

Hibernation (Brumation) Problems of Tortoises

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Tortoises are popular backyard pets and the most common reptile patient in southern California, host to their own peculiar problems, most of which result from inadequate care. Tortoises are challenging patients for veterinarians, who are, by and large, unfamiliar with tortoises. The goal of this lecture is to familiarize you with desert tortoises, how to house them, feed them and hibernate them. Much of this also applies to Sulcata tortoises, except that they do not hibernate.

Whenever possible, house tortoises outdoors, year round, in as large a pen as possible. This allows them space to exercise, graze, and bask in the sun. The enclosure should have nutritious plants, grasses and some shade. Most grasses, clovers, perennial legumes, ice plants, flowers, leaves, dandelions and weeds are healthy free forage. Toxic plants are rarely a concern (oleanders, tobacco, toadstools, and rhododendrons are exceptions) even though exhaustively discussed. Tortoises generally don't eat poisonous plants or are more tolerant of them, unless they have nothing else to eat. Hatchling and juveniles should be kept above 70°F. Adult tropical tortoises can be housed outdoors when morning temperatures are above 65°F and midday temperatures exceed 75°F. Bring them in at night when temperatures are below 65°F or provide a heated outdoor tortoise barn. Adult temperate species tolerate temperatures 5°F less than those listed for tropical species provided it warms up to 75°F during the day or a heated barn is present.

In San Diego coastally it is often too cold for tortoises without supplemental heat, and, even inland, supplemental heat is advisable at night, when temperatures drop into the 50's. All tortoises benefit from heated barns fashioned from ¾ inch AC plywood with a hinged, sloped, insulated, slightly overhanging and heated inner roof. The corners are secured with inner L braces and caulked, the floor is open to the dirt to boost humidity and ease cleaning. Hinging the roof makes it easier to clean; waterproofing the plywood will extend its lifespan. A 12 x 36 inch Kane pig blanket (Kane MKG, Inc., Des Moines, IA), or waterproof radiant heat panel, suspended loosely from the solid inner roof insulation warms the barn better than heat lamps. A dusk to dawn timer will keep heat on at night and off on warmer days, or it can be run continuously, and the doorway covered with slit plastic on colder days. On really cold nights a waterproof table cloth can increase heat retention. The doorway should be just large enough for tortoises to fit through and left open to provide an avenue to escape heat, should the timer fail.

Another way to boost heat and allow better thermoregulation is to make a solarium with ¼ inch safety glass leaned up against a wall and secured on one side by quarter round on top of two to three stacked 4 x 4 inch landscape timbers, drilled through and secured with rebar running through them and into the ground, with the glass leaning up against an eastern or southern exposure wall at 45° angle, open at both ends. Tortoises tend to push and move glass directly resting on the ground.

Burrows are not typically needed in coastal southern California because it rarely gets excessively hot. Further inland, where temperatures exceed 100°F on a regular basis, burrows are important to escape the heat of summer. Burrowing species (deserts, Sulcatas, Gophers) may excavate a burrow, be sure it cannot flood during heavy rains, either by berming around the entrance or providing drainage away from the entrance. Artificial burrows can also be constructed; see the Arizona Game and Fish Department website, www.azgfd.gov for good information on burrow construction. Tortoises may burrow under property lines but they do not burrow back to the surface. Do not allow Sulcatas to burrow near foundations, they can do extensive damage.

Outdoor enclosures should have secure perimeters. Tortoises pace perimeters and constantly try to get through perimeters they can see through. If there is a way out, or under the fence, the tortoise will find it. Solid barriers, such as wooden fencing, adobe, block walls, or smooth concrete, are preferable to open fencing. Open fencing, should be small or large enough that tortoises cannot entrap and cut a leg or neck in it, such as welded 1" x 2" wire (hog wire) or 2" poultry netting. Chicken wire or chain link are not recommended unless there is a solid barrier on the tortoise side. Fencing should be staked down to the ground or buried 12 to 24 inches, lean inward slightly, to discourage climbing, and be at least 18 inches

tall. Alternatively one can use buried metal flashing bent inward at 90° angle inward. Tortoises can climb chain link. Sulcatas require heavy reinforcement of fencing or they will push it down. Epoxying the patients name, address, and phone number, in the center of a scute, not overlapping a seam, is a service most clients appreciate.

