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Indoor Care of North American Box Turtles

**SANDRA L. BARNETT AND
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NORTH AMERICAN BOX TURTLES are among the most popular reptile pets in the United States. The species and subspecies most commonly kept are *Terrapene carolina carolina* (common eastern box turtle), *T. c. major* (Gulf Coast box turtle), *T. c. triunguis* (three-toed box turtle), and *T. ornata ornata* (ornate box turtle). They are not closely related to, and have different care requirements than, the Asian box turtles occasionally seen in the pet trade.

North American box turtles have many winning attributes. They are attractive, relatively small (3.5-7.0 inches [8.9-17.8 cm] in carapace length, depending on the age, sex and species), and are very long-lived animals if properly cared for. A life span of 50-60 years is not exceptional, and life spans twice as long have been recorded. Moreover, many box turtles are responsive to their owners, approaching and accepting food offered by hand or forceps.

Where the climate is appropriate, it is always better to house box turtles outdoors. However, if this is not possible, these animals can be successfully housed indoors by carefully following the guidelines provided in this article. Information is included on general box turtle care as well as on the design of an attractive, relatively inexpensive indoor enclosure that anyone can assemble with a minimum

of shop skills. While the enclosure is specifically designed for the common eastern box turtle, it can also be used to house the more aquatically oriented three-toed and Gulf Coast box turtles.

The ornate box turtle presents special husbandry challenges. This species is particularly shy and is generally considered to be the most difficult species of North American box turtle to successfully maintain in captivity, particularly indoors. The authors recommend that only experienced hobbyists who can provide appropriate outdoor accommodations keep this species. Nonetheless, since many ornate box turtles are kept indoors, the authors will note how the enclosure and care described in this article should be modified to make them appropriate for this species.

Don't Shop, Adopt

North American box turtle populations are seriously threatened by habitat loss and degradation, yet thousands of wild box turtles continue to be legally collected every year. Virtually all adult box turtles sold in pet stores are wild-caught. They commonly suffer from severe parasitic infections, life-threatening dehydration, eye and respiratory problems and other illnesses and injuries due to inappropriate handling and care. The authors strongly recommend purchase of only captive-born animals from a reputable breeder or adoption of rescued box turtles from a local herpetological society.

STEP-BY-STEP GUIDE TO BUILDING A BOOKCASE ENCLOSURE FOR BOX TURTLES

Components

1 The components for a bookcase enclosure for box turtles include:

- Bookcase (minus the shelves), at least 12 inches (30 cm) deep with a height and width that encloses an area of approximately 12-13 square feet (3-4 m²)
- Three pieces of 8-inch (20 cm) wide x ¾-inch (2 cm) thick “bookshelf” lumber to construct a support structure for overhead lights
- Two 4-foot (1.2 m) full-spectrum fluorescent light tubes
- Two light timers (one for fluorescent lights, one for a spot light)
- Maximum/minimum thermometer/hygrometer
- Clamp-on light fixture with ceramic socket
- 50-watt incandescent spot light
- 6-mm plastic sheeting as moisture barrier for interior of bookcase
- Trim molding to hold enclosure liner in place (shown), or 2-inch (5 cm) wide baseboard molding to discourage escape of large turtles (not shown)
- Very finely shredded hardwood mulch or loam soil substrate
- Large shallow water pan with access ramp
- Indoor/outdoor, rubber-backed mat
- Silk plants anchored in cups filled with plaster of Paris
- Misting bottle and watering can (latter not shown)
- Table/bench (not shown) to elevate enclosure off the floor, away from drafts

Lining the Enclosure and Adding Substrate

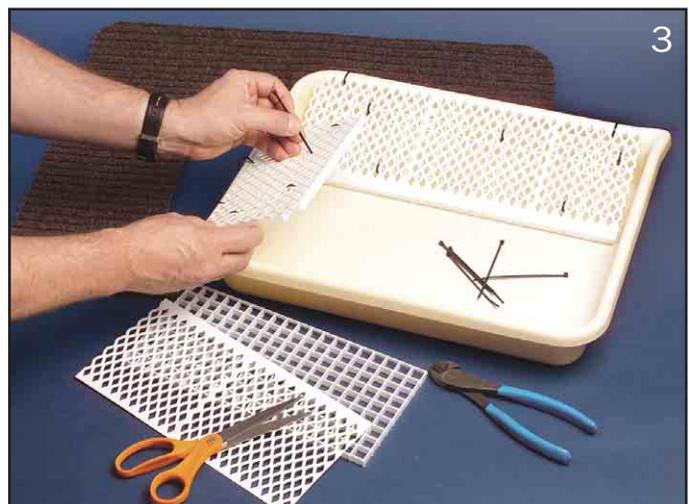
2 Line the bookcase with heavy-duty (6 mm) plastic sheeting or pond liner (the latter is more durable but expensive). Fold the corners of the liner square, with the folds facing down, so there are no folds or bulges where a turtle could gain purchase and climb the enclosure wall. Tape or staple gun the edges of the liner to the rim of the enclosure (shown), or for a more attractive and secure finish, fold the liner over the sides of the bookshelf, and cover the rim with molding screwed in place. Do not use nails, so the molding can be easily removed and the liner replaced if damaged. To prevent the escape of large box turtles, the molding should be wide enough to allow for a 2-inch (5 cm) lip around the inside perimeter of the rim. This overhang will prevent escapes.

