

The Tortoise Trust
and the Jill Martin Fund for Tortoise Welfare and
Conservation

(Registered Charity number 1123430)

BM Tortoise, London, WC1N 3XX

*Evaluating indoor tortoise housing for compliance with the
Animal Welfare Act (2006)*

Practical Guidelines for Retailers, Trading Standards
Officers, Keepers and Animal Welfare Officers



www.tortoisetrust.org
www.jillmartintortoise.org

Introduction

The Animal Welfare Act (2006) established some important principles that all accommodation intended for captive animals must be measured against. A formal duty of care now exists upon all persons responsible for animals in captivity. The Act says that an animal's welfare needs include:

- a suitable environment (how it is housed);
- the ability to exhibit normal behaviour patterns;
- any need it has to be housed with, or apart from, other animals; and
- protection from pain, suffering, injury and disease

This short guide sets out how these requirements apply to tortoises, and how accommodation that is in use for tortoises can be assessed to ensure that the above needs are being adequately met, ensuring compliance with the Act.

Any vivarium or other indoor tortoise enclosure or habitat that is sold to be used with tortoises should comply fully with the relevant legislation and should be fit for purpose. It should be safe, and when used as directed, it should produce a suitable environment that meets the animal's physiological needs.

A Suitable Environment

Tortoises are reptiles, and therefore rely almost exclusively upon the environment that they are kept in to meet their physiological and metabolic needs. This means that they **must** be able to attain adequate temperatures to permit normal activity patterns, and **must** be able to self-regulate their temperature using the environment provided. This is called behavioural thermoregulation (Heatwole and Taylor, 1987). This requires a range of different temperatures to be available to them. The difference between the highest temperature in the habitat and the lowest is called the thermal gradient.

It is generally accepted that non-tropical tortoises, such as Mediterranean tortoises (*Testudo graeca*, *Testudo hermanni* and *Testudo marginata*), or Central-Asian tortoises (*Testudo horsfieldii*) are active between temperatures of approximately 18 °C to 34 °C. At night, temperatures can safely fall to between 12-15 °C. An overnight temperature reduction is normal and desirable for all temperate zone, non-tropical tortoises.

These species require a *minimum* hot spot, or 'basking temperature' of 30 °C.

An *optimum* basking temperature would be in the 34-38 °C range.

At the same time as the hot spot, or basking temperature, they also require a cooler area to retreat to so that they can voluntarily reduce their body temperature on demand. This area should be in the 18-22 °C range and should be a minimum of 8 °C below the maximum safe temperature in the habitat. An optimum gradient or differential would be in the 10-15 °C range.

- If an adequate basing temperature is not available a tortoise will be unable to digest food normally and will suffer a compromised immune system and stress.
- If an adequate thermal gradient is not available it may overheat and will be unable to self-regulate its temperature.

Both of these conditions are a violation of the requirements of the Act in respect of the need for a) A suitable environment and b) The ability to exhibit normal behaviour patterns.

It should be noted that many tropical forest-dwelling tortoises (such as Redfoot and Yellowfoot tortoises (*Geochelone carbonaria* and *G. denticulata*) or Hinge-back tortoises (*Kinixys* species) do not require such high basking temperatures, neither do they require such a large gradient, or such a low temperature retreat zone. Instead, a more constant, all-round ambient temperature in the 28-30 °C range is required day and night for these tortoises.

Tropical non-forest dwelling species such as Leopard tortoises (*Geochelone pardalis*), African Spurred tortoises (*Geochelone sulcata*) and Indian Star tortoises (*Geochelone elegans*) have very similar requirements to Mediterranean tortoises, except that the minimum temperature day and night should be normally be no less than 20 °C.

Heat sources

The main source of basking heat for both Mediterranean or non-forest dwelling tropical tortoises should be an overhead lamp or ceramic heater. Floor mounted heat pads or 'hot rocks' are not suitable for providing basking heat for tortoises. These have been implicated in causing serious ill-health and death in tortoises (McArthur, et. al., 2004). They also inhibit normal thermoregulatory behaviour.

