



HIBERNATING YOUR TORTOISE OR BOX TURTLE

WHAT IS HIBERNATION?

Hibernation, or brumation as it is sometimes referred to in the case of reptiles, is that state of inactivity, during the winter, in which the animal's core body temperature drops and physiological and biochemical changes, such as lowered blood pressure and slowed metabolism occur. These changes allow the animal to conserve energy when the ambient temperature is too low, and so to survive until temperatures rise, days lengthen and food is available once more.

In their natural environments many box tortoises or turtles (*Terrapene* species) and true tortoises (*Testudo* species, *Geochelone* species) hibernate from October or November until late February, March or even early April. The natural shortening of day length and the reduced brightness of daylight, as well as the decreased availability of food are among the cues, which induce hibernating behavior. The animals burrow deep in leaf litter or soft earth, which insulates them from temperature changes and as the days lengthen and temperatures rise, they emerge in the spring.

For most tortoises, peak activity occurs between 22-28° C (70-85° F). This is the animal's POTZ (preferred optimal temperature zone). Above 30° C (86° F), activity decreases and above 35° C (95° F), there is no activity. If unable to escape such heat, the animal will suffer damage to his internal organs. Below 20° C (68° F), activity levels decrease and the animal's metabolism functions less than optimally. Below 16° C (60° F), hibernation may occur.

Tortoises, which originate in extremely hot climates, such as northern Africa, may not hibernate, as temperatures do not dip low enough for a long enough time. Any species of box tortoise or tortoise may inhabit a geographical range which includes several different climates, and thus may exhibit different hibernation patterns. The result is that there may be some members of a species will not hibernate. In captivity, where food is always available, lights are on for 12-14 hours a day and temperatures remain constant within the POTZ, hibernation may not occur. Reptiles do not, however, always follow rules and in spite of constant environmental parameters, some individuals will try to hibernate while others will not. The most significant sign that your tortoise wants to hibernate is a decrease in his appetite. If his environment allows, he may begin to dig a hibernaculum, or den in which to pass the winter. Some animals must be encouraged to hibernate by changes brought about in their captive environment, which mimic natural stimuli to hibernate.

Always remember that although most healthy tortoises, given the right conditions will go off their food in the late autumn in preparation for hibernation, this is not the only reason for which reptiles will stop eating. Disease, parasites, and improper housing conditions, particularly inadequate temperatures among many other factors will cause a tortoise to eat less or to stop eating. Only healthy animals can safely undergo hibernation.



WHY HIBERNATE?

We are only beginning to understand the physiology of hibernation in reptiles, but the benefits of hibernation and the potentially serious consequences of preventing hibernation are clearer. Healthy specimens deposit fat stores in preparation for hibernation. If not allowed to hibernate, these animals may be at an increased risk for obesity. Hibernation is believed to be necessary to the normal function of the thyroid gland. Testicular and ovarian function, as well as all other hormonally controlled physiologic processes have evolved in conjunction with hibernation and so may be linked to this regular period of dormancy. Some evidence also points to a decreased immune response in those animals, which are not allowed to hibernate. Experienced box tortoise and land tortoise keepers note that successful breeding may require hibernation through synchronization of ovulation by females, and by allowing males to achieve prime breeding condition. Hibernation is most likely required if a tortoise is to achieve his expected life span.

WHO SHOULD HIBERNATE?

Be certain that you own a species, which should hibernate. An exhaustive and absolute list is not possible, but there are guidelines. First, identify with certainty the species and in some cases, the subspecies you own. Familiarize yourself with its natural history, geographical origin and as far as possible determine whether this individual would be likely to hibernate in the wild. Reptile veterinarians, experienced keepers, breeders, local reptile clubs and organizations such as The Tortoise Trust can be excellent sources of practical information.

There is some disagreement in the precise classification of some tortoise species, and some subspecies will be difficult to distinguish, unless one is an expert, but the vast majority of pet tortoises and box tortoises will easily be identified and their hibernation requirements determined.

Only healthy specimens who have been eating well and who have not experienced recent or unresolved illness or stress should be allowed to hibernate. It is vital to know the animal's history. Has it hibernated before now? Has it been eating well? Has it been checked for parasites or treated for worms or for an illness? Has it seen a veterinarian recently? What has it been eating and how has it been housed? Malnourished animals or those kept at incorrect temperatures should not undergo hibernation. Animals who are to hibernate should be in good body condition, should show no signs of physical illness and should be behaving normally. Records of the animal's weight should indicate no loss. If weights are unavailable, or if the individual is new to the collection and his history is unclear, it may be wise to delay hibernation until the next year. Animals which are not healthy or which are stressed, and are kept at the low temperatures of hibernation will be unable to mount an adequate immune response when faced with disease, as the immune system of a reptile functions well only within the POTZ. Some of these tortoises will be hiding disease and those, which are not already ill, will be at increased risk of contracting disease.



