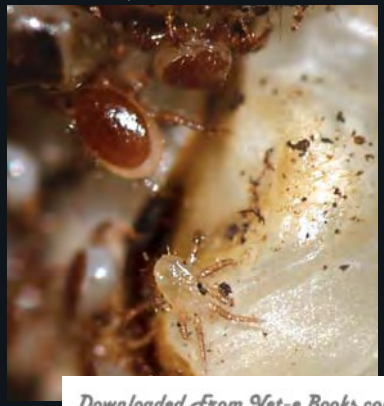
A close up of the cercusp of a hissing cockroach.



A close up of the leg of a hissing cockroach.



*Androlaelaps schaeferi* is a mite that lives on the hissing cockroach that takes part in its host's meal.



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## Hissing Cockroaches

### BEHAVIOR

- The characteristic hissing sound is made by expelling air through a pair of abdominal breathing pores (spiracles).
- Active mostly at night.

### PHYSICAL CHARACTERISTICS

- The hissing cockroach resembles a large beetle with a hard exoskeleton, shiny upper surface and lack of wings. The body is a dark chocolate brown with orange markings on the abdomen.
- Hissing cockroaches differ from most other cockroaches because they give birth to live offspring.
- Males have large horns on the prothorax and thicker hair on their antennae.
- Females have a relatively flat prothorax and smooth antennae.
- Unlike most cockroaches, they are wingless.

### MOST COMMON DISORDERS

- Mites (*Androlaelaps schaeferi,* also referred to as *Gromphadorholaelaps schaeferi*), usually concentrated between the host's legs and around the spiracles.
- Problems associated with not keeping environment warm

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# Hedgehogs (*Atelerix albiventris*/ *Erinaceus europaeus*)

By **Cathy Johnson-Delaney**, DVM,
Dipl ABVP-Avian Practice

## COMMON SPECIES

- African pygmy hedgehog (*Atelerix albiventris*)
  Several colorations have evolved, including animals with white and gray/brown ticked quills ("chocolate" commonly referred to as "salt and pepper") and white quills ("snowflake").
- European hedgehog (*Erinaceus europaeus*)

## PET APPEAL AND BEHAVIOR

- African pygmy hedgehogs' behavior is generally that of non-domesticated animals.
- While many young hedgehogs do not mind being held, many adults (especially males) resist handling and struggle to be free.
- Many adults do not interact with humans no matter how much handling they received when they were young.
- Very few hedgehogs bite, but they might "puff up," and adult males may hiss.
- Hedgehogs are nocturnal.
- If they are allowed freedom in the home, they tend to hide in corners or under furniture.
- Many hedgehogs dig in carpets, houseplants and dirt, and will forage for spiders and insects indoors.

# Hedgehog Pet Care*



© Sean Sosik-Hamor / HamorHollow.com

## VITAL STATISTICS

| | |
|---|---|
| Average life span (African) | 3-5 years (6-10 recorded in captivity) |
| Adult size | 6-14 inches (16-35 cm) |
| Adult body weight | |
| African (male) | 800-1200 g |
| African (female) | 250-400 g |
| European (male) | 500-600 g |
| European (female) | 400-800 g |
| Dental formula | I 3/2, C 1/1, P 3/2, M 3/3 = 36 |
| Rectal temp | |
| African | 36.1-37.2°C (97-99°F) |
| European | 35.1°C (95.2°F) |
| Sexual maturity | >2 months |
| Breeding | Year-round |
| Clutch size | 1-7 pups (avg 3) |
| Birth weight | 8-13 g (depending on litter/dam size = avg 10 g) |
| Gestation | 34-37 days |
| Weaning age | 4-6 weeks of age |

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European hedgehog (*Erinaceus europaeus*)



African pygmy hedgehog (*Atelerix albiventris*) chocolate or "salt and pepper" color



African pygmy hedgehog (*Atelerix albiventris*) albino color



Algerian hedgehog (*Atelerix algirus*) chocolate color





Plastic and paper tubes provide environmental enrichment for hedgehogs.



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## Hedgehogs

- When encountering something new in the environment, a hedgehog may "taste" it, then begin hypersalivating and create a foam, which is then spit onto itself.
- European hedgehogs hibernate; African pygmy hedgehogs do not.

### HOUSING

- Hedgehogs are solitary animals, except for mating, and usually must be housed individually.
- A smooth-walled enclosure is preferred over wire and must be high enough to prevent escape.
- A 20-gallon or larger size aquarium is acceptable.
- The optimum environmental temperature is 75-85°F (24-30°C). Supplemental heat may be necessary under one section of the enclosure.
- Preferred bedding is newspaper or recycled pelleted/absorbable material, which should be changed frequently and kept dry. Cedar shavings should be avoided.
- Most hedgehogs prefer quiet, dim environments and may react with fright at loud noises or bright sunlight.

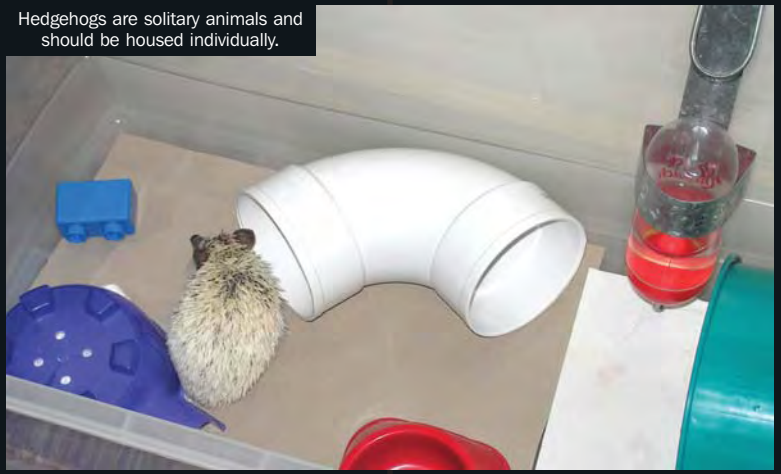
### ENVIRONMENTAL ENRICHMENT

- Environmental enrichment should include a hiding place, such as a cut-out box, plastic log or flower pot.
- Hedgehogs will use an exercise wheel with a solid floor.
- A pan or shallow tub with warm water in a warm ambient temperature may be provided for swimming.
- For bathing, a mild pet shampoo safe for kittens or ferrets is suitable. The hedgehog should be kept in a warmed environment post-bathing until the fur is dry.

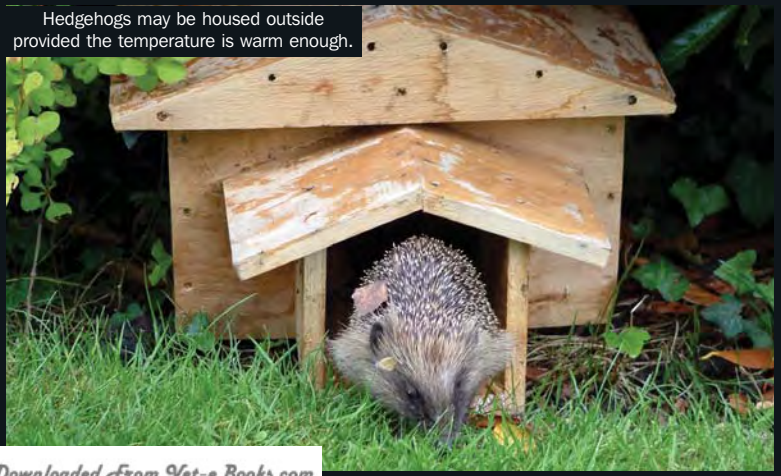
## DIET

- Free-ranging hedgehogs are insectivore/omnivores.
- Captive diets should be relatively high in protein and low in fat (see below for diet choices).
- Commercial complete hedgehog diets should be used if available. Cat or dog foods alone do not seem to be adequate as the sole diet component.
- To introduce individuals to new diets, mix new foods gradually into the old. It helps to have all pieces of the new and old diets the same size and relative consistency.
- To minimize obesity, ad lib feeding of adult hedgehogs should be discouraged. Feed a portion size in the evening that is almost completely consumed by morning. Only a small amount of food should be given during the day.
- Younger hedgies may eat an adult quantity, depending on their stage of life and activity.
- Water should be available at all times; many hedgehogs will use a water bottle or drink from a low dish or crock.
- **Diet Choice No. 1** (for one 550 g BW adult per day)
  - 1 heaping tsp bird of prey diet or insectivore diet
  - 1.5 heaping tsp high quality cat chow*
  - 1 heaping tsp fruit/vegetable mixture**
  - 6-10 small mealworms or 1-2 crickets*** (more if pregnant or lactating)
- **Diet Choice No. 2** (for one adult per day)
  - 3 heaping tsp high quality low calorie cat chow
  - 1 heaping tsp fruit/vegetable mix
  - 6 small mealworms or 1-2 crickets***
- **Diet Choice No. 3** (for one adult per day)
  - 3-4 tsp commercial insectivore diet
  - 5-6 mealworms or 1-2 crickets***

Hedgehogs are solitary animals and should be housed individually.



Hedgehogs may be housed outside provided the temperature is warm enough.



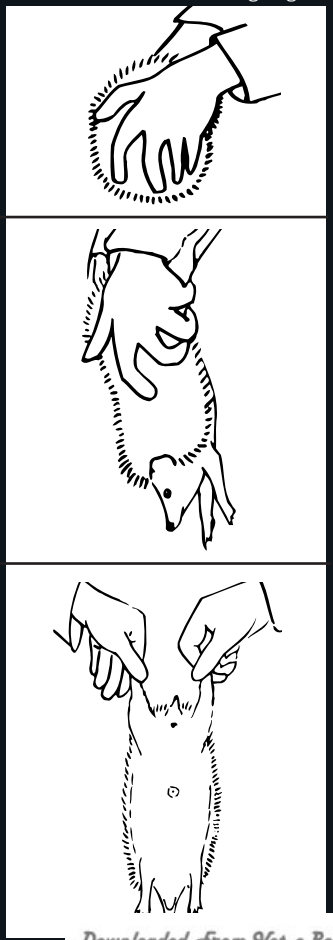
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| HEMATOLOGIC REFERENCE RANGES* | |
|---|---|
| Basophils | 0.096-0.45 x $10^3$/ml |
| Eosinophils | 0.36-2.4 x $10^3$/ml |
| Hematocrit | 36.0-38.5% |
| Hemoglobin | 12.0-13.2 g/dl |
| Lymphocytes | 3.72-6.14 x $10^3$/ml |
| MCH | 16.8-18.2 pg |
| MCHC | 33.3-35.2 g/dl |
| MCV | 49.1-53.2 (fL) |
| Monocytes | 0-0.084 x $10^3$/ml |
| Neutrophils | 1.6-2.8 x $10^3$/ml |
| Platelets | 230-430 x $10^3$/ml |
| RBC | 7.03-7.64 x $10^6$/ml |
| Reticulocytes | 8-14% |
| WBC | 6.3-9.6 x $10^3$/ml |

| BIOCHEMISTRY REFERENCE RANGES* | |
|---|---|
| BUN | 13.3-15.0 mmol/L |
| Calcium | 2.0-2.3 mmol/L |
| Phosphorus | 2.0-3.8 mmol/L |
| Potassium | 3.6-5.1 mmol/L |
| Serum protein | 5.1-7.2 g/100 ml |
| Sodium | 132-138 mmol/L |

*European hedgehog

One method to unroll a hedgehog.



m Beynon PG, Cooper JE (eds): BSAVA Manual of Exotic Pets. Cheltenham, BSAVA, 1991, and used with permission.

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* Young or pregnant/lactating hedgehogs can use kitten or ferret formulations; adults may use "lite" adult cat foods.

** Fruit/vegetable mix: chop together ½ tsp diced leafy dark greens (spinach, kale, leaf lettuce), ¼ tsp diced carrot, ¼ tsp diced apple, ¼ tsp diced banana, ¼ tsp diced grape or raisin, ¼ tsp vitamin/mineral powder (Vionate® or crushed feline vitamin tab).

*** Mealworms are high calorie, low calcium and should be limited to 2-3x a week. Crickets can be fed insectivore diet plus some of the fruit/vegetable mixture for a minimum of 3 days after purchase before being fed to the hedgehog. Other types of commercially available insects can also be fed.

## SEXING AND REPRODUCTION

- Males have a mid-ventral penis, and the testicles are located in a para-anal recess on the caudal abdomen.
- The spines develop within 24 hours and the eyes are open 13-16 days after birth.
- Puppy/kitten milk replacement may be used for orphans.
- Cannibalism is common if the female is stressed.
- The male should be removed prior to parturition.

## RESTRAINT

- Examination is best done in subdued light, and loud noises should be eliminated.
- The hedgehog can be placed on a towel for the exam; lightweight leather gloves may be needed.
- A clear acrylic "ferret tunnel" may be useful in an exam; a pediatric stethoscope may be slid under the hedgehog.

- Some hedgehogs uncurl with back stroking of their rump spines.
- Gentle but firm slow rolling of the mantle outward with the animal on its back may provide the opportunity to access the nail tip or perform an oral exam.
- Another trick to unball a hedgehog during a routine physical examination is to run some warm water over the animal in a sink.
- Some hedgehogs may need to be anesthetized with isoflurane.

## PREVENTIVE CARE

- Obesity is the most common disorder of captive hedgehogs. Hedgehogs should be weighed at least monthly.
- Dental prophylaxis should consist of routine brushing and scaling.
- The nails need periodic trimming.
- The primary husbandry consideration is to prevent chilling by providing a heated environment with dry bedding.

## FIRST VISIT/ANNUAL EXAMINATION

- Review diet, husbandry, habitat, behavior, methods for handling
- Physical examination: include weight, visual inspection, auscultation, oral exam, body temperature, palpation, digit exam
- Fecal flotation and direct smear
- Optional (depending on history):
  - Salmonella culture & screen
  - (Under isoflurane anesthesia): toe nail trim, skin

Commercial hedgehog diets may be used as long as the main ingredient is a meat source.



Thomas Bankstahl, DVM

Hedgehogs will often roll into a tight ball with all of the spines pointing outward as a defense mechanism.



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A wire mesh top may be used as an aid when trimming nails.

Dan Johnson, DVM



Blood collection from the cranial vena cava. Anesthesia is required when using this technique.

lo Selleri, Dr med vet

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scraping, ear examination, fungal exam, culture, full dental examination, scaling, CBC, chemistry panel, radiographs, ultrasonography

- Microchip transponder implantation is recommended for permanent identification

## DENTAL CARE FOR HEDGEHOGS

- The poultry or malt flavor CET brand pet toothpaste may be useful. It can be applied to the teeth with a cotton-tipped applicator or put on the hedgehog's favorite crunchy snack to dissolve off tartar and plaque from the teeth.
- The teeth should be scaled, polished and fluoridated under sedation.
- The hedgehog may be given 1-2 small "tartar control" dog food snack pieces a day.
- Tartar control snack foods work because of the sodium hexametaphosphate coating of the food that helps prevent tartar, plaque and calculus buildup.
- The secondary dentition is complete within a year.
- In older animals, the teeth are worn down at a comparatively early age.