Heat pads may be appropriate if used on the wall of a vivarium for background or overnight heat only, or if used on the floor with tropical forest dwelling tortoises to produce a gentle, all-round heat. In that case, they **must** be used in conjunction with a reliable thermostat to prevent overheating or excess temperatures developing in the substrate (cage bedding). **Heat mats can cause severe burns and death in tortoises if incorrectly installed or if used without an effective thermostat.**

Temperatures in excess of 40 °C can be rapidly lethal to all tortoises as they cause generalised overheating to the point beyond the animal's critical thermal maxima. The critical thermal maxima of most tortoises is in the range 39-41 °C. (Hutchinson, Vinegar and Kosh, 1966)

Temperatures of 41 °C and above can also produce severe, life threatening thermal contact burns in tortoises (McArthur, op. cit). These injuries are common where base-mounted heat pads are employed, especially if these are used without adequate thermostatic control.

Space and ventilation

Tortoises require as much horizontal floor space as possible. In the wild, they roam over extremely large areas. Individual Leopard tortoises (*Geochelone pardalis*), for example, have a home range from 58 hectares to 414 hectares, with long distance movements of up to 4 Km at a time being recorded (McMaster, 2001). Smaller tortoises such as the Mediterranean *Testudo* will also roam over several hectares regularly. No vivarium can possibly approximate this. Such habitats should therefore be regarded as for temporary use only, for example during inclement weather, and additional, much more extensive outdoor accommodation is mandatory in all cases. **In the view of the Tortoise Trust, no tortoise should ever be sold on the basis that it can be maintained entirely indoors on a permanent basis.**

An adequate sized vivarium or terrarium is also absolutely critical to achieving a satisfactory temperature gradient within the unit. Small enclosed units (typically those of 1.25 meters or 4 feet in length) have consistently been shown to provide completely inadequate temperature gradients for Mediterranean and non-forest dwelling tropical tortoises alike.

The basking lamp should be positioned at one end of the habitat, and the other end should be capable of providing a cooler retreat zone. There should be an absolute minimum of 8 °C differential between the two areas, and the hottest end should never exceed 40 °C.

In practice, the better the ventilation a unit has the easier it is to achieve acceptable gradients and the likelihood of excessively high temperatures building up is also reduced. Therefore, maximum airflow and ventilation should be encouraged. In smaller shop display

units, some form of forced air ventilation by means of fans may be required to comply with the Act.

Humidity

Different species have very different needs in terms of environmental humidity. Broadly speaking, these requirements closely correlate to the type of habitat they originate from. As a general guide, tropical forest species may require an average RH of 80% or more, while a typical arid or semi-arid habitat species will require the ambient RH to be in the 45-55% range.

Suitable microclimate provision will help to limit fluid loss from evaporation (which occurs via the skin and as a result of respiration), and will also help to stabilise sudden body temperature fluctuations. Microclimates are, therefore, very important to tortoises and they are utilised extensively in the wild by many species, and are of particular importance to species that inhabit inhospitable arid environments. This type of behaviour is not unique to tortoises, being particularly common among lizards, and the physiological results also closely parallel those established in other reptiles (Heatwolfe and Taylor, 1987, Zug, Vitt and Caldwell, 2001). In practice, providing a cooler area where a tortoise can bury its softer parts in a sufficient depth of substrate will do much to reduce respiratory and evaporative losses, and such a facility should be made available in all enclosures.

While excessively dry environments should be avoided, so too should excessively moist or damp environments. The correct environment should be dictated by the natural habitat. As a guide, drier substrates and relative humidity levels (<60% RH) should be avoided for most forest dwelling species, and damper substrates and higher relative humidity levels (>60% RH) should be avoided for arid habitat species. Subjecting arid habitat species to consistently excessive levels of humidity can result in shell infections, skin diseases of both bacterial or fungal origins, and respiratory disease.