No absolute rules dictate the minimum age at which to begin hibernation. Smaller animals with a lower body mass are more susceptible to temperature fluctuations, making hibernation more risky. Young animals may lack adequate fat stores and may not yet be immuno-competent. Captive bred animals may have hatched too late in the year to hibernate successfully. Although it may be that animals which hibernate will have more natural growth patterns and will mature sexually in a more normal way, this is not proven, and it is probably safer to wait until the animal is a few years old or is showing definite signs of readiness to hibernate. Some juveniles will show behavioral changes late in the winter, and may be put into hibernation for a short time. The decision to begin hibernation is based largely on the experience of the keeper. There may be no better source of support and practical information than a keeper of your species in your geographical area.

Unless you know that your pet is a member of a species, which does not hibernate, you can be fairly certain that he should. If your pet is of a hibernating species, there is a good chance that if he is housed in optimal, stable conditions, he will begin to indicate in late September to early November that he is ready to hibernate. Although not every tortoise that should hibernate will show obvious signs that he is ready to do so, many in spite of 12-14 hours of light and temperatures within the POTZ will stop eating. Unless there is a reason not to allow your tortoise to hibernate, such as known or suspected illness, recent stress or age, or a possible husbandry problem, it is in most cases advisable to proceed with hibernation. If there is any doubt, consult your reptile veterinarian.

PREPARATION FOR HIBERNATION

Be sure that your pet is fit to hibernate. In most cases, this should involve an annual pre-hibernation trip to your reptile veterinarian, for a physical examination and a review of dietary history to help to assess fitness for hibernation. Hibernation procedures or details, which may be relevant to your geographical area, can be reviewed at this time. Your veterinarian may also recommend fecal testing for parasites, treatment for parasites or blood tests to evaluate the animal's health.

Unless your experience or your reptile dictates otherwise, the beginning of hibernation is typically some time from early October to early November. Begin by withholding food, but not water, for 10-14 days. Smaller animals or species should be fasted for a shorter time than should larger species or individuals. During the fast, maintain the tortoise within his POTZ (22-28° C or 70-80° F). This will allow him to clear his digestive tract of all food, and it is a crucial step in preparation for hibernation. Ingesta (food) remaining in the animal's gastrointestinal system while he hibernates are partly digested and will slowly rot, releasing toxins into the body as the animal hibernates. This is especially dangerous as hibernation; in addition to halting the digestive process depresses the immune system. It is recommended that during the pre-hibernation fast, tortoises are soaked daily or every other day, in tepid water for 20-30 minutes. The water should be deep enough to reach their chins when their heads are at rest, or the level of the bridge (the junction between the top shell or carapace and the bottom shell or plastron). Soaking will ensure that the tortoise has every opportunity to be well hydrated and will also encourage him to evacuate wastes from his bladder and colon. These too, may prove dangerous if allowed to accumulate excessively during hibernation.



After 10-14 days kept in normal conditions, that is, within the POTZ, the tortoise should spend up to one week at room temperature (16-21° C or 60-70° F), before moving to the hibernaculum (see below). The temperature inside the hibernaculum should stay at 10-12° C. Occasional dips to 7° C are perfectly safe, but temperatures must not rise above 16° C and 5° C or colder brings the temperature dangerously close to freezing.

CONSTRUCTING A HIBERNACULUM

The purpose of the hibernaculum is to insulate the animal against exterior temperature fluctuations. The reptile produces no heat internally, so the ambient temperature must be controlled and monitored. A maximum-minimum thermometer is strongly recommended. The hibernaculum can be constructed from a crate, box, plastic tub, or Styrofoam container. The box should be large enough for the tortoise to extend his limbs and head, but not tall enough to allow him to flip. There should not be more than one animal in a box. A lid should fit securely and there should be ventilation holes in the top and sides of the box. A wire mesh lid can also be used. The box should be filled 2/3 of the way with peat based potting soil or shredded newspaper. The tortoise can burrow in to this substrate. The soil should be moist, but not dripping when squeezed. Dried leaves can be used as bedding, but they must be dry and free of pesticides. Hay or straw are not recommended, as they are more likely to be moldy or dusty, and may contribute to respiratory problems. Coarse hay or straw may cause eye injuries. To improve insulating properties, the box containing the reptile may be placed inside an outer larger box, and the intervening space filled with shredded newspaper.