## BLOOD COLLECTION SITES

- Lateral saphenous vein (crosses below the stifle)
- Cephalic vein (dorsum of the forearm)
- Jugular vein
- Cranial vena cava
- If all else fails, toenail clip (1-2 hematocrit tubes and a smear)

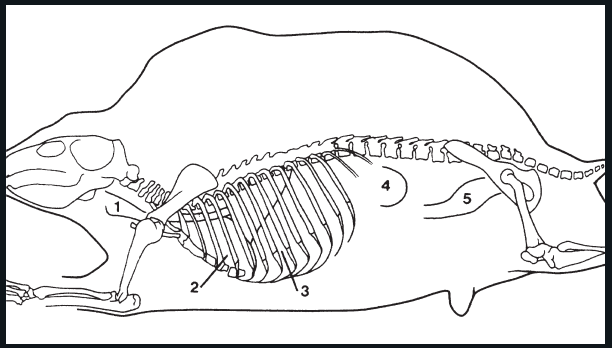
- Injection sites:
  - SC - Back, flank; be aware of fat layers; fluids may be slowly absorbed; large volumes (up to 100 ml/kg) possible
  - IM - Thigh, mantle (orbicularis)
  - IV - Lateral saphenous, jugular via catheter

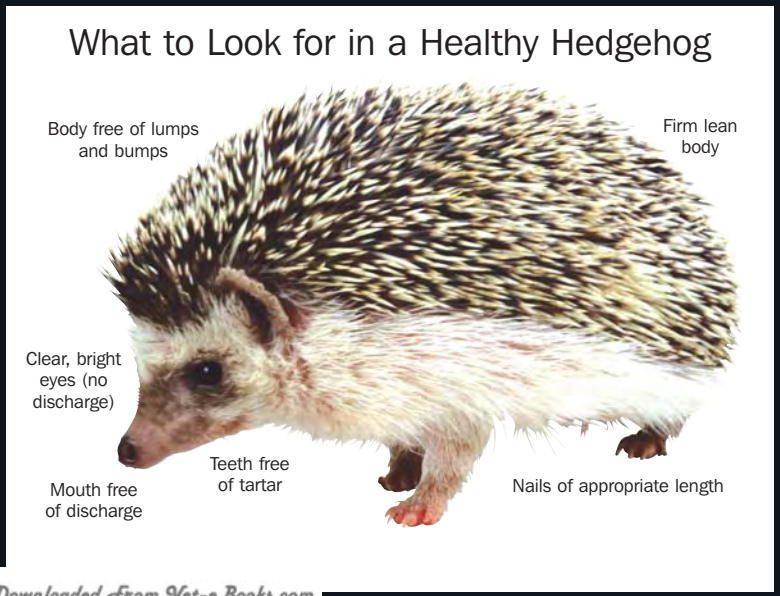
## RADIOGRAPHY

- In the normal lateral radiographic appearance of a European hedgehog, various organs, such as the trachea (1), heart (2), liver (3), kidney (4), a few gas or feces-filled intestinal loops and the rectum (5) may be visible.
- It is helpful to retract skin and spines dorsally using paper clamps or allis forceps to minimize spine artifact.
- In a ventrodorsal projection, differentiation between individual organs is more difficult due to superimposition of the muscle packets of the orbicular muscles, the cutis and the spines.

## SURGERY

- Neutering requires the abdominal approach.
- A fair amount of fat may surround the vas deferens and testicles.
- Ovariohysterectomy is performed as in other small mammals.
- There may be some peri-ovarian and uterine fat.




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Mites are a common problem with hedgehogs.



This hedgehog was presented with a swollen penis and was diagnosed with paraphimosis.



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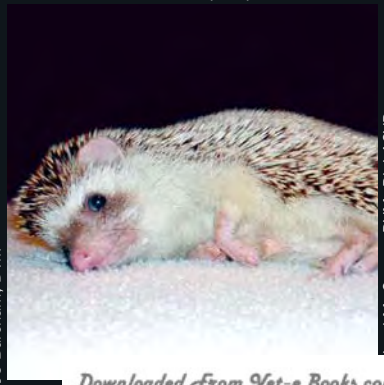
© Sean Sosik-Hamor / HamorHollow.com

Hedgehog with uterine cancer.



JC Burcham, DVM

Hedgehogs with advanced CNS lesions of wobbly hedgehog syndrome are usually recumbent but alert upon presentation.



hael M. Garner, DVM, Dipl ACVP

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## COMMON CLINICAL CONDITIONS

- Obesity
- Dental: gingivitis, periodontitis
- Neoplasia: high tumor rate in animals over 3 years of age; most common: mammary tumors (malignant, large, subcutaneous swelling along ventral thorax, abdomen); lymphosarcoma (multicentric or alimentary); oral squamous cell carcinoma. Neoplasia is usually malignant with poor prognosis
- Salmonella
- Trauma
- Dermatitis (chorioptic mange mites, fungal, bacterial)
- Fatty liver, hepatitis
- Pneumonia
- Intestinal parasites
- Heart disease
- Neurologic disease, including wobbly hedgehog syndrome

## SPECIAL CONSIDERATIONS

- The legality of keeping hedgehogs varies. Consult local animal regulations regarding permits or licenses.

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# Domestic Mice (*Mus musculus*)

By **Susan Leck**, DVM, Dipl ABVP-Canine & Feline

## PET APPEAL

- Mice are easy to keep as pets because of their small size and their minimal requirements for space and attention.
- Although naturally timid, a bond with humans may be formed with daily interaction and regular gentle handling.
- Mice may bite if they are handled roughly or startled and may become aggravated when restrained.

## BEHAVIOR

- Mice are territorial; males will initially fight when placed together, and females with litters may defend their nests.
- Mice that have been housed alone are more likely to fight when introduced to other mice.

## HOUSING

- Mice can thrive in captivity as long as they are not over-crowded or overheated.
- The recommend size for an enclosure for one adult should be 24" x 24" x 12" high (61 x 61 x 30 cm).
- Females with litters require 2-3 times more space.
- The enclosure must be able to accommodate a nesting area, feeding area and exercise wheel.
- The housing must be escape proof with a secure lid.
- Glass aquariums are not recommended, because they can overheat rapidly and provide poor ventilation.
- Suitable substrates include shredded paper (non-inked), recycled newspaper composite materials or pellets,



# Mouse Pet Care*



Normal domestic mouse

Normal hairless mouse

Robert E. Schmidt, DVM, PhD, Dipl ACVP

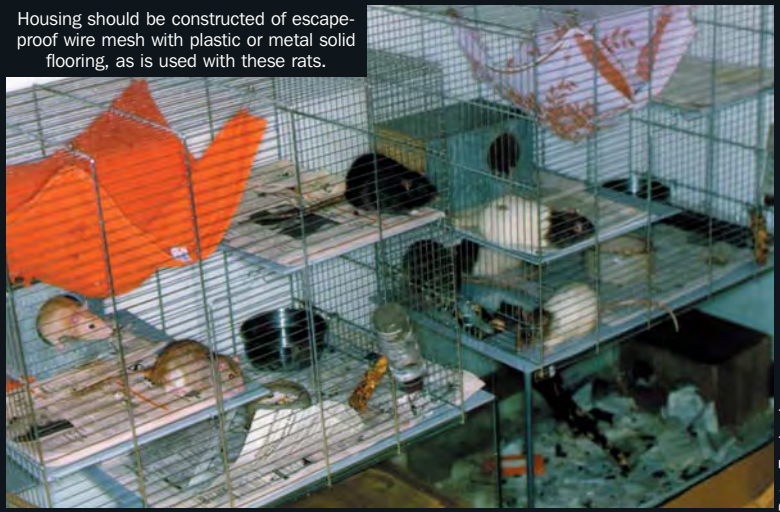
## VITAL STATISTICS

| | | |
|---|---|---|
| Average life span | | 1.5-2 years |
| Adult body weight | Male | 20-40 g |
| | Female | 25-40 g |
| Rectal/body temperature | | 101-102°F (38-39°C) |
| Respiratory rate | | 60-220 breaths/min |
| Heart rate | | 325-780 beats/min |
| Dental formula | | 1/1 incisors, 3/3 molars |
| Breeding onset | | 50-60 days |
| Litter size | | 10-12 |

*Adapted from Exotic DVM Volume 8.1 © Zoological Education Network, 2006

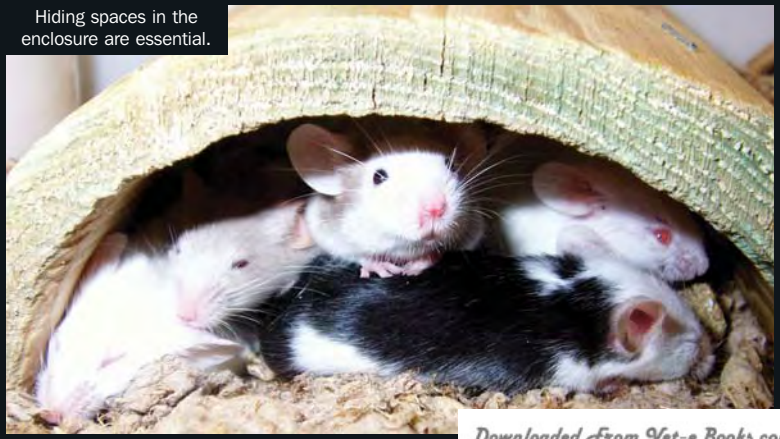
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Housing should be constructed of escape-proof wire mesh with plastic or metal solid flooring, as is used with these rats.



Petra Tresbach

Hiding spaces in the enclosure are essential.



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hardwood chips or shavings and compressed wheat straw. Substrate should be changed once or twice weekly in order to keep the cage as odor free as possible.

- Cedar chips should be avoided, as they may be toxic.
- Additional materials (e.g., paper towels, socks, mittens) may be added to the enclosure for nesting.
- The temperature should be 65-80°F (18-26°C) with a relative humidity between 30-70%.
- For activity, mice like to explore tubes, play with toilet paper rolls, gnaw on items and run in an exercise wheel.

## DIET

- Domestic mice should be fed a commercial pelleted mouse feed (>14% protein, ideally 20-24%).
- Breeding adults and youngsters may require additional calories.
- Pellets may be softened for baby mice, which will begin eating them around 2 weeks of age.
- Seed diets are not recommended; mice are often victims of obesity, starvation and malnutrition from all-seed diets.
- Sipper tubes or water bottles may be used. The water must be changed routinely and the tip checked to ensure it is flowing and free of obstruction.

## RESTRAINT

- The mouse may be grasped by the skin at the base of the neck and the base of the tail for restraint.
- Grasping the tip of the tail may cause degloving.
- A mouse may be accustomed to climbing onto hands, but one must ensure that it does not jump and fall off.

## Domestic Mice

### SEXING

- The male has a scrotum and longer anogenital distance than the female.

### BLOOD COLLECTION

- The tail may be warmed to enlarge the ventral artery for blood collection.
- The cranial vena cava is also a feasible blood collection site in mice.

### INJECTION SITES

- A 25- to 27-gauge needle may be used for injections.
  - IM: 0.05 ml volume in the quadriceps
  - SC 2-3 ml volume in the skin over the neck and thorax
  - IV: ventral tail vein

### ANESTHESIA PROTOCOLS

- The preferred method for isoflurane induction is to create a miniature tank by placing the mouse in a small animal anesthesia face mask and covering the opening.
- Isoflurane can be used to effect.

### RADIOGRAPHIC POSITIONING

- The patient is anesthetized and secured with masking tape in either a DV (preferable to VD to minimize rotation) or lateral orientation.

The over-the-back grip for restraint works well for this gerbil and mice as well.



A mouse may be restrained by grasping the neck and tail base.



Peter Fisher, DVM

One-handed restraint of a mouse for injections or blood collection.



**HEMATOLOGIC REFERENCE RANGES***

| | |
|---|---|
| PCV (%) | 27 (18-40) |
| RBC ($10^6$/ml) | 0.73 (0.46-0.99) |
| Hgb (g/dl) | 5.8 (3.6-8.2) |
| MCV (fl) | 308 (242-391) |
| MCH (pg) | 87 (78-95) |
| MCHC (g/dl) | 28 (20-36) |
| WBC ($10^3$/ml) | 11 (4-32) |

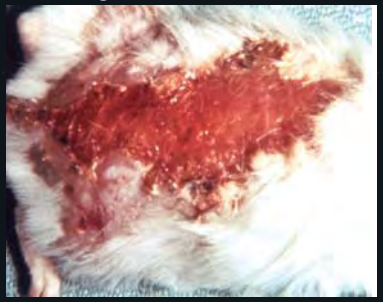
* Johnson-Delaney C: Small rodents. In Exotic Companion Medicine Handbook. Lake Worth, Zoological Education Network, 2000.

**BIOCHEMISTRY REFERENCE RANGES***

| | |
|---|---|
| AP (IU/L) | 98 (53-164) |
| ALT (IU/L) | 3 |
| AST (IU/L) | 37 (14-81) |
| Bilirubin, total (mg/dl) | 0.3 (0.1-0.7) |
| BUN (mg/dl) | 3 (1-4) |
| Calcium (mg/dl) | 11.3 (8.6-14.1) |
| Chloride (mEq/L) | 126 (111-135) |
| Cholesterol (mg/dl) | 317 (306-328) |
| Creatine kinase (IU/L) | 2003 (556-3454) |
| Creatinine (mg/dL) | 0.3 (0.2-0.4) |
| Glucose (mg/dL) | 184 (102-248) |
| LDH (IU/L) | 639 (197-1235) |
| Phosphorus (mg/dL) | 4.5 (1.3-10) |
| Potassium (mEq/L) | 3.7 (3-4.6) |
| Protein, total (g/dL) | 5.2 (3.1-8) |
| Albumin (g/dL) | 1.6 (0.9-2.4) |
| Globulin (g/dL) | 2.6 (2.2-4.6) |
| Sodium (mEq/L) | 173 |
| Uric acid (mg/dL) | 3.8 (2.6-5.6) |

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Fight wounds on a mouse.



Mouse with ectromelia virus.



Pinworms seen through the dilated intestinal wall.



Mouse viral hepatitis.



Chronic murine pneumonia from chronic mycoplasmosis.



Pathology photographs provided by Robert E. Schmidt, DVM, PhD, Dipl ACVP

Mouse with alopecia.



Agnieszka Drohobycka

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## WHAT EVERY OWNER SHOULD KNOW

- A child should not be responsible for the feeding and care of a pet mouse.
- Small children may handle the mouse too roughly or drop it, resulting in trauma.
- Common household dangers include predators, such as dogs, cats and ferrets.
- Mice should be prevented from accessing pesticides and other toxins.
- They should be protected from overheating.

## COMMON DISORDERS OF DOMESTIC MICE

- Obesity
- Ectoparasitism
- Epizootic diarrhea of infant mice
- Alopecia
- Barbering
- Chronic respiratory disease
- Pinworms
- Neoplasia
- Malocclusion
- Heat stress
- Viral infections
- Malnutrition
- Trauma, bite wounds
- Toxicities/poisoning
- Giardiasis
- Salmonellosis
- Mouse pox

# Egyptian Spiny Mice (*Acomys cahirinus cahirinus*)

By **Thomas Ryan**, DVM, Dipl ABVP-Avian

- Several captive mice species are referred to as spiny mice, but the most common are Egyptian spiny mice.
- The name “spiny” comes from the fact that the hair coat is modified into coarse bristle-like spines, similar to hedgehog spines, which are believed to serve as a defense against predators.
- Free-ranging spiny mice are golden brown with a lighter-colored underside and light patches underneath the eyes and behind the ears. Their spines can be black or tan.

## ORIGIN

- Their native habitat includes the deserts and rocky savannahs of Africa, the Middle East, India, Crete and Cyprus where they live in cracked soil, rock crevices and gerbil burrows. They are generally nocturnal.

## PET APPEAL AND BEHAVIOR

- This elegant little mouse has a calm temperament, general good nature and attractiveness.
- Relative to the domestic mouse, the spiny mouse is believed to be more intelligent and more sociable; it has little or no odor and a longer life span. If it is handled regularly, it makes an excellent, docile pet.
- Spiny mice are very social animals, and removing them from their social family is stressful.



Olaf Leillinger

## VITAL STATISTICS

| | | | |
|---|---|---|---|
| Average captive life span | up to 5 years | Breeding onset | 50-60 days |
| Adult body weight | 60-90 g | Breeding season | twice yearly: spring and summer |
| Adult size | head and body 12 cm (5 inches)<br>tail 12 cm (5 inches) | Litter size | 2-5 |

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Spiny mice are very social animals.