Tortoises can urinate profusely: also, water bowls can be tipped over. It is important that when this occurs the humidity within the habitat either remains within safe limits, or if it exceeds safe limits, it should not do so for an extended period and should quickly return to normal.

Excessively damp substrates or retreats can have serious implications for the health of arid habitat species, resulting in an increased incidence of respiratory disease, and an increase in both fungal and bacterial shell and skin infections. As a general recommendation for Mediterranean *Testudo* and semi-arid *Geochelone* species, such as Leopard tortoises and Indian Star tortoises, air humidity within an enclosure should normally be in the region of 50% (+/- 5%). Fresh drinking and bathing water should be available for all species, at all times.

Lighting

In the wild, tortoises rely extensively upon the UV-B radiation in sunlight to generate the vitamin D3 that they need for proper bone formation. In order for this process to work, adequate basking heat must also be present (www.uvguide.co.uk).

In an indoor environment various artificial lamps are available that are capable of producing UV-B artificially. See the above link for an in-depth discussion of this topic.

Tortoises in captivity can receive the D3 they need from various sources, including natural sunlight, artificial lamps, or orally by means of supplements. Illumination and basking heat should be provided for 12-14 hours daily. A period of near total darkness at night should be provided. Red or blue lamps should not be used at night.

It is important that lamps used produce a safe but effective level of UV-B and that they are sited at a safe (but still effective) distance from the animal.

Substrates (cage flooring material)

Incorrect substrates can interfere with desired humidity levels, or can kill and injure directly by piecing the eyes, nose or mouth or by causing obstructions and penetrating the gut if eaten. Organic substrates, if not changed often enough, can rapidly accumulate very high levels of bacterial and fungal pathogens that will contribute to disease (Gardner and Oberdorster, 2005). The smaller the floor space, the more often the soiled substrate will need to be changed if this is to be prevented.

Specific substrates that have been regularly noted in the literature to cause serious problems for tortoises include:

Hardwood chips: Lethal if ingested, fail to provide suitable microclimate, sharp splinters
Pine/Cedar shavings: Emit toxic fumes when heated, fail to provide suitable microclimate
Walnut shell litter: Piercing injuries and impactions, excellent culture medium for mould
Corn cob litter: High risk of impaction, excellent culture medium for mould and bacteria
So-called Calcium-Sand: Implicated in numerous cases of fatal gut impaction
Hemp: Sharp splines of hemp bedding have caused the loss of eyes and fatal peritonitis when ingested as a consequence sharp spikes of piercing the gut.

The Tortoise Trust strongly believes that use of the above is not in accordance with the requirement under the Act for protection from pain, suffering, injury and disease.

For short term use a paper substrate is safe, or for longer term use a variety of other options are available. See:

<http://www.tortoisetrust.org/articles/substrates.html>

<http://www.anapsid.org/substrates.html>

Whatever substrate is used, tortoises should be fed on a separate tiled area to prevent or reduce the risk of accidental ingestion.

Mixing species and keeping with other tortoises

Mixed species groups should be avoided. Different species may have very different temperature and humidity requirements, for example. They may also have mutually antagonistic behaviour patterns than can result in stress or physical injury. Different species may also have completely different and entirely incompatible dietary requirements. It is almost impossible to keep species from different habitats together as the environment and diet will invariably prove sub-optimal for both. Different species from different origins

may also carry diseases to which the other has no acquired immunity. There are high levels of reported disease and death among mixed species groups (McArthur, op. cit.)

Overcrowding should also be avoided as this will result in high levels of aggression, excessive competition, and unavoidable stress. It will also increase the rate of fecal contamination within an enclosure and result in more general hygiene problems.