Add appropriate substrate (see Tips, page 28) to a depth of 3 inches (7.5 cm) for *T. carolina* and 4 inches (10 cm) for *T. ornata*.

Preparing the Pool

3 Modify a new, large photograph developing tray (14 x 17 x 3-inch [35 x 43 x 8 cm] model works well) to serve as a pool. Lightly sand the interior surface of the tray so it will not be slippery.

Construct an access ramp (no steeper than a 35° angle) from a piece of plastic egg crate screen (sold in 2 x 4-foot [5 x 10 cm] sheets as diffuser panels for overhead lights) overlain with an equal size piece of plastic snap-in gutter guard. Use small electrical ties to fasten the two together, as well as to “hinge” the finished





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ramp to the tray (through two small holes drilled near the rim of the tray). By hinging the ramp loosely, it can be conveniently flipped back when cleaning the tray. When constructing the ramp, take care to sand off all rough or sharp edges. Cut ends of electrical ties are easily rounded off with a match or lighter.

Scoop out an area in the substrate so the pool's rim sits just above the the substrate's surface. Add a piece of 6- to 7-inch (15-18 cm) wide rubber-backed, indoor-outdoor mat to the perimeter of the pool to reduce the amount of substrate that the turtle drags into the water. Avoid using outdoor carpeting with a looped weave or any indoor carpeting, since turtles can snag claws and toes on this material. Also, if the carpet tends to fray at the edge, finish the border with hot glue or 100% rubber silicone caulk.

Alternatives to carpeting include thin slate tiles, smooth flat rocks, flat cork bark or a layer of moist hardwood leaves. These options are equally good, varying only in their maintenance, longevity and esthetics.

Adding Plants

4 Add silk ferns and similarly shaped soft silk or soft plastic plants to provide cover (See Tips for Housing Box Turtles Indoors on page 28). The turtle can hide underneath the arched fronds while still being irradiated by beneficial UV lights overhead. Space the plants so that the turtle is never too far from cover. Placing a plant in the pool may encourage a particularly shy animal to soak longer.

To keep artificial plants from toppling over, set them upright in plastic yogurt cups (cut the cups down to 2 inches (5 cm) in

height) filled with a mixture of gravel and plaster of Paris or cement. Just before the plaster or cement hardens, push a little mulch into the surface for camouflage. Once the compound hardens, bury the yogurt cups in the enclosure substrate. Consider "potting" the plant intended for use in the pool in an attractive piece of small glazed crockery, since the container will show.

Lighting

5 To make an attractive light support for the turtle enclosure, use three pieces of 8-inch (20 cm) wide x 3/4-inch (2 cm) thick "bookshelf lumber" (can be purchased pre-finished). Along the length of the underside of the largest piece of lumber, screw in a U-shaped metal shelf bracket (track) or an equally long piece of 1 x 2-inch (2.5 x 5 cm) stock (with the narrow side against the bookshelf lumber) to prevent the long piece from bowing. Attach the two upright pieces of wood using wood glue and two 2-inch (5 cm) corner braces where the long piece joins each upright. Alternatively, glue and screw a 1 x 2 x 8-inch (2.5 x 5 x 20 cm) piece of stock into each inside corner for structural support.

Hang the fluorescent light fixture from cup hooks over the center of the enclosure, adjusting the height of the fixture so there are 15-18 inches (38-46 cm) between the lights and the substrate. Add a clamp-on fixture positioned to shine down on a back corner of the enclosure (where a basking turtle is least likely to be disturbed by surrounding human activity). Take care to keep plants far enough away from the basking lamp to avoid burning but close enough to give the turtle a sense of security.



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BOX TURTLE HUSBANDRY

Hallmarks of a Healthy Box Turtle

A healthy box turtle (see below) feels heavy in the hand, like a rock. The shell is firm all over with no moist or discolored, foul-smelling patches or uplifted scutes. (Box turtles do not shed scutes like many other turtles.) A gentle tug on a leg will cause the turtle to strongly pull the leg away. There are no swellings about the face or limbs, nor any swelling or discharge around the vent. The eyes are open, clear and alert; the nose and mouth are clear, the tongue pink, and there are no bubbly secretions or clicking sounds as the animal

breathes. (It is normal for a turtle to make a hissing sound as it withdraws its head in defense, however.) The beak is even, free of breaks and overgrowth.