Mary Beth Finocchiaro - www.spinymice.com

Hiding spaces are essential for a sense of security.



gan McCluskey www.thebettabubble.com/spiny

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## Egyptian Spiny Mice

- They are most active early in the day, late afternoon and evening.

### ENVIRONMENTAL ENRICHMENT

- Because they are desert animals, spiny mice require a warmer temperature and lower humidity in captivity than do most other mice.
- The temperature should be 80-90°F (26-32°C) with a relative humidity between 30-70%.
- They are not acclimated to cooler climates and can easily become ill or even die if they are not provided with supplemental heat in the home, such as a cage warmer or a small heating lamp.
- The enclosure size is similar to that of a domestic mouse.
- Spiny mice are social animals that normally live in groups and should not be housed alone, although certain individuals can be very territorial.
- The enclosure must be secure to prevent escape.
- These are particularly active rodents that enjoy multi-level enclosures, non-toxic branches and rocks for climbing.
- A metal hamster running wheel with solid flooring should be provided.
- Because they are excellent chewers, plastic products should not be used in the enclosure. Wooden blocks and leather chew toys are good for enrichment.
- Hiding spaces (e.g., hide boxes) in the enclosure are essential.

## Egyptian Spiny Mice

### DIET

- Spiny mice are omnivorous; they prefer to eat plant matter but adapt to anything edible.
- In the wild they compete for sources of food with the *Mus musculus* and gerbils.
- In captivity, standard mouse chow is recommended with some supplementation with grains and vegetables.
- They enjoy mealworms as a treat.
- Their diet may require more protein than domestic mice.
- Because obesity is a major problem with these rodents, it is important not to overfeed nuts, fruits or high-fat treats and grains. Seeds and high sugar content should be avoided.

### TAIL

- A spiny mouse's tail is hairless with large conspicuous scales.
- The tail is delicate and can break off in crowded conditions or can suffer a degloving wound by inappropriate restraint.
- When the spiny mouse's tail is removed, it will not grow back again.

### COMMON DISORDERS OF EGYPTIAN SPINY MICE

- Obesity (diet too rich, inadequate exercise)
- Diabetes with or without pancreatitis (extremely common—any ill spiny mouse over 2 years of age should have a blood glucose level evaluated).

Mice enjoy foraging for food hidden in a cardboard tube.

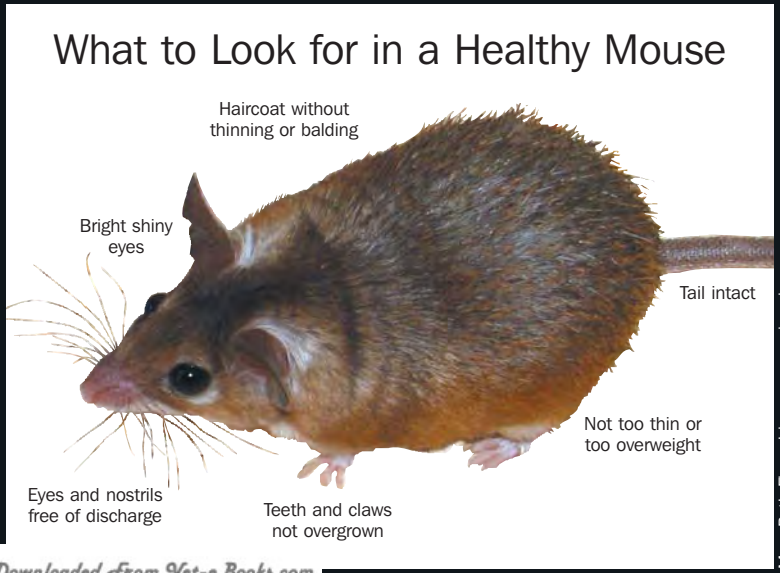


Mary Beth Finocchiaro - www.spinymice.com

Tail biting and amputation are very common in spiny mice and may be due to stress, overcrowding or lack of protein in the diet.



Megan McCluskey www.thebettabubble.com/spiny




Mary Beth Finocchiaro - www.spinymice.com

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| FORMULARY FOR DOMESTIC MICE (*Mus musculus*)[2,3] | |
|---|---|
| Acepromazine | 0.75 mg/kg IM |
| Amikacin | 10 mg/kg q8-12h IM, SC |
| Atropine | 0.05-0.4 mg/kg IM, SC |
| Buprenorphine | 0.05-0.1 mg/kg q6-12h SC |
| Cephalosporin | 30 mg/kg q12h SC |
| Chlortetracycline | 25 mg/kg q12h IM, SC |
| Cimetidine | 5-10 mg/kg q12h |
| Ciprofloxacin | 10 mg/kg q12h PO |
| Dexamethasone | 0.1-0.6 mg/kg IM |
| Diazepam | 5 mg/kg IP |
| Doxycycline | 2.5 mg/kg q12h PO |
| Enrofloxacin | 5-10 mg/kg q12h PO |
| Fenbendazole | 20 mg/kg q24h PO x 5 days |
| Furosemide | 5-10 mg/kg q12h |
| Griseofulvin | 25 mg/kg q24h PO x 14 days |
| Isoflurane | Induction: 5%; Maintenance: 3-5% |
| Ivermectin | 200-500 μg/kg PO, SC, topical |
| Ketamine 2.5-5% | 30-50 mg/kg IM |
| Meperidine | 1-2 mg/kg q2-3h IM, SC, IP |
| Metoclopramide | 0.5 mg/kg q8h SC PRN |
| Metronidazole | 30-40 mg/kg q8-12h PO |
| Morphine | 2-5 mg/kg q4h IM, SC |
| Naloxone | 0.01-0.1 mg/kg IP, IV |
| Oxytetracycline | 10-20 mg/kg q8h PO |
| Praziquantel | 30 mg/kg q14d PO x 3 |
| Prednisone | 0.5-2.0 mg/kg PO |
| Tetracycline | 10-2( |

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- Not eating (the rodent may be ill or too cold; problems start under 70°F [21°C])
- Digit/limb necrosis (possibly from thread or fiber constriction injury)
- Greasy coat (high-fat diet)
- White spots on coat (recessive gene, not pathological)
- Jumping in loops (psychological, stress-induced; similar to stereotypical behavior seen in other confined animals)
- Juvenile death in newly purchased mice (possibly stress-induced)
- Lump on nape of neck (usually a fat store from over-feeding, not pathological)
- Trauma (from fighting)
- Hypothermia (because of a reduced amount of undercoat)

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# Raccoons (*Procyon lotor*)

By **Dan Johnson**, DVM

## ORIGIN

- North America

## FREE-RANGING HABITAT

- Wooded areas usually near water

## CAPTIVE HOUSING

- Cage should be at least 6 x 6 x 6 feet (2 x 2 x 2 m).
- Large open wire crate allowing good ventilation is adequate for indoor cages.
- Raccoons will dig, climb and open latches with their paws to escape; enclosure must have escape-proof wire mesh walls and a closed secured roof.
- A concrete floor covered by sand, soil and vegetation will prevent escape by digging.
- Enclosure should be cleaned daily.
- Access to clean water is necessary and should be provided in a secured water dish to avoid tipping.

## ENVIRONMENTAL ENRICHMENT

- Enclosure should contain tree branches and hollow logs large enough to allow for climbing.
- Hammocks or ledges should be provided for sleeping.
- Toys, such as balls, stuffed animals and blankets, help keep raccoons entertained.



# Raccoon Pet Care



## VITAL STATISTICS

| | |
|---|---|
| Life span | 15-20 years |
| Adult size | 20-40 inches (50-100 cm) with tail |
| Body weight | 30-49 lbs (4-14 kg) |

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Raccoons use hollow trees for hiding places during the daytime.



Free-ranging raccoons also use hollow trees for nests.



Tall enclosures that allow vertical space for climbing are best suited for raccoons.



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## RESTRAINT

- Raccoons are difficult to manually restrain and are capable of inflicting severe bites.
- Attempt restraint only for injection of medications and anesthesia.
- Heavy leather gloves, towels, blankets and catch nets may be necessary.

## ANESTHESIA

- Anesthetic combinations for IM injection:
  - ketamine 10-30 mg/kg
  - ketamine 10 mg/kg + diazepam 0.5 mg/kg
  - ketamine 10 mg/kg + midazolam 0.25-0.5 mg/kg
  - ketamine 2.5 mg/kg-5.0 mg/kg + medetomidine 25-50 mcg/kg
  - teletamine/zolazepam 3-10 mg/kg
- Induction involves exposure to sevoflurane or isoflurane in a large cat induction chamber.

## DIET

- Free-ranging raccoons are omnivores and eat birds, mice, bird eggs, crabs, shellfish, worms, insects, fish, turtles and frogs. Occasionally they eat seeds, nuts and berries.
- In captivity, high-grade dog food kibble makes a suitable staple and may be supplemented by fish, chicken, turkey, eggs, fresh fruits and vegetables and whole prey items (e.g., rodents, day-old chicks, fish, frogs and crustaceans).

## SUITABILITY AS PETS

- Raccoons are gregarious, active and relatively simple to feed and house, especially if raised in close contact with humans.
- Raccoons may be trained to use a litter box.
- Raccoons may be unpredictable and are capable of destructive behavior, damaging property and inflicting serious injury. They may carry zoonotic diseases and have special requirements that usually go beyond what an owner can provide.
- They should not be recommended as pets.

## BEHAVIOR

- Raccoons are mostly nocturnal.
- Raccoons are solitary and territorial.
- Captive raccoons may become aggressive if they feel threatened, are bored or do not receive enough social interaction.
- Digging is part of the natural food gathering process and helps prevent nail overgrowth.

## MOST COMMON DISORDERS

- Obesity
- Ectoparasites, especially ear mites (*Otodectes*) and fleas
- Intestinal parasites, especially *Baylisascaris* spp.
- Protozoal infections, especially *Toxoplasma gondii*
- Trauma (eye injuries, bite wounds, fractures)
- Intestinal foreign body impactions
- Dental disease and fractured canine teeth

Hammocks and nets provide areas for captive raccoons to climb.

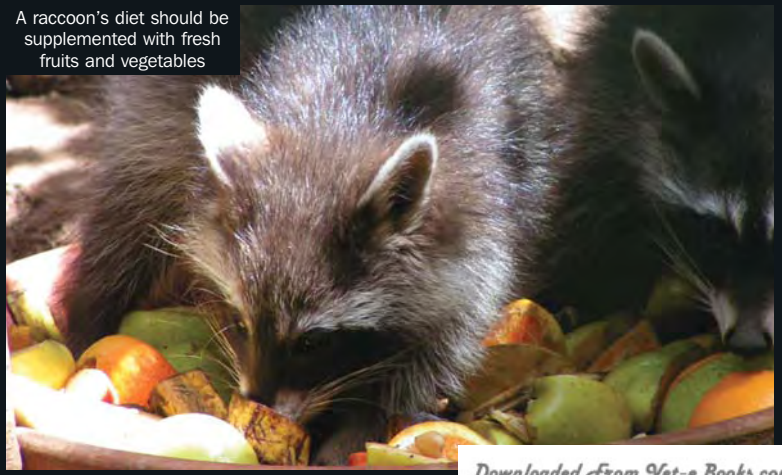


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Access to clean water should be provided in a water bin large enough for the raccoon.



A raccoon's diet should be supplemented with fresh fruits and vegetables



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- Pododermatitis from "digging" at hard surface
- Neoplasia (lymphosarcoma, thyroid adenocarcinoma)
- Hyperthyroidism
- Polycystic kidney disease
- Metabolic bone disease

## SPECIAL CONSIDERATIONS AND CAUTIONS

- States, counties or cities may restrict keeping raccoons as pets.
- Monthly heartworm and flea preventives are recommended.
- Raccoons are capable of inflicting severe bite wounds if stressed or frightened.
- They may transmit a number of zoonotic diseases, including rabies and parasitic diseases (e.g., *Toxocara canis*, *Baylisascaris* spp.)
- They should be bathed (no shampoo) monthly.

## VACCINES

- Canine distemper (Merial PUREVAX® Ferret Distemper): vaccinate at 6-8 weeks and every 3-4 weeks until 14 weeks of age; booster annually. Recombinant canary pox-vectored CDV is recommended.
- Traditional MLV vaccines should not be used because they can cause post-vaccinal CDV encephalitis.
- Rabies: vaccinate at 16 weeks; booster annually.
- Only a killed rabies vaccine product should be used.
- Feline parvoviruses (panleukopenia) and leptospirosis may be indicated depending on location, possible exposure or outbreak.

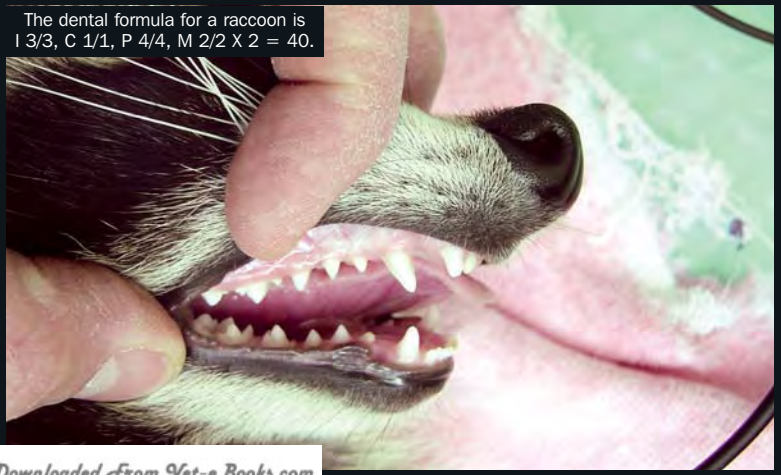
- Feline parvoviruses killed vaccine (i.e. Fort Dodge FVRCP®): vaccinate at 6-8 weeks, then repeat every 3-4 weeks until 14 weeks of age; booster annually.
- Leptospirosis: vaccinate at 10-12 weeks; repeat once in 3-4 weeks and then annually.

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Because of their dexterous fingers, raccoons are agile climbers and are able to open latches and turn doorknobs to escape.



The dental formula for a raccoon is I 3/3, C 1/1, P 4/4, M 2/2 X 2 = 40.

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# Coatimundi Pet Care



## VITAL STATISTICS

| | | | |
|---|---|---|---|
| Life span | 15-20 years | Dental formula | I 3/3, C 1/1, P 4/4 M 2/2 |
| Adult size | 41-67 cm (1.5-2 feet) head to base of tail + 32-69 cm (1-2 feet) tail | Sexual maturity | 2 years |
| | | Breeding season: | April to May (in some climates again in the early fall) |
| Body weight | 3-7 kg (7-15 lbs) | | |
| Body temp | 96-104°F (35.5-40°C) | Gestation | 74-77 days |
| Respiratory rate | 23 breaths/min | Litter size | 2-7 |
| Heart rate | 115 beats/min | | |

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## Coatimundis (coati) (*Nasua* sp.)

By **Sandra Grant**, DVM

- The coatimundi is a member of the raccoon family (Procyonidae), Order Carnivora.

### COMMON SPECIES

- White-nosed (or brown-nosed) coati (*N. narica*)
- Ring-tailed or South American coati (*N. nasua*)
- Nelson's coati (*N. nelsoni*)
- Wedel's coati (*N. wedeli*)

### ORIGIN

- South and Central America, southwestern US

### FREE-RANGING HABITAT

- Arboreal; wooded areas; prefer more humid climates

### CAPTIVE HOUSING

- Cage should be at least 6 x 6 x 6 feet (2 x 2 x 2 m).
- Large open wire crate allowing good ventilation is adequate for indoor cages.
- Coatis will dig or climb to escape; enclosure must have escape-proof wire mesh walls and a closed secured roof.
- A concrete floor will prevent escape by digging and may be covered by sand, soil and/or vegetation.
- Enclosure should be cleaned daily.
- Access to clean water in a secured water dish to avoid tipping is necessary.