It is against Federal and California State regulations to intentionally breed desert tortoises, artificially incubate their eggs, sell them or collect them from the wild. California requires a free permit to possess a desert tortoise, available from California Department of Fish and Wildlife or from the California Turtle and Tortoise Club (see www.tortoise.org/general/permit.html). Only one tortoise is allowed per person in all indigenous states (CA, NV, UT, AZ). It is also not recommended to breed Sulcatas; both are over populated in captivity. Males of both species will fight relentlessly and should be housed singly. Females may be housed together separate from males. Ovarioectomy through the prefemoral fossa, orchietomy, or phallectomy, is recommended to reduce unwanted numbers of these tortoises (see Innis, *et al*, 2007, Innis, *et al*, 2013). Castration is difficult as the testicles are deep in the coelom. Phallectomy won't change the male's belligerent behavior or persistence of mating behavior. Never release tortoises into the wild, they won't survive and can spread disease to wild populations. Jarchow mentioned 2 tortoises regenerated their penises years after amputation.

Tortoises will eat anything that falls into their enclosure. Enclosures must be regularly screened for scraps of metal, staples, wires, nails, tacks, twist ties, bottle caps, or any other type of metal, pieces of plastic or rubber, plastic bags, twine, and any other trash that blows in. Tortoises will also consume small rocks, gravel, decomposed granite, pumice, pebbles (especially if they don't have enough calcium in their diet) and sand. Do not house tortoises on small rocks, gravel, pebbles or sand or life threatening intestinal impactions may occur.

In colder areas of the country indoor housing is usually mandatory for a good portion of the year. The combined shell size of all tortoises present should not exceed a quarter of the floor surface area available to the tortoises. Aquariums, plastic or metal livestock troughs, concrete mixing containers, or plastic sweater boxes can be used for small tortoises. Large commercially available plastic tubs are waterproof, easy to clean, and much more suitable for larger tortoises than aquariums (Vision Products, Tubs, Canoga Park, CA or Waterlandtubs). Cages can also be constructed for larger tortoises with ½ to ¾-inch plywood on the bottom and 2 by 12 inch planks stacked on one another or plywood along the sides. The inner cage surfaces should be caulked and sealed with an undercoat of water sealant and two to three coats of polyurethane, or one can use melamine. Melamine tends to warp if it gets wet. Sealing exposed wood surfaces facilitates cleaning and disinfecting. Allow the cage to air out thoroughly (usually about a week) before placing any tortoises in it. To prevent chilling, the cage bottom should not be in direct contact with cold concrete; a gap of several inches is advisable, such as on resting on 2 x 4's. Ambient indoor temperature should be 70 to 85°F, depending on the species. Rooms can be heated with thermostatically controlled space heaters, radiant heat panels and basking lights, provide a thermogradient. Self-ballasted mercury vapor lamps (Powersun, Zoo Med, San Lois Obispo) are recommended for basking sites to provide both ultraviolet light and heat.

Juveniles are often maintained indoors on alfalfa pellets or newspaper and as they graduate to larger cages, a mixture of medium to large conifer bark nuggets and peat moss, coconut coir, soil (which is a good source of cellulolytic bacteria), newspaper, indoor-outdoor carpeting (be sure to avoid frayed edges), or corrugated cardboard. Remove fecal material from the enclosure several times per week and replace the substrate several times per year. Avoid sand, gravel, cat litter, crushed corncob or walnut shells. Most tortoises are reclusive animals, a tortoise barn or hide box should be provided.

Water should be regularly available for indoor and outdoor tortoises. Shallow plastic plant saucers work well for tortoises, except desert tortoises. Tortoises often defecate in their water; thus, water bowls should be changed whenever dirty. Desert tortoises and other species outdoors will also drink from standing water. An alternative to water bowls is to soak the tortoises in chin-deep water every 1 to 2 weeks.

Feeding captive tortoises is an area of considerable uncertainty, variability and evolving change. Chronic nutritional disease is epidemic in tortoises fed back yard grasses, weeds, grocery store fruits and vegetables. See the section on herbivores in 'How to Feed Reptiles Right' for a thorough discussion of feeding tortoises.

Annual examinations are important to discuss overall care and feeding, educate owners, compare weight to species normals, and screen for parasites and diseases. After a year, review of husbandry is again indicated, to get back to healthy habits. Tortoises are more challenging to work with therefore reliance on diagnostics, especially bloodwork (CBC and chemistry panel), fecal analysis (both direct and fecal flotation) and 3 view radiographs (dorsoventral view, anterior posterior and lateral views) are vital in the early diagnostic work up. If the owner thinks something is wrong with the turtle, there generally is. Often the tortoise has been sick for weeks to months so do not delay diagnostic work-up, adopting a wait and see attitude doesn't help.