The underweight and undersized male shown on the lower left exhibits classic signs of poor diet and an abnormally dry environment: e.g., a saddle-shaped shell that appears to be too small for the body. The beak is slightly overgrown as a result of the animal's very soft, all-produce diet. The turtle has abnormally long claws, the result of being housed on recycled

paper litter, a substrate that did not allow proper claw wear. The substrate was also very dry, causing the turtle to suffer from dry, flaking skin, irritated eyes and respiratory problems (resolved with improved husbandry before this photo was taken). The turtle's skin is unusually lightly pigmented due to its lack of exposure to natural sunlight.

Outdoor Pens are Best

Captive box turtles do best in a well-designed, predator-proof outdoor enclosure. It should be heavily planted with ferns, bushes or other vegetation that provide cool, shady retreats. There should also be areas that receive at least a few hours of sun (preferably in the morning) for basking. Since cool refuges away from the sun are critical to the survival of these turtles outdoors, newly planted pens that lack good shade cover should include boards over part of the pen with plenty of moist leaf litter underneath where the animals can retreat from the sun and heat.

A box turtle pen should have well-drained, moist loam soil where the turtles can burrow for thermal- and hydro-regulation. There should also be a shallow pool positioned so it is easy for the owner to reach and keep it clean. If the pool is small (e.g., a plant saucer sunk in the ground), it should be placed in the shade to keep the water cool.



Healthy box turtle



Unhealthy box turtle

 For specific information and helpful photographs on sexing eastern and ornate box turtles, see www.boxturtlesite.org.



A unique feature of the pen shown here is the large volume (40-gallon [151-L]) pool. It has a false floor made of black egg crate screen covered with 3/8-inch (3 mm) mesh, black plastic screening (#XV-1672, InterNet, Inc., www.internetmesh.net). The egg crate screen is flush with the rim at the access end of the pond and gently slopes to fall 2 inches (5 cm) below the rim at the “deep” end (water depth is 1½ inches [4 cm]). A removable section of the false floor allows access to a small submersible pump, which moves the water to a trickle filter located outside the enclosure. The return pipe gravity feeds the water back into the enclosure via a small waterfall. The pond maintains excellent water quality and a stable water temperature due to the large volume of water in the system and the large-capacity trickle filter. At the same time, the turtles do not have access to deep water where they may drown.

Diet Variety is the Spice of Life

In the wild, box turtles are omnivores, eating a large variety of plant and animal material. Contrary to popular opinion, there is no evidence to suggest that there is any difference in diet between animals of different ages. However, ornate box turtles appear to be more insectivorous/carnivorous than the eastern box turtles.

Diet in captivity should include a variety of raw leafy greens, vegetables, fruits, berries and animal protein. Nutrition Support Services offers an excellent, ready-to-serve box turtle diet (www.herpnutrition.com). For people who want prepare their own diet, the authors have had long-term success using the diet in Table 1.

Table 1. Successful Homemade Diet for Box Turtles

MEAL 1 (per turtle)	MEAL 2 (per turtle)
<p>Ingredients:</p> <ul style="list-style-type: none"> ■ Rehydrate 1 Tbs of dry “Turtle Brittle” (www.enasco.com), a fish/meat/grain-based chow, in 2 tsp of water. ■ Add ½ Tbs of a hard squash from List A. ■ Add ½ Tbs of a vegetable from List B. ■ Add ½ Tbs of a leafy green from List C. ■ Add ½ Tbs of a fruit from List D. ■ Several times a month add 1 tsp of crumbled, hard-boiled egg. ■ Mix all of the above ingredients together well so the turtle is less likely to focus on a single food item. ■ Top with a few berries from List E. ■ Top with 1-2 freshly killed crickets or mealworms. ■ Dust the entire meal very lightly with pure calcium carbonate (sold as a supplement for humans; the pills must be crushed) or finely crushed cuttlebone (about 85% calcium carbonate) 	<ul style="list-style-type: none"> ■ Serve as every <i>third</i> meal for eastern box turtles ■ Serve as every <i>other</i> meal for ornate box turtles <p>Feed to satiation:</p> <ul style="list-style-type: none"> ■ Pesticide-free slugs ■ Terrestrial snails ■ Grubs ■ Earthworms ■ Beetles ■ Sow bugs ■ Crickets (cultured crickets should be gut-loaded with high calcium cricket diet for at least 2 days before use) ■ Grasshoppers ■ Preying mantids (remove pincers) ■ Katydid <p>Feed occasionally:</p> <ul style="list-style-type: none"> ■ Mealworms ■ Super mealworms (<i>Zophobas</i> beetle larvae) ■ Pre-killed pinkie mice