- In general, females can be housed together whereas males should not.
- Coatimundis may damage property or sustain injury from household hazards if allowed free roam of the house.

## ENVIRONMENTAL ENRICHMENT

- Enclosure should contain branches and hollow logs large enough for climbing.
- Hammocks or ledges should be provided for sleeping.

## RESTRAINT

- Coatis are difficult to manually restrain; attempt restraint only for injection of medications and anesthesia.
- Heavy leather gloves, towels, blankets and catch nets may be necessary.

## ANESTHESIA

- Inhalation anesthesia is recommended.
- If the coati can be restrained, general anesthesia should be given with a non-rebreathing circuit and a face mask.
- Induction involves exposure to sevoflurane in a large cat induction chamber; coatis often recover quickly.
- Anesthetic via IM injection is not recommended by the author.

## DIET

- Free-ranging coatimundis are omnivores and will scavenge for grubs, berries, edible roots and leaves. They also steal eggs from nesting birds, and catch birds, reptiles and small mammals.

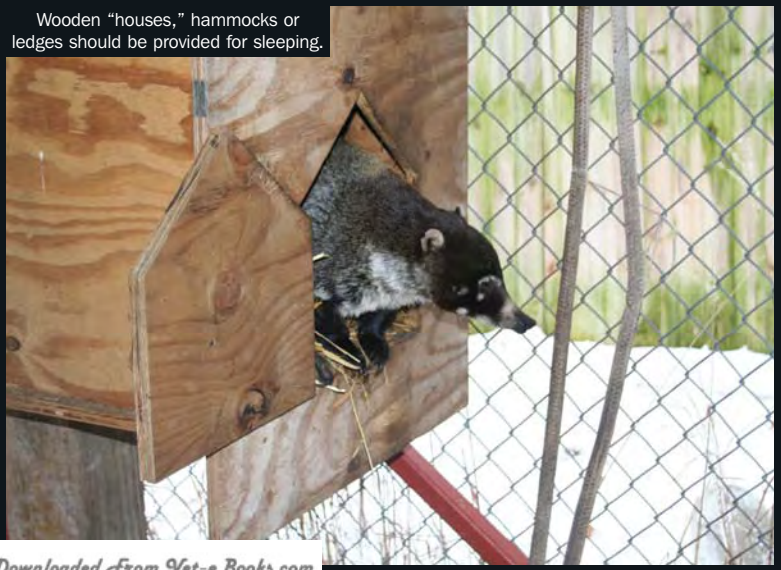
Ring-tailed coati (*Nasua nasua*)



White-nosed coati (*Nasua narica*)

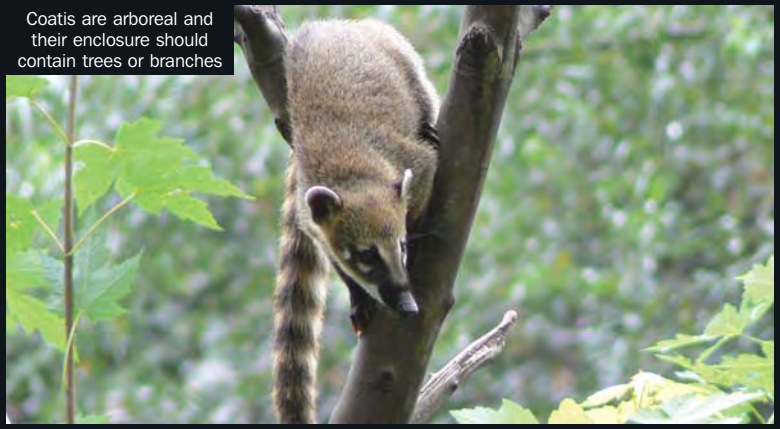


Wooden “houses,” hammocks or ledges should be provided for sleeping.



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Coatis are arboreal and their enclosure should contain trees or branches



Coatimundi anesthesia: non-rebreathing circuit with face mask; then endotracheal intubation induction.









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- In captivity, high-grade dog food kibble should be the primary diet with daily supplementation of fresh fruits and vegetables. Poultry, beef, eggs in small quantities, crickets and mealworms may be fed as treats. Obesity is often a problem if coatis are allowed free choice food.
- Whole prey, such as rodents, day-old chicks, fish, frogs, crustaceans and mollusks, can provide essential nutrients, such as taurine.

## SUITABILITY AS PETS

- Coatimundis are gregarious, active and relatively simple to feed and house, especially if raised in close contact with humans.
- Coatis may be trained to use a litter box, walk on a leash, and play games like fetch.
- Coatis are often taken as pets when they are young and cute, but as these animals reach sexual maturity they may become unmanageable.
- Coatis are unpredictable, capable of inflicting injury and may carry zoonotic diseases.
- They should not be recommended as pets.

## BEHAVIOR

- Intelligent and inquisitive
- Generally social
- Primarily diurnal
- Captive coatis may become aggressive if they are bored or do not receive enough social interaction.
- Digging is part of the natural food gathering process and helps prevent nail overgrowth.

Coatimundis

## MOST COMMON DISORDERS

- Eye injuries
- Bite wounds
- Foreign body impactions
- Diabetes
- Kidney disease (too much protein in diet)
- Dental disease and fractured canine teeth
- Frostbite (housed outdoors in cold climates)
- Ectoparasites, especially ear mites (*Otodectes*) and fleas
- Intestinal parasites
- Fractures
- Foot ulceration from "digging" at hard surface or from foot sucking vice due to boredom
- Neoplasia (uterine adenocarcinoma, cutaneous lymphoma, lipoma)
- Obesity
- Metabolic bone disease

## VACCINES

- Canine distemper/parvo* (Fort Dodge MLV distemper parvo combo is recommended by the author; Merial PUREVAX® Ferret Distemper is recommened by the AAZV): first vaccine at 6-8 weeks and every 3-4 weeks until 14 weeks of age; booster annually.
- Traditional MLV vaccines should not be used because they can cause post-vaccinal CDV encephalitis.
- If housed outdoors, leptospirosis may be suggested depending on location, possible exposure or outbreak: vaccination with commercial bacterin at 10-12 weeks of age; booster annually.

## HEMATOLOGIC REFERENCE RANGES

| | |
|---|---|
| Basophils | 0-0.276 x $10^3/\mu l$ |
| Eosinophils | 0.063-1.84 x $10^3/\mu l$ |
| Hemoglobin | 7.9-16.0 g/dl |
| Hematocrit | 25.5-48.0% |
| Lymphocytes | 0.3-10.4 x $10^3/\mu l$ |
| MCH | 12.1-19.7 pg/cell |
| MCHC | 29.3-40.7 g/dl |
| MCV | 38.8-56.3 L |
| Monocyets | 0.009-1.661 x $10^3/\mu l$ |
| Neutrophilic bands | 0-0.109 x $10^3/\mu l$ |
| Platelet count | 200-806 x $10^3/\mu l$ |
| RBC | 4.89-11.3 x $10^3/\mu l$ |
| Seg. neutrophils | 2.01-16.3 x $10^3/\mu l$ |
| WBC | 3.01-18.8 x$10^3/\mu l$ |

## BIOCHEMICAL REFERENCE RANGES

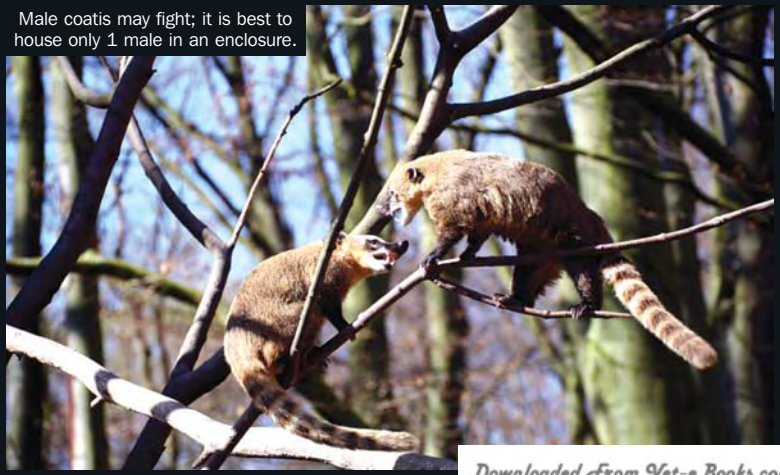
| | |
|---|---|
| AKP | 12-910 IU/L |
| Albumin | 2.1-5.2 g/dl |
| ALT | 65-1021 IU/L |
| AMY | 1116-4857$\mu$/L |
| AST | 142-659 IU/L |
| Bicarbonate | 17 mmol/L |
| BUN | 10-42 mg/dl |
| Calcium | 7.7-10.7 mg/dl |
| Carbon dioxide | 2-38 mmol/L |
| Chloride | 100-118 mEq/L |
| Cholesterol | 83-731 mg/dl |
| CPK | 468-3070 IU/L |
| CR | 0.8-1.7 mg/dl |
| Fibrinogen | 300-500 mg/dl |
| GGT | 9-970 $\mu$/L |
| Globulin | 2.8-5.2 g/dl |
| Glucose | 48-177 mg/dl |
| Lactate dehydrogenase | 722-1242 IU/L |
| LIP | 182-1128 $\mu$/L |
| Magnesium | 1.94 mg/dl |
| Osmolarity | 297 mOsmol/L |
| Phosphorus | 2.9-8.9 mg/dl |
| Potassium | 3.4-6.4 mEq/L |
| Sodium | 136-154 mEq/L |
| Total bilirubin | 0.1-1.0 mg/dl |
| Total thyroxine | 2.5 $\mu$g/dl |
| Total protein | 5.6-8.5 g/dl |
| Triglyceride | 12-107 mg/dl |
| Uric acid | 0.2-1.9 mg/dl |

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Coatis are generally social, and alive in small groups.



Male coatis may fight; it is best to house only 1 male in an enclosure.



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- Rabies (i.e., Merial IMRAB 3) if possible exposure or outbreak: first vaccine at 16 weeks; booster annually.

## SPECIAL CONSIDERATIONS AND CAUTIONS

- Some states or counties may not allow pet coatis.
- Heartworm is recommended for coatis housed outdoors.
- Flea preventives (e.g., Frontline spray, Feline Advantage) should be used.
- Coatis may bite or claw if stressed or frightened, and they have extremely long, sharp canine teeth.
- They may transmit a number of zoonotic diseases, including rabies and parasitic diseases (e.g., toxoplasmosis, *Toxocara canis* and *Baylisascaris* spp.).

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# Chipmunks (*Tamias* sp.)

## COMMON SPECIES

- Siberian (Asian) chipmunk (*T. sibiricus*)
- Eastern chipmunk (*T. striatus*)
- Least chipmunk (*T. minimus*)

## ORIGIN

- Northern Europe, Asia and Japan (*T. sibiricus*)
- Eastern North America (*T. striatus*)
- North central and western United States and central Canada (*T. minimus*)

## FREE-RANGING HABITAT

- Terrestrial, although climb trees
- Forest animal

## CAPTIVE HOUSING

- Chipmunks should not be housed in an aquarium.
- A large wire mesh cage at least 36 x 24 x 24 inches (90 x 60 x 60 cm) and mesh size less than 1" x ½" provides an adequate enclosure.
- A nest box should be provided (one for each chipmunk in the enclosure).
- Cage should have a solid bottom or solid shelves to avoid foot problems.
- Substrate may be newspaper, shredded paper products (Yesterday's News), aspen or corn cob (corn cob substrates must be changed frequently due to the risk of mold growth).



# Chipmunk Pet Care



A Siberian chipmunk foraging for food.

## VITAL STATISTICS

| | |
|---|---|
| Life span | 4-6 years |
| Adult size | 4.5-6.5 inches (12-17 cm) + 4-5 inch (10-12) cm tail |
| Body weight | 85 g |

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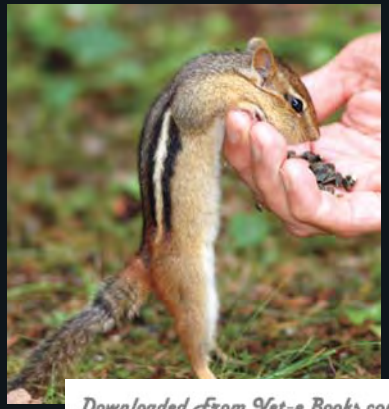


Captive housing should include logs or pieces of bark for hiding.

Chipmunks eat insects as part of their diet.



Chipmunks may be fed nuts and seeds.



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## ENVIRONMENTAL ENRICHMENT

- Captive housing for chipmunks should include climbing branches, pieces of bark to hide under, cardboard tubes to chew and a 9-inch solid exercise wheel.
- Cracked nuts, hide food or treats may be offered in a tray of hay or on the climbing branches.
- Items to chew, such as parrot toys, rawhide and chew blocks, should be provided.

## RESTRAINT

- Chipmunks can be restrained manually by gently holding in a soft towel or with gloves and grasping the base of the tail.
- Some chipmunks are tame and allow gentle manipulation.
- Care must be taken to not grab the tail by the end because of the risk of degloving injuries.

## DIET

- Omnivorous
- Free-ranging Siberian chipmunks eat vegetables, conifer seeds, nuts, tree buds, shrubs, mushrooms, berries, field crops, insects, young birds and lizards.
- In captivity, Siberian chipmunks may be fed a rodent pellet diet, nuts (e.g., pine nuts, hazelnuts), seeds, fresh vegetables, rodent blocks, flower buds (e.g., dandelions), high protein products (e.g., cottage cheese, crickets, mealworms) and hay.
- Low sugar fruit (e.g., oranges, berries), Cheerios and wheat bread may be given occasionally as treats.

- Mineral blocks, cuttlebones and lava stones should be made available for gnawing.
- It is important periodically to look for food stored in the nest box or buried in the substrate to avoid spoiled or moldy food.
- Water bottles should be available for fresh water.

## SUITABILITY AS PETS

- It is important to “chipmunk proof” a room if the animal is allowed to roam by removing all electrical wires and any other items that might be harmful if chewed.
- May be kept singly; however, chipmunks appear to appreciate having a cage companion.

## BEHAVIOR

- Diurnal
- Intense curiosity
- Most chipmunks are not domesticated.
- It often buries its food underground.
- It spends much time grooming.

## MOST COMMON DISORDERS

- Respiratory disease
- Wounds
- Constipation and diarrhea
- Genetic problems in the white Siberian chipmunk from inbreeding (e.g., blindness, epilepsy, hearing problems, cleft palate and other facial deformities)
- Foot problems
- Dental malocclusion

Chipmunks spend much of their time grooming themselves.





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Siberian chipmunk (*T. sibiricus*)



Eastern chipmunk (*T. striatus*)



Least chipmunk (*T. minimus*)



Hopi chipmunk (*T. rufus*)



- Dominance-related problems (e.g., limited access to food that can lead to malnutrition and poor coats)

## SPECIAL CONSIDERATIONS AND CAUTIONS

- Like other rodents, chipmunks have incisors that continuously grow.
- Some chipmunks will hibernate in the winter.

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# Kinkajous (honey bears) (*Potos flavus*)

By **Dan Johnson**, DVM

## ORIGIN

- Central and South America

## FREE-RANGING HABITAT

- Arboreal; rainforest

## CAPTIVE HOUSING

- Cage should be at least 6 x 6 x 6 feet (2 x 2 x 2 m).
- Large open wire crate allowing good ventilation is adequate for indoor cages.
- Kinkajous will dig or climb to escape; enclosure must have escape-proof wire mesh walls and a closed secured roof.
- If kinkajous are allowed free roam of the house, dangerous items and medication should be locked away.
- Kinkajous are very good escape artists; locks on cages are necessary.
- A concrete floor will prevent escape by digging and may be covered by sand, soil and vegetation.
- Enclosure should be cleaned daily.
- Access to clean water in a secured water dish to avoid tipping is necessary.
- Environmental temperature should remain above 65°F (18°C).
- If housed outside, heat must be provided in most places.