How to Measure Environmental Conditions within a Vivarium

It is important that reliable, professional grade thermometers and humidity gauges are employed for all measurements. The consumer-grade “reptile” thermometers often sold in pet stores typically have extremely poor accuracy and should not be relied upon under any circumstances.

The minimum tools required include:

- An accurate infra-red, non-contact ‘laser’ type thermometer
- An accurate ambient (air) temperature thermometer
- An accurate relative humidity meter
- An accurate general purpose contact thermometer with remote probe

Additionally, a dual-channel electronic differential thermometer is helpful for taking simultaneous measurements at both ends of a vivarium or cage to determine gradients.

For longer term testing and evaluation, and for evidential purposes, temperature and relative humidity data-loggers are excellent.

It is instructive to test temperatures over a period of hours, as if measurements are taken immediately lamps and heaters are switched on, the results can be misleading.

To test UV-B levels special meters are available. Solartech Model 6.2 will give a reading in microwatts per sq. cm, and Solartech Model 6.5 will produce a UV Index figure of general safety.

CHECKLIST

1. Test the substrate temperature at various locations

It should not normally exceed 39 °C at any point, even under the basking lamp. If it is above 40 °C, it should be regarded as extremely dangerous and capable of causing severe injury or death.

2. Ideally using a differential thermometer, measure the temperature gradient available within the unit taking both substrate and air temperature readings. Take one measurement directly at the basking position and the other at the opposite (coolest) end of the enclosure.

Assuming that the enclosure is intended for Mediterranean tortoises or non-forest dwelling tropical tortoises, there should be a differential of at least 8 °C between the two readings.

Ideally, look for a gradient of 10-15 °C. If it is intended for tropical forest dwelling species, an all-round ambient, stable temperature of approximately 28-30 °C is acceptable.

3. Test the basking temperature directly under the spot lamp/heater.

It should be a minimum of 30 °C, and ideally 34-38 °C for all Mediterranean and non-forest dwelling tropical species.

4. Using an accurate relative humidity meter, check the ambient air humidity within the enclosure.

It should be in the range of 45-55% for arid and semi-arid habitat species, including Mediterranean tortoises, Leopard, Indian Star and African Spurred tortoises and approximately 80% or more for tropical forest species such as Redfoot, Yellowfoot and Hingeback tortoises. The humidity should not normally be sustained below 40% for any species.

5. Check the substrate for hygiene quality, and for safety and suitability.

See page 6.

6. Check that the substrate depth is adequate to permit the tortoise to at least half-bury its body (and soft fleshy parts).

This is important for fluid conservation and the prevention of dehydration. It is also an important natural behaviour pattern for many species which they must be able to express.

6. Ensure that the enclosure is of a suitable size for the inhabitants and that it is not overcrowded. Note the dangers of mixing different species of tortoise, or with other reptiles, within the same environment.

*Tortoises should also never be kept in the same enclosures as snakes or lizards due to the presence of mutually antagonistic parasites in these groups, such as the frequently fatal *Entamoeba invadens*.*

References:

Gardner, S. C. and Oberdorster, E. (2005) Toxicology of Reptiles. CRC, Taylor & Francis. 328 p.

Heatwole, H. F. and Taylor, J. (1987) Ecology of Reptiles. Surrey Beatty & Sons, Pty. NSW.

Hutchison, V., Vinegar, A. and Kosh, R. (1966). Critical Thermal Maxima in Turtles. Herpetologica, Vol. 22, No. 1, pp. 32-41

McArthur, S., Wilkinson, R. and Meyer, J. (2004) Medicine and Surgery of Tortoises and Turtles. Blackwell Publishing, 579 p.

McMaster, M.K. 2001. The status and ecology of the leopard tortoise (*Geochelone pardalis*) on farmland in the Nama-Karoo. M.Sc. thesis, University of Natal, Pietermaritzburg.

Zug, G. R., Vitt, L. J. and Caldwell J.P. (2001): Herpetology. Academic Press.