Hibernating species of chelonians should be hibernated if in good health. Hibernation is part of the normal physiology for many temperate chelonians. Hibernation helps synchronize reproduction and utilizes excess body reserves of fat. Hibernating species often don't feed well in the winter and thyroid values are lower if not kept warm. Most *Gopherus* spp., and Mediterranean tortoises, *Testudo* spp., should be hibernated if healthy with the exception of the Egyptian tortoise, *Testudo kleinmanni*, and lowland southern Greek tortoises, such as the Moroccan Greek tortoise, *Testudo graeca graeca*. In contrast, none of the former *Geochelone* hibernate (Leopards, Sulcatas, Red foots, Yellow foots, Stars, Radiated, etc). The box turtles, *Terrapene* spp, all hibernate except for the gulf coast, *T. carolina major*, and Florida box turtles, *T. c. bauri*. Other commonly kept species that should hibernate are Wood turtles, *Clemmys insculpta*, Spotted turtles, *Clemmys guttata*, Common snapping turtles, *Chelydra serpentina serpentina*, and Red-eared sliders, *Trachemys scripta elegans*. Hatchlings of hibernating species have better survival rates if hibernated their first year.

Only healthy chelonians should hibernate, which means they have been eating and drinking well through the summer. A physical examination, weight check and blood work prior to hibernation is recommended in late summer to early fall. Low body weight, weight loss, low blood albumin, anemia or other signs of illness, such as nasal discharge, bladder stones, or hepatic lipidosis, may be indications not to hibernate. If the chelonian doesn't have sufficient body reserves it will catabolize its own body. Most cases of post-hibernation anorexia involve preexisting disease that was exacerbated by hibernation. Body condition scores have been described for desert tortoises (Lamberski 2013), with 1 to 3 being poor or under-condition, 4 to 6 in good condition and 7 to 9 obese or in over-condition.

Supplemental food should be discontinued several weeks prior to hibernation, larger animals may require three weeks, smaller turtles one or two weeks. Water should be available and soaking prior to hibernation is recommended. Desert tortoises and box turtles often enter hibernation in mid to late October and November when night time temperatures drop into the 50's and 60's, and the days are no longer hot, but there is great individual variation in the timing and duration of hibernation. Onset of hibernation in northeastern Mojave desert tortoises is from late October to early November and they emerge 4 to 5 months later in mid-February to late April. Mean temperatures of hibernaculi was 52 to 61°F, with minimum temperatures of 45 to 50°F. Hibernaculi often maintained higher temperatures than the surrounding open environment, with less temperature variation.

Hibernaculi can be indoors or outdoors, with outdoors preferred. For desert tortoises, an outdoor burrow, with a south or west facing entrance, or tortoise barn works well. Temperatures should be between 45 to 65°F, ideally around 55°F, and always above freezing. Make sure the burrow can't flood during winter rains. Indoors a tortoise can be hibernated in a cool area, such as an unheated garage, storeroom or closet. Try and keep the tortoise below 60 to 65°F. A Styrofoam box, or a cardboard box insulated with thick layers of newspaper, within a larger cardboard box, can be used. The box should be large enough for the tortoise to turn around in, lined with newspaper and some shredded newspaper, or slightly humid substrate, covered with blankets and kept dark. Do not put the box directly on cold concrete, unless it is too warm. Better insulation minimizes temperature swings. Indoors the low humidity can dehydrate tortoises, juveniles should be soaked every 2-3 weeks and adults every 4-6 weeks. Soaking should be for 15-30 minutes in shallow lukewarm water during the day, allow the

tortoise to dry before returning it to the hibernaculum. As overnight temperatures stay above 65°F and days warm the tortoise will start to move around and can emerge from hibernation. It should be soaked again, and watch to see if it urinates. Healthy tortoises will start eating and urinating within a week of emergence, make sure they stay above 65°F at night. If hibernated properly they should lose less than 6–7% of body weight over winter.

Box turtles and *Testudo* tortoises can tolerate much colder temperatures, ideally from 40 to 50°F. They generally dig into outdoor substrates but do not use burrows. Avoid freezing, on frost warning nights cover them up or bring indoors. Both groups can survive freezing but is not recommended and can result in blindness.

Aquatic turtles housed outdoors will hibernate in southern California in the winter if they have no supplemental heat. Feeding is discontinued in November. The turtles will remain active in the water. Feeding can be started again as it warms in March or April. Watch for signs of pneumonia such as not floating level laterally, (not anterior to posterior), inability to submerge, discharge from the nares or mouth or not opening the eyes. Hypovitaminosis A can develop in animals that were poorly fed prior to hibernation.