# Kinkajou Pet Care



## VITAL STATISTICS

| | |
|---|---|
| Life span | 15-25 years |
| Adult size | Body up to 18 inches (45 cm) + tail up to 18 inches (45 cm) |
| Body weight | 3-10 lbs (1.4-4.6 kg) |
| Dental formula | I 3/3, C 1/1, P 3/3, M 2/2 |

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Housing should be contain tree branches for climbing and sleeping quarters.

Rob Coke, DVM



Housing should be constructed of escape-proof wire mesh with plastic or metal solid flooring.

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## ENVIRONMENTAL ENRICHMENT

- Enclosure should contain tree branches for climbing and large hollow logs.
- Hammocks, hide boxes or ledges should be provided away from direct sunlight to allow kinkajous to sleep during the day.
- Toys, such as ropes, balls and stuffed animals, help keep kinkajous entertained.

## RESTRAINT

- Kinkajous may be difficult to manually restrain and will bite if threatened; attempt restraint only for injection of medications and anesthesia.
- Heavy leather gloves, towels, blankets and catch nets may be necessary.

## ANESTHESIA

- Anesthetic combinations for IM injection:
  - ketamine 10-30 mg/kg
  - ketamine 10 mg/kg + diazepam 0.5 mg/kg
  - ketamine 10 mg/kg + midazolam 0.25-0.5 mg/kg
  - ketamine 2.5 mg/kg-5.0 mg/kg + medetomidine 25-50 mcg/kg
  - teletamine/zolazepam 3-10 mg/kg
- Induction involves exposure to sevoflurane or isoflurane in a large cat induction chamber.

## Kinkajous

### DIET

- Over 90% of a free-ranging kinkajou's diet is composed of fruit with less than 10% made up of insects, leaves and flowers.
- In captivity, fruit (e.g., bananas, grapes, mangoes, apples, berries, figs and melons) makes a suitable staple for kinkajous.
- This diet should be supplemented by high-grade monkey chow or dog food kibble (may be soaked in fruit juice), eggs, insects, baked chicken and fresh vegetables.
- Honey may be given as a treat.
- Avoid strawberries, avocados and dairy products.
- Papaya may help prevent periodontal disease, which is common due to their soft diet.

### PET APPEAL

- Kinkajous do not have any noticeable odor.
- When hand-raised from very young, they are very social and enjoy being handled.

### BEHAVIOR

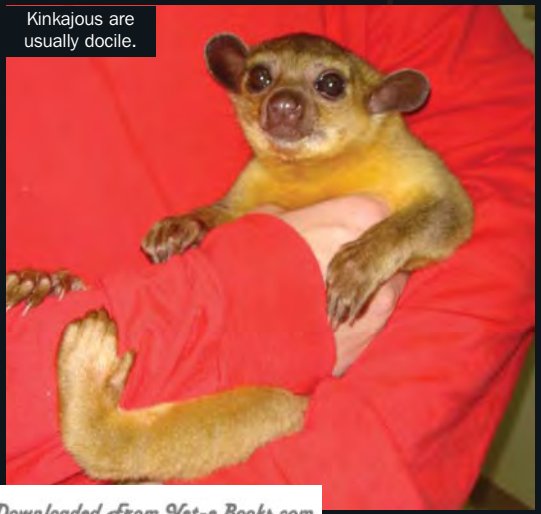
- Kinkajous may be curious to look inside your mouth or reach inside with their fingers.
- May be trained to use a litter box.
- Kinkajous require much stimulation, which they can get from various toys and activities.
- Nocturnal
- Docile and gentle
- Inquisitive and social

Kinkajous should be fed in the evening, so they can eat at night.




Rob Coke, DVM

Kinkajous are usually docile.



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A hand-raised kinkajou baby for a zoo's educational program,

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## Kinkajous

### PHYSICAL CHARACTERISTICS

- Kinkajous have 2 hairless areas on the face, which are often mistaken for a *Sarcoptes* infection.
- Kinkajous have prehensile tails, which are used for climbing.

### MOST COMMON DISORDERS

- Obesity
- Ectoparasites
- Intestinal parasites
- Bite wounds
- Foreign body impactions
- Fractures
- Periodontal disease
- Neoplasia
- Cardiomyopathy
- Diarrhea

### SPECIAL CONSIDERATIONS AND CAUTIONS

- States, counties or cities may restrict keeping kinkajous as pets.
- Heartworm and flea preventives are recommended.
- Kinkajous are capable of delivering painful, severe bites if frightened or threatened.
- They may transmit a number of zoonotic diseases.

## VACCINES

- Canine distemper (Merial PUREVAX® Ferret distemper vaccine): vaccinate at 6-8 weeks and every 3-4 weeks until 14 weeks of age; booster annually. Recombinant canary pox-vectored CDV is recommended.
- Traditional MLV vaccines should not be used because they can cause post-vaccinal CDV encephalitis.
- Rabies: vaccinate at 16 weeks; booster annually.
- Only a killed rabies vaccine product should be used.

## REFERENCES AND FURTHER READING


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7. Wallach JD, Boever WJ: Procyonidae. *In* Wallach JD, Boever WJ (eds): Diseases of Exotic Animals: Medical and Surgical Management. Philadelphia, WB Saunders, 1983, pp 464-493.




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# Meerkat Pet Care



Meerkats will stand lookout while others are foraging to warn them of approaching dangers.

## VITAL STATISTICS

| | |
|---|---|
| Life span | 5-15 years |
| Adult size | 10-14 inches (25-35 cm) head and body + tail (7-9 inches [18-23 cm]) |
| Body weight | 1-2 lbs (0.5-1 kg) |

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## Meerkats *(Suricata suricatta)*

### ORIGIN

- South African savannah

### FREE-RANGING HABITAT

- Terrestrial
- Savannah and arid grassland plains
- Meerkats live on rock crevices and in underground burrows as deep as 10 feet (3 m).
- Free-ranging underground burrows average 5 m x 1.5-2 m deep.

### CAPTIVE HOUSING

- Captive housing can be a real challenge, because of their burrowing nature.
- Meerkats need access to sunlight.
- Meerkats are more commonly kept as pets in South Africa, because they can be housed outside where they can roam, dig burrows and eat their natural diet.
- Very low humidity and warm temperatures are necessary for survival.
- Grass-lined, wooden “houses” and hollow wooden logs may be used to simulate their natural dens and provide hiding places.
- Concrete or wire line enclosures may be necessary if they are housed outside.
- Meerkats may be considered potential injurious wildlife if they escape; therefore, keeping them as pets is banned by many city/state ordinances.

Meerkats

## RESTRAINT

- Meerkats can deliver very painful bites.
- Heavy leather gloves should be used for restraint.
- Meerkats may be difficult to restrain manually because of their ability to wiggle and twist while being held.

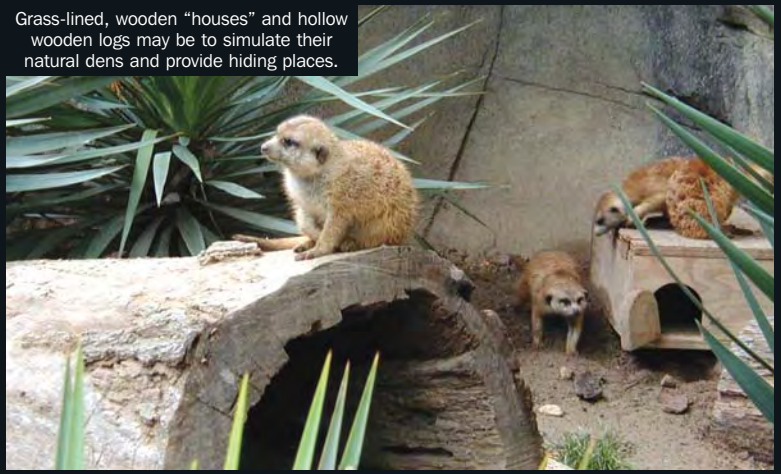
## DIET

- Free-ranging meerkats are mainly insectivores, but will eat some animals, eggs and plants. Their diet consists of scorpions (they tear off the stinger and are partially immune to the venom), beetles, spiders, centipedes, millipedes, worms, crickets, small mammals, reptiles and birds and eggs.
- In captivity, meerkats may be fed a diet consisting of about 85% high quality feline kibble and 15% fresh finely diced produce, including apple, carrot, sweet potato, banana and pear.
- Meerkats may be fed insects as a daily treat. Other prey, such as small mammals, lizards and amphibians, may also be added.
- Water bottles should be available at all times for fresh water.

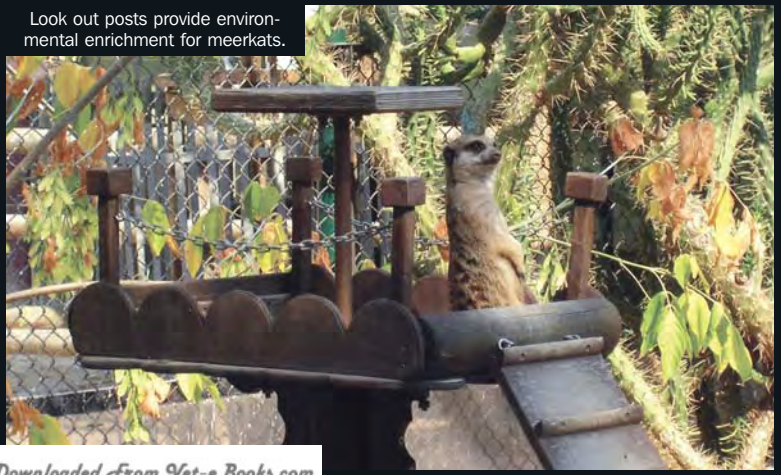
## SUITABILITY AS PETS

- Meerkats are often sought after because they are cute and captivating, but they do not make good pets as they require much attention and can be very destructive.
- Adult animals often scent mark their territory.
- Meerkats may bite, often viciously and seemingly unprovoked.

Grass-lined, wooden “houses” and hollow wooden logs may be to simulate their natural dens and provide hiding places.



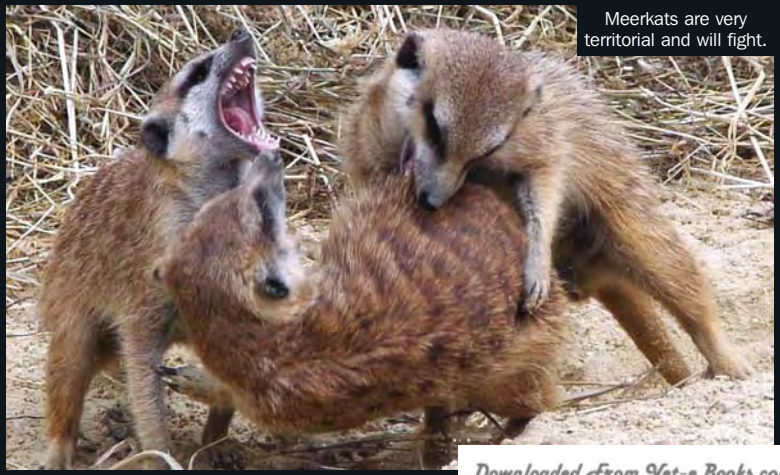
Look out posts provide environmental enrichment for meerkats.



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Meerkats are highly social animals and are found in large groups.



Meerkats are very territorial and will fight.

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## Meerkats

- Meerkats may be litter trained if kept indoors.

### BEHAVIOR

- Diurnal
- Extremely social; live in large colonies for survival
- Curious
- Free-ranging meerkats are nomadic.
- Meerkats are very territorial and will fight.
- In captivity, removal of one member of the troop may cause it to be rejected, attacked or killed when it is reintroduced. When necessary, remove 2 or 3 meerkats at once and distract the others with food when they are reintroduced.
- Meerkats regularly groom each other.
- The group's alpha pair often scent-mark other meerkats in the group to show their authority.
- Most members of the group are siblings and offspring of the alpha pair.

### MOST COMMON DISORDERS

- Foreign body ingestion
- Coccidiosis
- Bacterial hepatitis
- Metabolic bone disease
- Toxoplasmosis
- Heart disease
- Rabies
- Spinal problems

## VACCINES

- Meerkats should be vaccinated against canine distemper (Merial canarypox CDV vaccine) and feline panleukopenia at 6-8 weeks, 9-12 weeks, 14-16 weeks of age, 1 year and then every 2 years after that.
- Rabies (for ferrets) if possible exposure or outbreak: first vaccine at 16 weeks; booster annually.

## SPECIAL CONSIDERATIONS AND CAUTIONS

- Meerkats bite often.
- Meerkats are illegal to own without the proper licenses and permits, which are difficult to obtain.
- The US government controls owners with strict requirements for enclosures and climate.
- Classified by USDA as Detrimental Species/Injurious Wildlife.

## REFERENCES AND FURTHER READING

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Meerkats have been observed having wrestling matches and foot races.



To warm their bodies on cold days, meerkats may either lay on their backs or sit up to expose the bare skin on their stomachs.

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# Brushtail Possum Pet Care



## VITAL STATISTICS

| | |
|---|---|
| Life span | 6-11 years |
| Adult size | 35-50 cm (14-20 inches) from head to rump + 25-40 cm (10-15 inches) tail |
| Body weight | |
| Males: | 1.3-4.5 kg (2.8-10 lbs) |
| Females: | 1.3-3.5 kg (2.8-7.7 lbs) |

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## Brushtail Possums (*Trichosurus vulpecula*)

### ORIGIN

- Australia and surrounding islands

### FREE-RANGING HABITAT

- Arboreal
- Open eucalypti forest and woodland
- Rest in hollow trees or shelters built by other animals
- Often live in the roof space of houses

### CAPTIVE HOUSING

- Length: body length x 8 (min. 1.2 m [4 feet])
- Width: body length x 4 (min. 0.6 m [2 feet])
- Height: 1.8 m (6 feet)
- Enclosure temperature range should be 50-86°F (10-30°C) with a relative humidity of about 65%.

### ENVIRONMENTAL ENRICHMENT

- The enclosure should include numerous branches and hollow limbs to simulate arboreal environment.
- Hollow logs or boxes are necessary for sleeping quarters (two per possum).

### RESTRAINT

- Restraint should be used only for minor procedures or to administer anesthesia.
- Possums may scratch or bite.

- Gloves are not recommended because the possum may be crushed or injured.
- The possum may be placed in a sack or pillowcase or covered with a towel. The head or leg may be extracted for examination.
- Once covered, it may be grasped firmly behind its head and at the base of the tail with the other hand or by another person and gently stretched out.

## ANESTHESIA

- Inhalation anesthesia is recommended.
- If the possum can be restrained, general anesthesia should be given with a non-rebreathing circuit and a mask.
- The possum may be pre-oxygenated for 2-5 minutes before isoflurane administration.
- Induction involves exposure to 5% isoflurane delivered at an oxygen flow rate of 200 ml/kg/min with a minimum of 1 L/min.
- The possum can be maintained at 2% isoflurane, although it may vary with the animal.
- If the possum cannot be restrained, an injectable induction of diazepam (1-2 mg/kg) IM is acceptable; effective for 1-2 hours.
- For general anesthesia: xylazine (6 mg/kg) + ketamine (30 mg/kg) IM; or tiletamine/zolazepam (2.5-10 mg/kg) IM.

Sleeping quarters may be made out of blankets or cushions.



The enclosure must include trees or numerous branches to simulate arboreal environment.



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Brushtail possums enjoy eucalyptus leaves.



A juvenile brushtail possum can be fed vegetables.



stal Ocean Australian Wildlife Rescue & Rehabilitation

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## BLOOD COLLECTION

- Lateral tail vein is easily accessible for IV access. Tail should be held at the base.
- Alternative IV access sites include the jugular and cephalic veins.