The hibernaculum should be placed in a dark or dimly lit, draft free, secure room, which is not subject to much disturbance, such as from a washing machine, children or other pets. The hibernaculum can be placed inside an old refrigerator, provided that it is fitted with ventilation holes, or that the door is opened daily to allow the escape of carbon dioxide, which will accumulate secondary to the tortoise's respiration. A maximum-minimum thermometer should be installed close to the tortoise. It is strongly recommended that owners set up the hibernaculum in the precise conditions, which the tortoise will experience several weeks prior to placing the animal into hibernation. This allows time to monitor the maximum and minimum temperatures under different weather circumstances, and will allow the opportunity to make changes if necessary.

Dehydration is a serious concern during the hibernation of tortoises in captive conditions. If soil is used, it should not be allowed to dry completely. A small bowl of water can be placed near the tortoise, in the fridge, for example, and allowed to evaporate and be refilled.

Tortoises can be allowed to hibernate outdoors. A deep pit, lined with thick plastic and plywood, filled with peat moss or topsoil and secure from predators can work. The structure must be in place for weeks to months prior to hibernation, so that the animals become accustomed to it. Animals which hibernate outdoors will generally do so for longer than those kept inside, often from mid-October to early April. Obviously, outdoor hibernation carries much more risk than does indoor hibernation. In addition to concerns about frost damage, flooding and predators, the inability to monitor hibernation is a consideration, which makes outdoor hibernation inappropriate in many cases.



MONITORING HIBERNATION

Check the maximum and minimum temperatures daily. If the tortoise is in a fridge, a daily air change takes place when the thermometer is checked. If air is not changed, carbon dioxide levels will rise, and oxygen levels will fall. Every 3-4 days, check that although the tortoise is very sluggish, he is breathing (slight limb or head movement), but not overly active. Every 10-14 days, in the case of small or juvenile reptiles, or every 2-3 weeks in the case of large, mature specimens, remove the tortoise from the hibernaculum. Check the hibernaculum for excessive or inadequate moisture, mould, insects or evidence of rodent presence. Weigh the tortoise and make a note of the weight. Allow the tortoise to rehydrate by placing him in tepid water to soak for 30 minutes to an hour. The tortoise should exhibit sluggish but normal behavior. Take this opportunity to examine your pet. Observe his breathing, be sure that his eyes, nose, mouth and vent are clear of discharge, and that he shows no swellings or wounds. After weighing, soaking and examining your pet, return him directly to the hibernaculum. Do not expose him to unnecessary light, noise or other stimulation. If there are any indications of a problem, or if weight loss is excessive (see below) wake the tortoise by returning him to his usual environment, within his POTZ, and assess the need for veterinary attention. Once woken fully and returned to his usual environment, do not return the animal to hibernation that year.

Pay strict attention to the weight of your tortoise. This should be monitored in grams. A mature, healthy tortoise will lose 1-2% of his pre-hibernation (fasted) weight for every month of hibernation. That is, after one month, a 1000g tortoise should weigh no less than 980 g. Weight loss in excess of this limit may be a sign of disease, parasitism or an excessively warm or dry hibernaculum.

WAKING FROM HIBERNATION

There are no absolute rules as to the proper length of hibernation for captive tortoises and Box turtles. Generally speaking, indoor hibernation will occur between mid-October and late March. Small or young animals might hibernate for as long as eight to ten weeks, but six weeks may be adequate. Larger animals (mostly *Testudo* species) might spend as long as twelve to fourteen weeks in hibernation. Box turtles from the southern or south eastern United States may require as little as four to six weeks in hibernation. Some period of hibernation is almost certainly beneficial to your pet, and while animals should be woken at the first sign of concern, if a tortoise is doing well and losing no more than the expected amount of weight, there is no reason to end hibernation early. Make careful notes of weight loss. By the end of hibernation, a mature tortoise should not lose more than 60-70% of his pre-hibernation weight. Tortoises should be weighed and examined regularly during hibernation. See related articles for more details.

Once your tortoise starts to show sign of activity, once he has spent a reasonable time in hibernation, if there are any reasons to be concerned about his health or if his weight loss is approaching your limit of comfort, it is time to wake up.