Post-hibernation anorexia is not really a specific entity but a collection of diseases that often get worse after hibernation such as upper respiratory tract disease, liver or renal dysfunction. This seems to be much a bigger problem in northern latitude Mediterranean tortoises, in Europe, than what we see in southern California, but desert tortoises can be affected. Sub-optimal nutrition, as well as sub-optimal hibernation conditions, can result in a dehydrated starved tortoise with major organ system failure upon emergence from hibernation. Tortoises should lose no more than 6 to 7% of their body weight over hibernation, under ideal conditions *Testudo* spp. lose less than 1% body weight. Hibernation should be no more than 3 to 5 months and immediately upon emergence tortoises should be soaked. The tortoise should drink, urinate and flush out the bladder. Chelonians should be kept above 65°F at night and start eating, drinking and urinating within 1 week of emergence. Chelonians that do not eat or urinate should see a veterinarian as soon as possible. Post-emergence tortoises are often dehydrated, immunocompromised and vulnerable to disease. Thorough evaluation including history, CBC, chemistry panel, urinalysis, radiographs and fecal analysis are indicated to find out why the chelonian is anorexic. Is it a husbandry issue or is there a medical basis for anorexia? Acidic urine indicates catabolism in tortoises. Many *Testudo* spp. are hyperuricemic, hyperkalemic, and hypoglycemic. Treatment includes shallow warm water soaks twice daily and aggressive fluid therapy, with 40 mls/kg/day 0.9% NaCl plus 5% dextrose, in divided doses via stomach tube, to encourage urination. After multiple urinations, fluid administration can decrease to 20 ml/kg/day until the tortoise is eating. If not eating within a week or two consider an esophagostomy tube for easier long-term nutritional support until the patient is eating well and blood values normalize. Broad-spectrum antibiotics are indicated. If UA is > 16 mg/dL, start allopurinol, 20 mg/kg SID via stomach tube (crush a 100 mg tablet in 5 mls/water). Address any other problems found on workup. Long-term care involves improved husbandry. Absence of urination is a poor prognostic sign, but often difficult to confirm. Patients with blood uric acid > 34 mg/dl or potassium > 35 mg/dl typically die. See McArthur, *et al*, for detailed discussion.

Pneumonia is common in aquatic turtles during hibernation. Anterior posterior radiographs may reveal unilateral opacity in the lungs. Tracheal lung wash of the affected side (guided with sterile cerclage wire) for aerobic culture and sensitivity is indicated. Most patients respond well to 20 mg/kg ceftazidime SC q 72 hrs for 7–10 treatment provided the patient is kept warm (70–85°F).

Upper respiratory tract disease, mycoplasmosis, is common in tortoises upon emergence. Treatment consists of nasal flushing and antibiotics (see Nasal Discharge in Tortoises). Desert and Sulcata tortoises may have several concurrent diseases that manifest after emergence such as cystouroliths, hepatic lipidosis and mycoplasmosis. Many Sulcata owners do not realize Sulcatas do not hibernate, and fail to provide adequate heat in the winter. Not unexpectedly, Sulcatas don't feed well under these conditions. Keep them above 65°F at night and allow them to bask above 75°F during the day and they usually start eating again.

REFERENCES

1. Boyer T, Boyer D. Turtles, tortoises and terrapins. In: Mader D, ed. *Reptile Medicine and Surgery*. 2nd ed. St Louis, MO: Saunders Elsevier; 2006:78-99.
- Innis C, Hernandez-Divers S, Martinez-Jimenez D. Celioscopic-assisted prefemoral oophorectomy in chelonians. *JAVMA*. 2007;230(7):1049-1052.
- Innis C, Feinsod R, Hanlon J, *et al*. Coelioscopic orchietomy can be effectively and safely accomplished in chelonians. *Vet Record*. Published online April 4, 2013.
- Jacobson E, Berry K, Stacy B, Huzella L, Kalasinsky V, Fleetwood M, Mense M. Oxalosis in wild desert tortoises, *Gopherus agassizii*. *J Wildl Dis*. 2009;45(4):982-988.
- Johnson J, Averill-Murray R, Jarchow J. Captive care of the desert tortoise, *Gopherus agassizii*. *JHMS*. 2001;1(3):8-16.
- Lamberski N. Body condition scores for desert tortoises.
www.fws.gov/nevada/desert_tortoise/documents/reports/2013/assess/Desert-Tortoise-BCS-2013-lamberski-po.pdf. 2013.
- Mathes K, Gunther P, Kowaleski N, Fehr M. Urinary calculus in the pelvic region of a Moorish tortoise. *Tierarztliche Praxis*. 2009;37(6):427-432.
- MacArthur S, Wilkinson R, Meyer J, Innis C, Hernandez-Divers S. *Medicine and Surgery of Tortoises and Turtles*. Oxford, UK: Blackwell Pub; 2004.
- Nussear K, Esque T, Haines D, Tracy R. Desert tortoise hibernation: temperatures, timing, and environment. *Copeia*. 2007;2:378-386.