## DIET

- Free-ranging possums are primarily herbivores with a diet that includes eucalyptus leaves, flowers, fruit and other plant species (e.g., grasses and herbs). Occasionally they also eat insects, grubs and bird eggs.
- In captivity, possums may be fed a diet of vegetables, nuts, fruit (e.g., apples, cherries, grapes and pears) and native vegetation (e.g., branches from eucalyptus, callistemon and grevillea) as well as crickets, mealworms, waxworms and boiled eggs or small pieces of boiled chicken.
- Water bottles should be available at all times for fresh water.

## SUITABILITY AS PETS

- May be kept in captivity in a large aviary.
- Males are capable of making loud noises.

## BEHAVIOR

- Brushtail possums are normally nocturnal; however, the light cycle may be reversed to allow for human interaction.
- Docile as individuals

## Brushtail Possums

- Extremely territorial animals; will fight
- Adult males will not tolerate another male, even a juvenile, in their territory and will injure or kill it.
- Solitary
- Spend most of their time in trees

### PHYSICAL CHARACTERISTICS

- Females have marsupial pouch.
- Male has bifurcated penis in floor of cloaca.
- Use hindgut flora for digestion, similar to rabbits.
- Brushtail possums have a powerful grip, which gives them an excellent climbing ability.

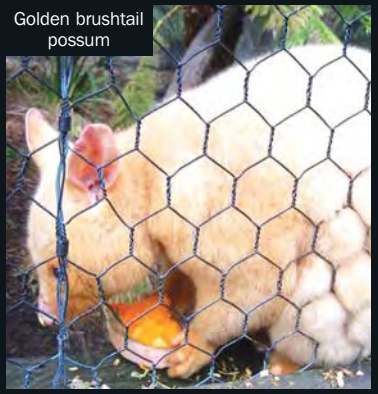
### MOST COMMON DISORDERS

- Malnutrition and its consequences (including pneumonia and death)
- Enteropathies
- Dental/oral problems
- Trauma
- Obesity
- Parasites (internal and external)
- Heat stress

### CAUTIONS

- Possums are reservoir species for bovine tuberculosis (*Mycobacterium bovis*) in New Zealand.
- They may carry zoonotic diseases, such as *Sarcoptes scabei* and *Salmonella* spp.

Golden brushtail possum



Brushtail possum babies usually spend about 6 months in their mother's pouch.



At the age of 6-18 months, the juveniles will separate from their mother.



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Compound fracture of the hind leg of a brushtail possum.

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# Patagonian Cavies (Mara) (*Dolichotis patagonum*)

By **Jack Kottwitz**, DVM

## ORIGIN

- Central Patagonian steppes of Argentina to southern Argentina

## FREE-RANGING HABITAT

- Arid grasslands and brushlands with a great deal of open space
- Typical territory size for a pair can be as large as 40 hectares (0.4 $km^2$).

## CAPTIVE HOUSING

- Although Patagonian cavies can be housed indoors, this may lead to problems because of their predispositions for chewing on nearly everything.
- If housed indoors, care must be taken to remove all potentially dangerous objects (e.g., electrical cords) that might be chewed. Burrowing may lead to destruction of walls and flooring.
- Ideal captive housing should include access to a large outdoor yard area for grazing and exercise.
- Outdoor yard may be cavy-proofed by using chain link fencing that is sunk into the ground at least 1-2 feet (30-60 cm).
- Patagonian cavies can be intensive burrowers, so they should be carefully monitored to make sure they do not burrow below the buried fence.



# Patagonian Cavy Pet Care



## VITAL STATISTICS

| | | |
|---|---|---|
| Life span | | 10 years (avg) |
| Adult size: | head and body | 69-75 cm (27-30 inches) |
| | tail | 4 cm (1.6 inches) |
| Body weight | | 18-35 lbs (8-16 kg) |
| Dental formula | | I 1/1; C 0/0; P 1/1; M 3/3 |
| Sexual maturity: | females | 2-3 months |
| | males | 6 months |

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It is important to provide adequate shade/shelter during hot weather.



Cavies spend a large part of their day grazing on grass and plants.



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## Patagonian Cavies

- Frightened cavies have been reported to jump as high as 6 feet (2 m) in the air. The use of a double fence may be necessary to prevent escape, although they generally do not jump fences.
- Patagonian cavies in their native habitat experience extremes of temperature ranging from 28-90°F (-2-32°C).
- Cavies tolerate cold and hot temperatures very well. If given a preference, cavies prefer cooler temperatures.
- It is important to provide adequate shade/shelter during hot weather.

### ENVIRONMENTAL ENRICHMENT

- Exposure to a variety of nontoxic plants, grasses and tree limbs/wood for grazing is ideal.
- If housed indoors, a dirt-filled “digging box” may provide an outlet for burrowing behaviors.

### DIET

- Cavies are strict herbivores that spend a large part of their day grazing on grass and plants.
- Their ideal captive diet should be composed entirely of plant material, such as timothy grass hay, grasses and leafy vegetables.
- A small amount of timothy-based guinea pig or chinchilla pellets may be added to the diet.
- Because Patagonian cavies and guinea pigs are members of the same family, Cavidae, it may be extrapolated that cavies may have similar dietary vitamin C requirements. Feeding a diet rich in vitamin C is encouraged to prevent deficiencies.

## Patagonian Cavies

### SUITABILITY AS PETS

- If raised from birth among humans and properly socialized, Patagonian cavies may be very social with humans, interacting with grunts, grumbles and screams.
- Normally Patagonian cavies are active during daylight hours; however, if they are not accustomed to humans, they may begin to become more active at night to avoid interactions with humans.
- Patagonian cavies can be litter box-trained, but patience is required.

### BEHAVIOR

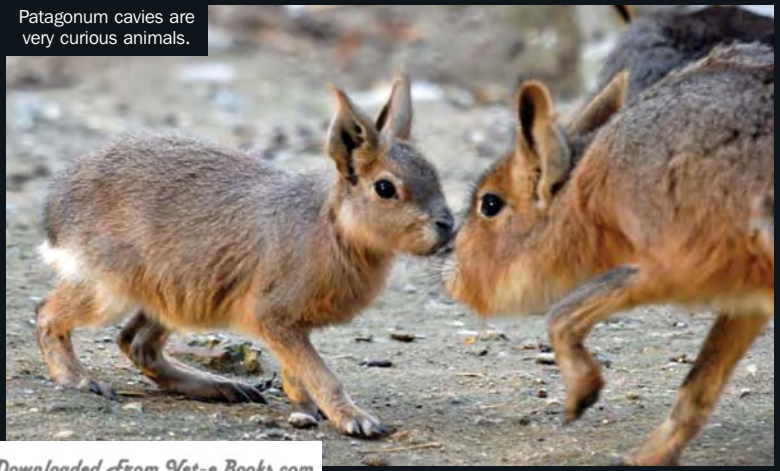
- In captivity, Patagonian cavies can be very social animals, interacting with humans both through vocalizations and attention-seeking behaviors.
- Free-ranging Patagonian cavies usually live in groups of 10-15 and form monogamous pairs that last for life.
- Very little territoriality is evident in free-ranging cavies, but males appear to have a moderate dominance hierarchy.
- Like all rodents, they reach sexual maturity quickly.

### PHYSICAL CHARACTERISTICS

- The general body form of a Patagonian cavy is that of a long-legged rodent with a body similar to a hoofed animal.
- The haircoat, while stiff and dense, should have a very fine texture.
- The front feet have 4 toes while the back feet have 3. All toes have a sharp claw.

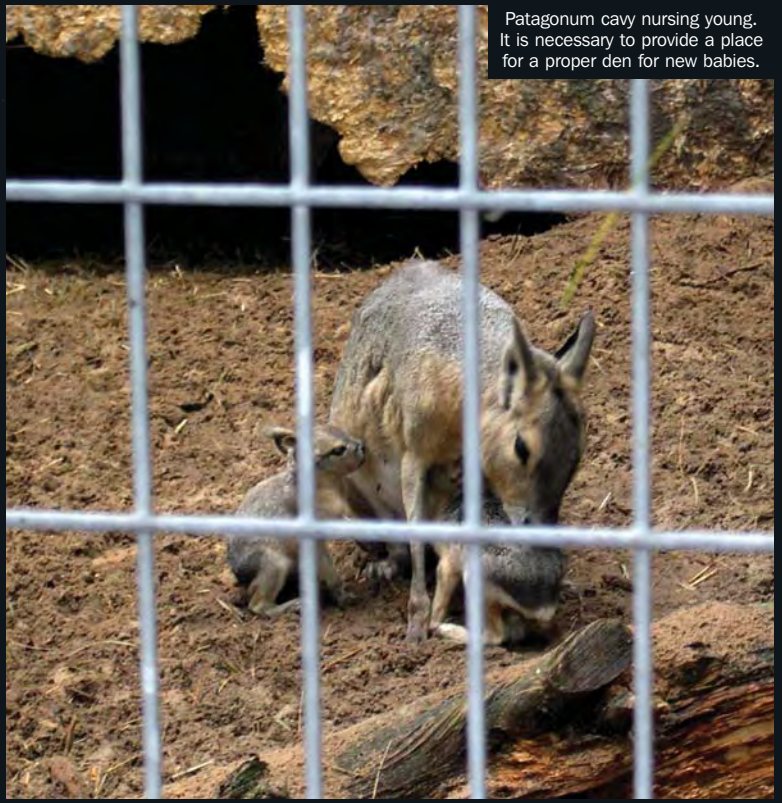


Patagonum cavies are social animals, and prefer to live in groups.



Patagonum cavies are very curious animals.

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Patagonum cavy nursing young. It is necessary to provide a place for a proper den for new babies.

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## Patagonian Cavies

- The hind legs are slightly larger than the front.
- Patagonian cavies are elodonts with open-rooted teeth like guinea pigs.

### MOST COMMON DISORDERS

- Dental malocclusion occurs in Patagonian cavies for many of the same reasons it occurs in guinea pigs, including genetic structural abnormalities (brachygnathism), inappropriate wear as a result of diets lacking in dietary fiber, and injuries, such as broken incisors. The approach to managing dental disease is the same as with guinea pigs.
- The long stature of the leg bones can predispose to limb fractures, especially in the tibia.

### SPECIAL CONSIDERATIONS AND CAUTIONS

- If frightened, Patagonian cavies will try to escape.
- Patagonians have reported sprint speeds up to 35 mph (45 km/hour) for distances of more than half a mile (1000 m). Their speed and jumping ability may predispose them to injury.
- While generally non-aggressive, the sharp claws are capable of causing deep scratches.

# Two-toed Sloths (*Choloepus* spp.)

By **Marc Kramer**, DVM

## SPECIES

- Linnaeus's two-toed sloth (*C. didactylus*)
- Hoffmann's two-toed sloth (*C. hoffmanni*)

## ORIGIN

- *C. didactylus* is from the New World tropics, ranging throughout Central America, northern South America, and south to southern Brazil
- *C. hoffmanni* is from Central and South American from Nicaragua to Peru and Brazil

## FREE-RANGING HABITAT

- Arboreal animal, found in tropical rainforests and deciduous forests

## CAPTIVE HOUSING

- Several large trees for ample horizontal and vertical perching must be provided, with at least one parallel pair of each.
- A nest box should be included in the habitat.
- Feeding pan or bowl should be placed high on a secure platform with easy access by the animal from the branches.
- Ideal environmental temperature is 82-85°F (28-30°C) with 60-70% humidity.



# Two-toed Sloth Pet Care



Rob Coke, DVM

## VITAL STATISTICS

| | |
|---|---|
| Life span | 15-30 years |
| Adult size | 21-29 inches (53-73 cm) |
| Body weight | 7-9 kg (15-20 lbs) |

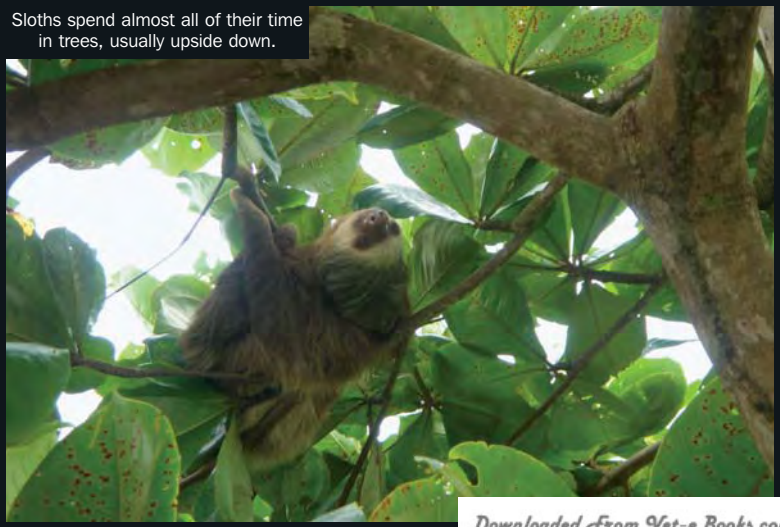
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Hoffmann's two-toed sloth (*C. hoffmanni*)



Linnaeus's two-toed sloth (*C. didactylus*)



Sloths spend almost all of their time in trees, usually upside down.

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## Two-toed Sloths

- Sloths have lower body temperatures compared to other mammals, ranging from 90.9-95.9°F (32.7-35.5°C). Their temperature will vary with their surroundings.
- Sloths are poor regulators of body temperature. Heat stress, hypothermia and disease may be precipitated by sudden changes in environmental temperature.
- Sloths generally do not fare well in cool temperate latitudes unless provided with temperature and humidity controlled habitats simulating a tropical climate.

### RESTRAINT

- Sloths may be dangerous, inflicting severe damage with their claws and teeth.
- They should be restrained with nets or contained in a nest box.
- Administering immobilization drugs through blow darts or quick administration by hand syringe in the hind musculature may be necessary.

### ANESTHESIA

- Sloths may be anesthetized with isoflurane at 5% at 3-5 L/min $O_2$ in a chamber and then the isoflurane is reduced to 1-3% at 1-2 L/min $O_2$ via face mask.
- Anesthetic for IM injection may be either ketamine (5-10 mg/kg) or a combination of ketamine (3-4 mg/kg) and medetomidine (0.03-0.04 mg/kg).
- If necessary, reversal with atipemazole may be used to shorten the recovery.

## Two-toed Sloths

### DIET

- Free-ranging sloths are omnivores, eating a diet consisting of leaves, buds, flowers, and fruits.
- In captivity, a mix of vegetables (a variety of greens, carrots, yams), leaves, fruits, omnivore biscuits, and primate diets have been used.

### SUITABILITY AS PETS

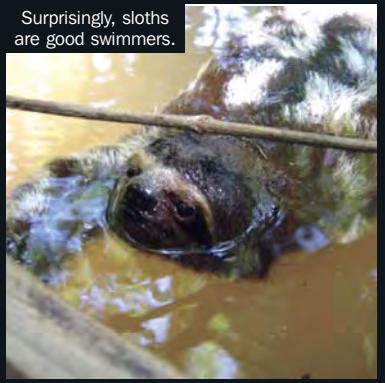
- Sloths are not commonly kept nor advocated as pets.

### BEHAVIOR

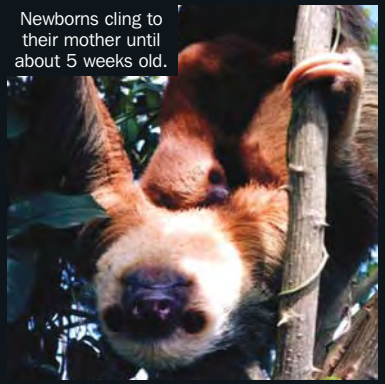
- Sloths are solitary, and come together only to mate.
- Sloths exhibit slow activity and are primarily nocturnal, although bursts of crepuscular or diurnal activity may be seen.
- This species climbs down to the ground for defecation and urination only, and with the sloth's slow metabolism it typically occurs once a week.
- Almost everything is carried out in trees while suspended upside down, including eating, sleeping, mating and birth.
- Sloths usually spend about 15 hours a day sleeping.