After you remove your tortoise from his hibernaculum (den in which he has hibernated), keep him at room temperature for a few hours. This will mimic the time it would take him in the wild to emerge from his burrow, into bright, warm sunlight. Then move him to his normal enclosure, and maintain him within his POTZ (Preferred Optimal Temperature Zone – see related care articles for further information). Soak him daily for a week, and he should resume normal behavior and eating within three to four days. Use lukewarm water, which is only deep enough to reach his chin, or the bridge (where the plastron, or bottom shell meets the carapace, or top shell). The reptile should be soaked for 20-30 minutes daily. Soaking will encourage your pet to eliminate the wastes, which have been accumulating in his body during hibernation. The accumulation of wastes within the colon and bladder can lead to the release of toxins in to the animal's body, as well as to the inability to pass hard dry stool, and to the development of bladder stones and gout. Since many tortoises and turtles come from areas of the wild where water is scarce, they will often not urinate until they know that a source of water is available. This is a method of water conservation. Misting (with a spray bottle) at least once a day will increase humidity levels in the enclosure, and by mimicking rainfall will encourage tortoises to eat, drink and evacuate waste.

Many tortoises, which do not eat within three to four days, are simply not warm enough, or are not exposed to sufficiently bright radiant light. A focal bright, "hot spot" is recommended. These conditions are necessary to stimulate the reptile to eat. In the wild your pet would emerge from a cool, dark burrow into bright sunlight, and quickly warm himself by basking in intense sunlight. A warm (generally not warmer than 20° C), bright room simply does not mimic the animal's natural environment.

If your tortoise does not show any definite signs of illness and is behaving normally except that he is not eating, the first step is to review your husbandry techniques. In particular, pay attention to lighting (brightness and appropriate ultraviolet content-see related articles for more details on lighting recommendations), temperature, the presence of a focal "hot" spot (for basking) and photoperiod (recommended number of light and dark hours).

Failure to eat is probably the most common post-hibernation concern. If you cannot detect a problem in the tortoise's environment, if the animal shows any other signs of a health problem, or if the does not begin to eat within four to five days of correcting any husbandry problems, a visit to your reptile veterinarian is warranted. Conditions commonly associated with hibernation include frost damage to eyes and limbs, injury from predators (rodents, raccoons), sores or corneal ulcers from rough bedding, pneumonia and excessive weight loss. The reptilian immune system does not function optimally at the temperatures required for hibernation. Reptiles hide illness very effectively, and many are sub-clinically (not obviously) ill when they begin hibernation. Disease may therefore have worsened during hibernation.

Any signs of illness, such as respiratory sounds, eye, nose or mouth discharge, failure to eat or abnormal behavior, wounds or sores warrant veterinary advice. See related articles for signs of a sick reptile.



If all is well, and your pet resumes normal eating and behavior patterns, the weeks following emergence from hibernation are a good time to schedule a well pet check up with your reptile veterinarian. He or she may detect reason for concern following a physical examination, or may be able to make suggestions regarding husbandry for the season to come. Worming or blood testing may also be appropriate at this time. Examination findings provide valuable information, especially when compared with those from previous years.

BOX TURTLES

Terrapene Carolina species

- Common or Eastern Box Turtle (*Terrapene carolina carolina*)
- Three Toed Box Turtle (*T. c. triunguis*)
- Gulf Coast Box Turtle (*T. c. mojar*)
- Florida Box Turtle (*T. c. baun*)

Terrapene ornata species

- Eastern Ornate Box Turtle (*Terrapene ornata ornata*)
- Salt Basin or Texas Ornate Box Turtle (*T. o. luteola*)

Florida Box turtles, Gulf Coast Box turtles from the southern extremes of their range and Ornate Box tortoises from the southern extremes of their range do not usually hibernate.

GOPHER TORTOISES

Gopherus (Xerobates) species

- Desert Gopher Tortoise (*Gopherus (Xerobates) agassiziz*)
- Texas Gopher Tortoise (*G. (X.) berlandieri*)
- Mexican Gopher Tortoise (*G. flavomarginatus*)
- Florida Gopher Tortoise (*G. polyphemus*)
- Gopher tortoises hibernate.

TORTOISES

Testudo species

- North African or Moorish Tortoise (*Testudo graeca graeca* and *T. g. iberia*)
- Hermann's Tortoise (*T. hermanni hermanni* and *T. h. boettgeri*)
- Afghan, Steppe or Horsfield's Tortoise (*T. horsfieldz*)
- Greek or Spur Thighed Tortoise (*T. iberia*)
- Marginated Tatoiise (*T. marginata*)
- Egyptian Tortoise (*T. kleinmanm*)

Most *Testudo* species hibernate. The exceptions are some North African tortoises (not a common pet) and those of African origin, such as the Egyptian tortoise.