### PHYSICAL CHARACTERISTICS

- Two-toed sloths possess two digits on each forelimb and three digits on each hindlimb.
- Many internal organs of sloths (liver, stomach, spleen, pancreas) are in different positions from other mammals.



Surprisingly, sloths are good swimmers.



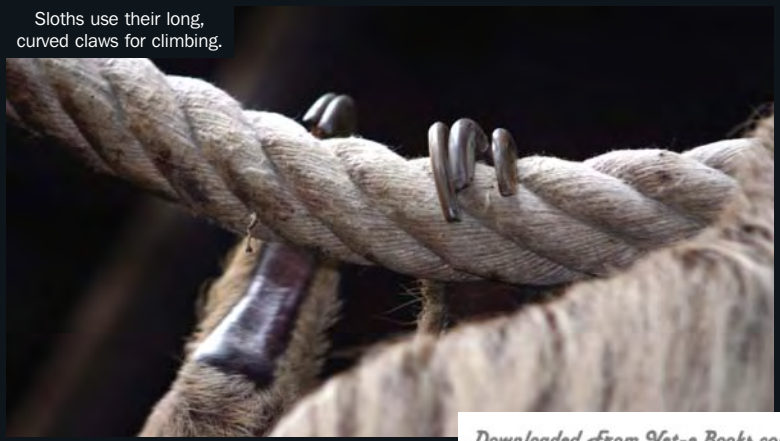
Newborns cling to their mother until about 5 weeks old.



Sloths rarely come down to the ground.

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Sloths use their long, curved claws for climbing.

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## Two-toed Sloths

- The stomach in sloths is enormous and almost fills the abdominal cavity. Gastrointestinal anatomy and physiology are complex; they possess a multi-chambered stomach and utilize foregut fermentation.
- Determining gender in sloths can be especially challenging. This is in part due to the presence of internal abdominal testicles in males and genital areas in both sexes that look rather similar to the untrained eye.

### MOST COMMON DISORDERS

- Hypothermia
- Claw infections
- Pneumonia
- Enteritis
- Intestinal parasites
- Diskospondylosis
- Metastatic mineralization
- Interstitial nephritis
- Trauma (from bite wounds)
- Abscesses
- Orphan (abandoned by mother)

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## Mynahs (Myna) (Family Sturnidae)

- Family Sturnidae consists of the starlings, mynahs, and oxpeckers, about 107 species of birds

### COMMON SPECIES

- Common mynah (*Acridotheres tristis*)
- Crested mynah (*Acridotheres cristatellus*)
- Bank mynah (*Acridotheres ginginianus*)
- Jungle mynah (*Acridotheres fuscus*)
- White-vented mynah (*Acridotheres grandis*)
- Javan mynah (*Acridotheres javanicus*)
- Pale-bellied mynah (*Acridotheres cinereus*)
- Collared mynah (*Acridotheres albocinctus*)
- Bali mynah (*Leucopsar rothschildi*)
- Hill mynah (*Gracula religiosa*)
- Yellow-faced (Papuan) mynah (*Mino dumontii*)
- Golden mynah (*Mino anais*)
- Long-tailed mynah (*Mino kreffti*)
- Sulawesi mynah (*Basilornis celebensis*)
- Helmeted mynah (*Basilornis galeatus*)
- Long-crested mynah (*Basilornis corythaix*)
- Apo mynah (*Basilornis miranda*)
- White-necked mynah (*Streptocitta albicollis*)
- Bare-eyed mynah (*Streptocitta albertinae*)
- Fiery-browed mynah (*Enodes erythrophris*)
- Finch-billed mynah (*Scissirostrum dubium*)
- Golden-crested mynah (*Ampeliceps coronatus*)
- Southern hill mynah (*Gracula indica*)
- Sri Lanka mynah (*Gracula ptilogenys*)



# Mynah Pet Care

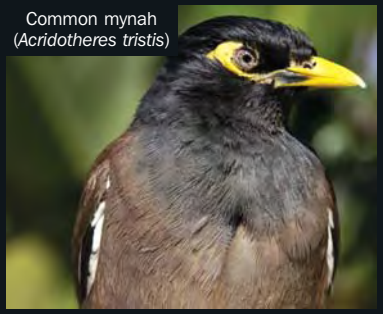


### VITAL STATISTICS

| | |
|---|---|
| Life span | 12-20 years |
| Adult size | 30-45 cm (12-18 inches)<br>Size varies by species |
| Body weight | 110-270 g |

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Common mynah
(*Acridotheres tristis*)



Hill mynah
(*Gracula religiosa*)



Bank mynah
(*Acridotheres ginginianus*)



Golden-crested mynah
(*Ampeliceps coronatus*)



Charles Lam

Jungle mynah
(*Acridotheres fuscus*)



J M Garg

Crested mynah
(*Acridotheres cristatellus*)



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## Mynahs

### ORIGIN

- Common mynah: Indian sub-continent; from Afghanistan east through India and Sri Lanka to Bangladesh
- Hill mynah: Eastern India, southern China, Indochina, Thailand, Malaysia and the Philippines

### FREE-RANGING HABITAT

- Arboreal
- Common mynah: warm climates; roosts in isolated stands of tall trees
- Hill mynah: Forests, particularly at the edge of dense forests or in thinned or cultivated areas
- Prefers high rainfall and humidity

### CAPTIVE HOUSING

- Mynahs are social birds and should be housed near the activity center of the household.
- Enclosure: minimum size is 18 cubic ft: 2 x 3 x 3 feet (60 x 90 x 90 cm).
- Metal cage should be a horizontal rectangle to allow lateral movement from perch to perch.
- Newspaper or recycled newspaper product may be used beneath cage floor.
- Natural branch perches in a variety of sizes should be provided.
- Water should be available in a large dish (1½-2” depth of water) for bathing.
- Mynahs should be taken outside or provided access to unfiltered sunlight 3 times a week for at least 15 minutes a day or be provided with a UVA/UVB light source.

## ENVIRONMENTAL ENRICHMENT

- Mynahs require an environment enriched with toys, various branches and opportunities for activity.
- Toys designed for smaller birds (e.g., mirrors, beads, shiny bells) work best.
- Mynahs may be given mist baths and showers in the morning or outdoors when weather permits.

## RESTRAINT

- The bird should be positioned with the head protruding between the index and middle fingers, with the thumb encircling one wing and the little and ring fingers around the other wing.
- An alternative method may be used with a small washcloth or paper towel cradling the entire bird and the three point hold around the head.
- The bird should be held loosely enough so as not to restrict respiration while still maintaining control.

## DIET

- Free-ranging common mynahs eat fruits, eggs and nestlings of other birds.
- Free-ranging hill mynahs are arboreal frugivores; their diet includes figs, berries, tree and shrub seeds, nectar, insects and lizards.
- In captivity, a commercial low-iron (<100 ppm) softbill pellet food should be given as 75% or more of the diet.
- The diet may be supplemented with a variety of low-iron fruits (e.g., diced apples, bananas) and vegetables (e.g., diced sweet potato, greens) at 25% of the daily intake.



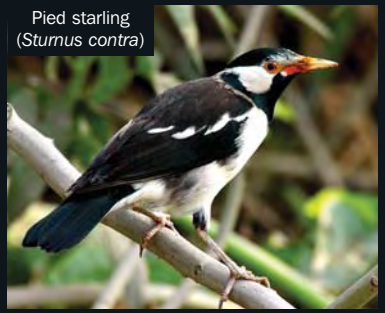
Golden mynah (*Mino anais*)



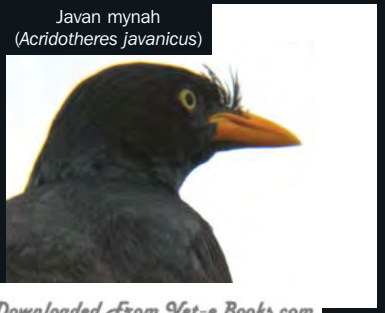
Bali mynah (*Leucopsar rothschildi*)



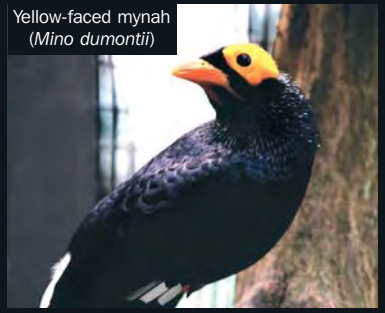
White-necked mynah (*Streptocitta albicollis*)



Pied starling (*Sturnus contra*)



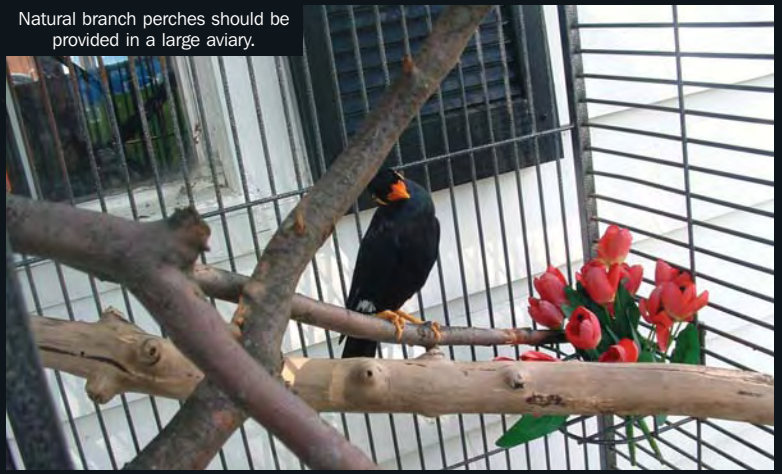
Javan mynah (*Acridotheres javanicus*)



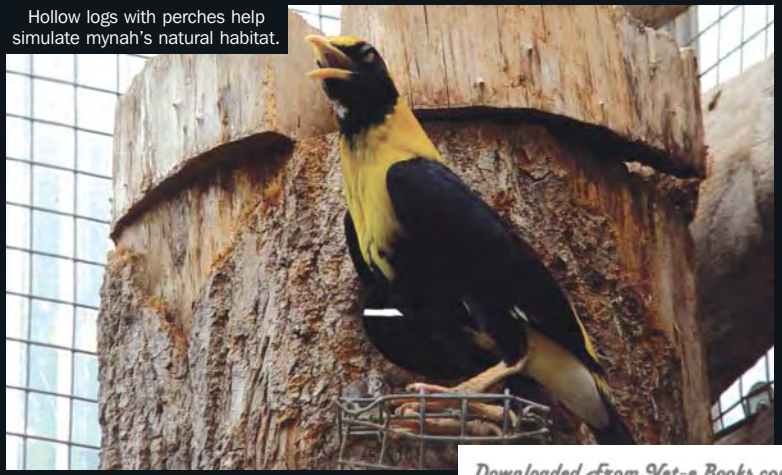
Yellow-faced mynah (*Mino dumontii*)

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Natural branch perches should be provided in a large aviary.



Hollow logs with perches help simulate mynah's natural habitat.



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## Mynahs

- Insects (e.g., mealworms), fruits, fruit juices, nectars and balanced electrolyte formulas (Gatorade) may be offered occasionally. Fruits with high levels of vitamin C should be avoided.
- Tannin-rich tea may be offered several times a week or for 1-week intervals 2 times monthly to help prevent hemochromatosis.

### SUITABILITY AS PETS / BEHAVIOR

- Extraordinary mimicking ability, especially the greater Indian Hill and the Java Hill mynahs
- Nondestructive
- Mynahs can be trained to sit on a hand or shoulder, although some prefer not to be handled.
- Intelligent
- Hill mynahs are monogamous; couples remain together throughout the year.
- Mynahs often hop sideways between branches.
- May collect or play with shiny objects; caution should be taken that the birds do not ingest them.

### MOST COMMON DISORDERS

- Hepatopathies, hepatic cirrhosis or neoplasia
- Iron storage disease (hemochromatosis)*
- Congestive heart disease*
- Aspergillosis
- Mycobacteriosis
- Eye disorders (corneal scratches, keratitis, chronic keratoconjunctivitis)*
- Bacterial upper respiratory infections*

- Foreign body ingestion
- Coccidiosis
- Toxicosis

**Often related to malnutrition*

## SPECIAL CONSIDERATIONS

- Mynahs produce copious amounts of loose feces, requiring many layers and frequent changes of enclosure liners. Formulated diets with limited fruits should be fed to minimize mess.
- A vaccination for poxvirus is available.
- Mynahs have 7 air sacs instead of 9.

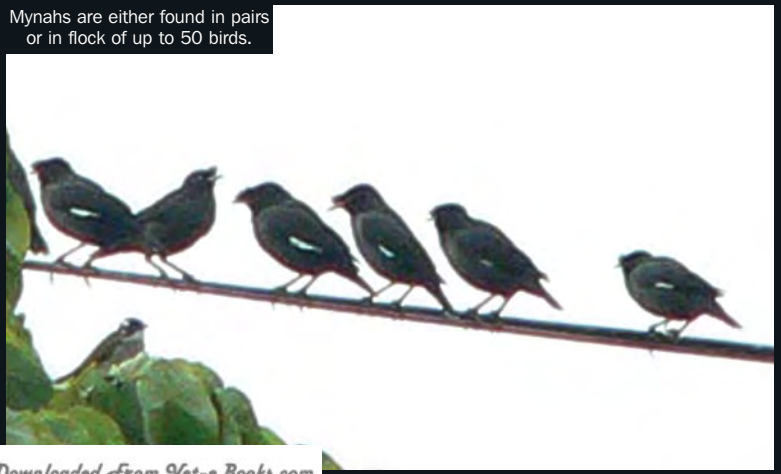
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Mynah's nests are made with small twigs, dry pine needles, leaves, dirt and feathers. They usually nest in a hole of a tall tree; in captivity they will nest in a cockatiel nest box.



Mynahs are either found in pairs or in flock of up to 50 birds.



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# Turaco Pet Care



## VITAL STATISTICS

| | |
|---|---|
| Life span | 13-20 years |
| Adult size | Size varies according to species. The green turaco is the smallest (14 inches [35 cm], 200-300 g), and the great blue turaco is the largest (up to 28 inches [71 cm], up to 1000 g) |

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## Turacos (Touracos) (Family Musophagidae)

### COMMON SPECIES

- White-cheeked turaco (*Tauraco leucotis*)
- Violaceous (violet) turaco (*Musophaga violacea*)
- Green turaco (*Tauraco persa*)
- Great blue turaco (*Corythaeola cristata*)
- Red-crested turaco (*Tauraco erythrolophus*)
- Schalow's turaco (*Tauraco schalowi*)
- Hartlaub's turaco (*Tauraco hartlaubi*)
- Lady Ross' turaco (*Musophaga rossae*)
- Fischer's turaco (*Tauraco fischeri*)
- Livingstone's turaco (*Tauraco livingstonii*)
- Purple-crested turaco (*Tauraco porphyreolophus*)
- White-crested turaco (*Tauraco leucolophus*)
- White-bellied go-away bird (*Corythaixoides leucogaster*)
- Western grey plantain-eater (*Crinifer piscator*)

### ORIGIN

- Africa

### FREE-RANGING HABITAT

- Arboreal
- Forests, woodland and savannah areas

### CAPTIVE HOUSING

- Outdoor, well-planted flights are best.
- Large aviary (flight cage) should be at least 6 x 12 x 8 feet (2 x 3.5 x 2.5 m).

## Turacos (touracos)

- For short-term use or if the bird is sick, smaller enclosures (1 $m^3$) may be used.
- May be housed individually or as a pair, but not more than one pair in the same enclosure in most cases.
- Pairs may have to be separated due to aggression.
- Juveniles must be separated from adults as soon as they are able to care for themselves and may be kept in groups until sexually mature.
- Hiding places and sturdy perches should be provided.
- Preferred ambient temperature range is 64-77°F (18-25°C).
- Most turacos can tolerate mild winters without supplemental heat if they have access to shelter, but some species may not do well with frost, e.g. western grey plantain-eater (*Crinifer piscator*).

### DIET

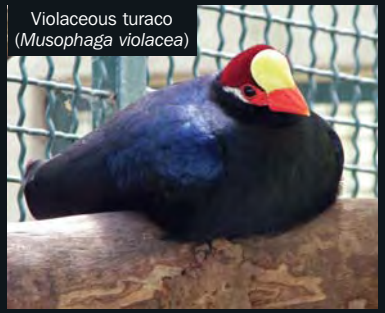
- Free-ranging turacos eat leaves, fruits, berries, some soft shoots, flowers, and occasionally small insects, snails, slugs and invertebrates.
- In captivity, turacos may be fed a low-iron softbill diet mixed well with fruit (e.g., apples, bananas, melons, papaya, pears) and dark green leafy vegetables. Citrus should be avoided.
- Fruit must be chopped into small pieces because turacos cannot chew and will swallow fruit whole.
- Calcium supplementation is recommended, especially when breeding.

White-cheeked turaco (*Tauraco leucotis*)



David Jones - www.touracos.co.uk

Violaceous turaco (*Musophaga violacea*)



Purple-crested turaco (*Tauraco porphyreolophus*)



Fischer's turaco (*Tauraco fischeri*)



Hartlaub's turaco (*Tauraco hartlaubi*)

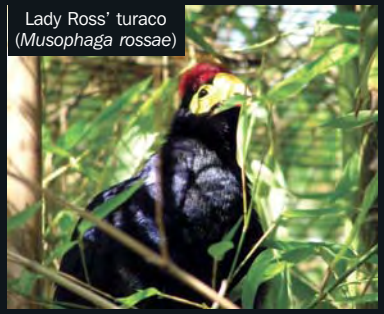


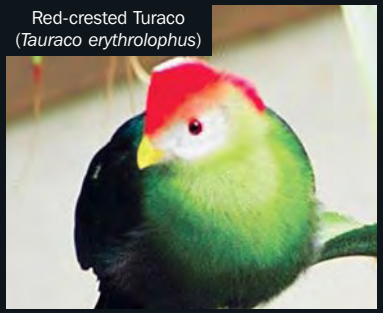
Great blue turaco (*Corythaeola cristata*)



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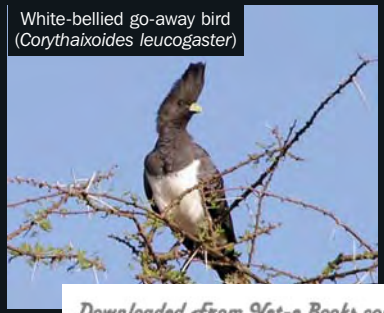

Schalow's turaco
(*Tauraco schalowi*)


Lady Ross' turaco
(*Musophaga rossae*)


Red-crested Turaco
(*Tauraco erythrolophus*)


White-crested Turaco
(*Tauraco leucolophus*)


Livingstone's turaco
(*Tauraco livingstonii*)


White-bellied go-away bird
(*Corythaixoides leucogaster*)

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## Turacos (touracos)

### SUITABILITY AS PETS

- Hardy and relatively easy to care for.
- Curious birds, and if tamed, turacos will approach familiar people and perch on the shoulder or head; however, many do not want human contact.
- Droppings are very messy.

### BEHAVIOR

- Territorial, especially when nesting
- Turacos may become aggressive, especially during breeding season.
- Free-ranging turacos live in flocks.
- Turacos can fly, but more often run along and hop between horizontal branches in the tree canopy.
- When excited, turacos raise their head crest.

### PHYSICAL CHARACTERISTICS

- Outer toes (D1 and D4) rotate forward or backward and inner toes (D2 and D3) rotate forward to grip branches (zygodactylous).
- Turacos do not have a crop.
- Ceca are rudimentary or absent.
- Turacos have a short gastrointestinal tract.
- Most are sexually monomorphic; feather coloration is due to two unique copper-based pigments, coverdin (green) and turacin (red), not light diffraction.
- Long tails, short rounded wings and crests are common.

### MOST COMMON DISORDERS

- Metabolic bone disease

Turacos (touracos)

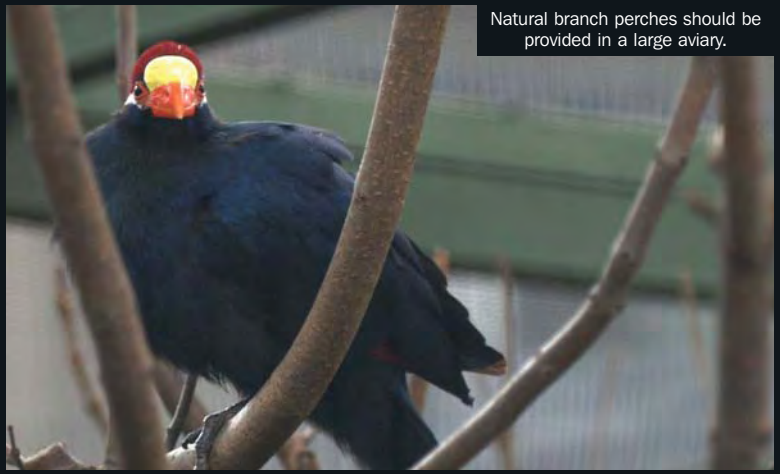
- Iron storage disease
- Avian tuberculosis (*Mycobacterium avium*)
- Bumblefoot
- Hypothermia
- Frostbite
- Traumatic injuries
- Egg binding
- Coccidiosis
- Infectious diseases, such as: *Yersinia pseudotuberculosis, Salmonella, E. coli,* aspergillosis and candidiasis

## SPECIAL CONSIDERATIONS AND CAUTIONS

- May be aggressive towards humans.
- Should be fasted prior to anesthesia as these birds may regurgitate.
- Turacos are CITES Appendix II listed (restricted trade).

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Natural branch perches should be provided in a large aviary.



Turacos are typically found in pairs or family groups. In some areas pairs defend a territory year round.

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# Domestic Duck Pet Care



## VITAL STATISTICS

| | |
|---|---|
| Life span | 10-15 years |
| Adult size | 15-26 inches (38-66 cm) in length depending on species |
| Body weight: | 2-12 lbs (1-5 kg) depending on species |

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## Domestic Ducks (Family Anatidae)

### COMMON SPECIES

- Mallard duck (*Anas platyrhynchos*)
- Pekin duck (*Anas domesticus*)
- Muscovy duck (*Cairina moschata*)
- Crested duck (*Lophonetta specularioides* formerly *Anas specularioides*)

### ORIGIN

- Mallards are found worldwide (northern hemisphere, Oceania, Asia, Africa, South America) and are migratory.
- Most domesticated ducks are descended from the mallard (e.g., Pekin from China).
- Muscovy duck: Mexico, Central and South America.

### FREE-RANGING HABITAT

- Lakes, ponds, streams, rivers and marshes

### CAPTIVE HOUSING

- Ideal captive housing is a clean, dry, warm shelter within an area to roam safely (pen or fenced yard) with a pond.
- A 3-sided enclosure is best with the sides and top secure enough to keep predators out.
- Adequate ventilation is required to prevent aspergillosis.
- A minimum of 3 feet (1 m) high and 5-6 square feet (1.5-2 $m^2$) of floor space per duck is recommended.
- A concrete floor allows easy cleaning, but must be covered with substrate.

## Domestic Ducks

- Substrate may be straw, hay, peat moss or sand. An alterative that is easy to clean with a hose is Astroturf.
- Substrate should be cleaned daily.
- Wood shavings should not be used because ingestion can cause intestinal blockages.
- If using a wire cage, the floor should be covered with washable soft towels or blankets (changed daily).
- Burlap or a soft cloth may be used to make a visual barrier to predators.
- Water for swimming and playing with a ramp for access must be provided at all times. Water should be changed when cloudy or after swimming.
- Muscovies require places for perching.
- Supplemental heat should be provided in the cold, using a 75-watt standard, infrared or ceramic bulb, positioned above one end of the enclosure and placed on the outside of the cage to prevent burns.
- Shelters should be insulated and water- and wind-proofed.
- Birds may be moved indoors in extreme weather conditions or at night.
- Shade and plentiful water should be available in hot climates.
- Environmental tolerance varies among breeds.

### RESTRAINT

- Both hands should be used to support the bird's weight with the wings held against the body.
- Alternatively, the duck may be supported by holding the neck with one hand and cradling the body with other, and the middle finger positioned between the hocks.

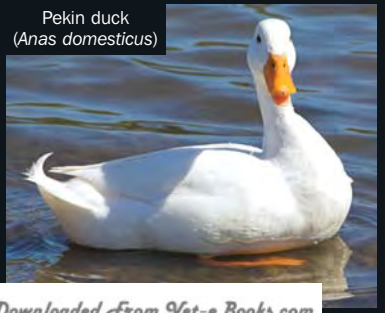

Male mallard duck (*Anas platyrhynchos*)

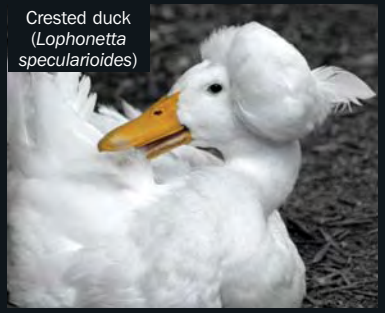

Female mallard duck (*Anas platyrhynchos*)


Male muscovy duck (*Cairina moschata*)


Female muscovy duck (*Cairina moschata*)

Gerard Hogervorst


Pekin duck (*Anas domesticus*)


Crested duck (*Lophonetta specularioides*)

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A chain link fence provides security and prevents escape.



Straw makes a good substrate.



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## Domestic Ducks

### DIET

- Free-ranging ducks are herbivorous and eat leaves, stems, flowers, roots and seeds of aquatic plants.
- In captivity, ducks may be fed pelleted mash:
  - Ducklings: 18-22% protein starter feed (3 weeks)
  - Adolescents: 16% protein
  - Adults: 14-16% protein, increased to 16-18% when laying
- Adult ducks' diet should be supplemented with calcium (e.g., oyster shell), shredded vegetables (e.g., carrots, greens), finely chopped hard-boiled eggs (with the shell), tomatoes, cracked corn, garden snails and slugs, worms, night crawlers, and bloodworms.
- Bread, scratch grains, seeds, nuts, chocolate and foods high in fat, sugar or salt should not be fed.
- Uneaten food should be removed daily.
- Unlimited access to non-medicated fresh water should be provided and changed frequently.

### SUITABILITY AS PETS

- Domestic ducks need human interaction and enrichment.
- Ducks are entertaining, interactive, vocal animals that may form a strong bond with their owner.

### BEHAVIOR

- Ducks spend their time foraging for food and swimming.
- Males may be territorial.
- Aggressive pinching behavior may occur and should be addressed by gently holding the bill closed while issuing a verbal reprimand.

## Domestic Ducks

### SEXING

- Sexing by plumage color is dependent on age, species and season.
- Most ducks may be sexed by their voices from the time they are about 6 weeks old. The females will quack loudly while the males make a soft, muffled, hoarse sound.
- Male ducks (drakes) acquire a curled tail feather called a drake feather when they mature.
- Male muscovy ducks are 30-50% larger than females.
- Ducks may also be vent sexed.

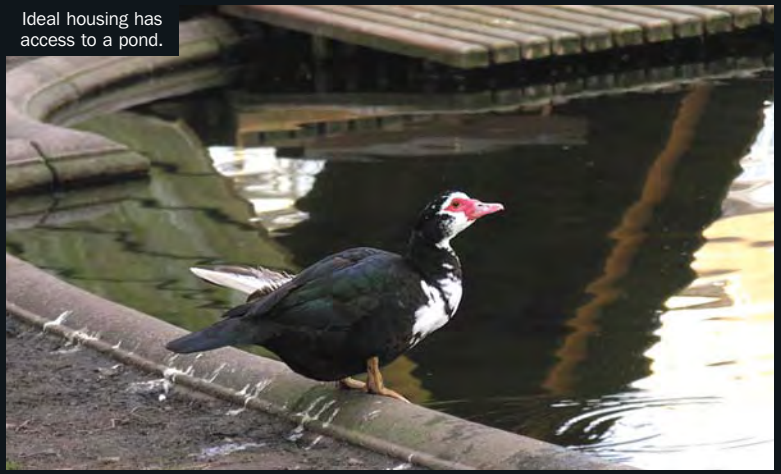
### MOST COMMON DISORDERS

- Respiratory infections: pneumonia, aspergillosis
- Heavy metal toxicity
- Toxicosis: dietary, aflatoxin (moldy bedding), insecticides and rodenticides
- Nutritional deficiencies
- Bumblefoot (pododermatitis) and joint infections
- Limb deformities (housing on wire mesh or slats)
- Fractures
- Avian tuberculosis (*Mycobacterium avium*)
- Frostbite

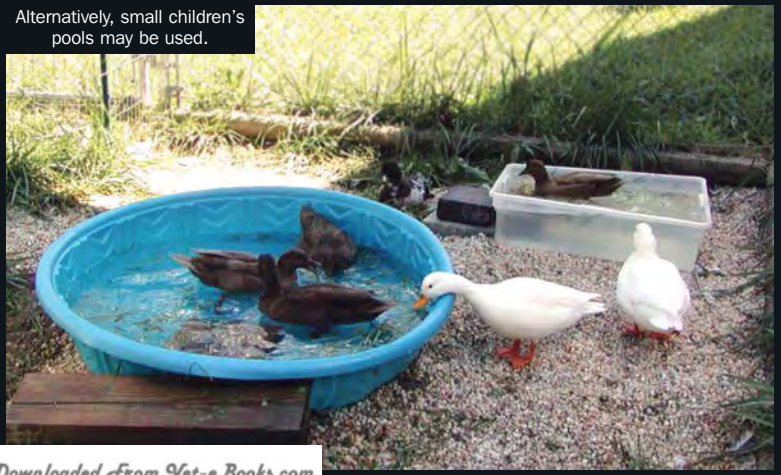
### SPECIAL CONSIDERATIONS AND CAUTIONS

- Ducks should be immunized against infectious diseases (duck virus hepatitis, duck virus enteritis)
- If presented with a native species on an emergency basis, the bird may be triaged and sent to a licensed rehabber within 24 hours.

Ideal housing has access to a pond.



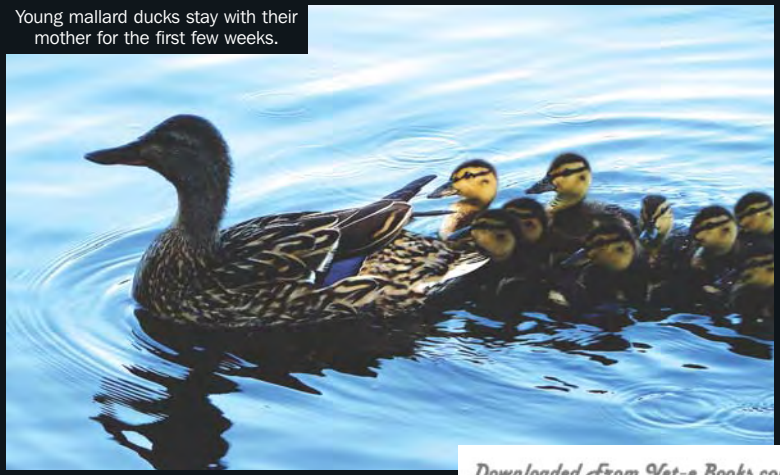
Alternatively, small children's pools may be used.



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Mallard duck nests are made with sticks and leaves near water.



Young mallard ducks stay with their mother for the first few weeks.

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- The legs of free-ranging ducks must not be amputated above the carpus or they can no longer be released.

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