Foods to include in vegetable portion of box turtle diet

List A	List B	List C	List D	List E
<p><i>Grated and very finely diced</i></p> <ul style="list-style-type: none"> ■ Acorn squash ■ Butternut squash ■ Pumpkin ■ Winter squash 	<p><i>Very finely diced</i></p> <ul style="list-style-type: none"> ■ Sweet potatoes ■ Carrots ■ Red/orange bell peppers ■ Okra ■ <i>Opuntia pad</i> (no spines) 	<p><i>Very finely diced</i></p> <ul style="list-style-type: none"> ■ Clover and blossoms ■ Collard greens ■ Dandelions (all parts) ■ Endive ■ Escarole ■ Romaine ■ Watercress 	<p><i>Very finely diced</i></p> <ul style="list-style-type: none"> ■ Apples ■ Apricots ■ Figs ■ Grapes ■ Mango ■ Melon ■ Oranges ■ Papayas ■ Peaches ■ Tomatoes 	<ul style="list-style-type: none"> ■ Blackberries ■ Blueberries ■ Elderberries ■ Gooseberries ■ Raspberries ■ Wild strawberries

This list is far from complete, but represents a reasonable variety of commonly available foodstuffs that are palatable and nutritious. Try to vary which items are used from each list. Be sure that any field-collected foodstuff has not been exposed to harmful chemicals.

Table 2. Feeding Guidelines

- Feed adult box turtles every other day; feed hatchlings daily.
- Offer all meals on a flat rock, tile, plastic butter tub lid or the like to facilitate eating and to prevent the animal from ingesting substrate with the meal.
- Provide each animal with its own food dish.
- Feed turtles in the morning, right after they have had time to warm up.
- Remove leftovers within several hours to prevent access to spoiled food and to keep flies away.
- If a turtle is reluctant to eat, try misting the enclosure just before feeding to simulate a light summer rain shower. It also may help to feed the animal underneath foliage, where it feels secure.



Box Turtles Relish Live Food

Box turtles are highly attracted to moving prey, yet they are often slow and clumsy eaters. It may be necessary to cut up or use forceps to restrain live prey and keep it in front of the turtle. Do not allow crickets to roam freely in an indoor enclosure, because they will breed there, and the enclosure will fill with tiny young.

Acknowledgements

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Further Reading

1. Dodd CK: North American Box Turtles, A Natural History. Norman, Oklahoma, Univ. of Oklahoma Press, 2001.
2. Ernst CH, Lovich, JE, and RW Barbour: Turtles of the United States and Canada. Washington, Smithsonian Institution Press, 1994.
3. Highfield AC: Practical Encyclopedia of Keeping and Breeding Tortoises and Freshwater Turtles. London, Carapace Press, 1996. (Available at www.tortoisetrust.org.)
4. Highfield AC: The Tortoise and Turtle Feeding Manual. London, Carapace Press, 2000. (Available at www.tortoisetrust.org.)

Useful Web Sites

- Melissa Kaplan (www.anapsid.org)
- Tortoise Trust (www.tortoisetrust.org)
- Tess Cook (www.boxturtlesite.org)

TIPS FOR HOUSING BOX TURTLES INDOORS

■ Enclosure Dimensions

One to two female or one male North American box turtle can be successfully maintained in an enclosure with at least 12 square feet (1.11 dm²) of floor space. A large bookcase, children's sandbox or preformed children's pool work well if an owner does not want to build a pen. Cement mixing tubs and aquariums are too small for housing adult box turtles on a permanent basis. Moreover, the high walls on most aquariums make it difficult to establish good ventilation and a proper thermal gradient.

The walls of a turtle pen should be high enough so the animal cannot reach up, grab the top and hoist itself up and over the rim. (Box turtles are remarkably good climbers!) An 8- to 9-inch (20-23 cm) clearance above the substrate is adequate if the walls are smooth and there are no plants or other objects (including cage mates) on which a turtle can stand or use as a ladder. For added security, add a 2-inch (5 cm) overhanging ledge around the inside perimeter of the pen.

■ Enclosure Material

Ideally, use smooth plastic or finished lumber (i.e., coated with exterior-grade varnish, polyurethane or an epoxy sealant) to make an enclosure. Such material weathers well and can be easily cleaned. If raw lumber is used, it must be lined with a plastic sheet to keep the wood from rotting and maintain sanitary conditions. Do not use screening on the walls, since turtles may abrade themselves on it. Also, avoid clear plastic or glass; turtles often pace along walls they can see through.

If there are pets or small children that could gain access to the enclosure, cover it with a screened lid. Do not use a solid lid with small ventilation panels; it is unlikely to provide adequate ventilation.

■ Location

Box turtles are shy animals and may be stressed by excessive nearby noise and activity. Place their pen in a quiet room. Also, avoid placing the enclosure on the floor or near doors and heating/cooling vents where there may be rapid changes in temperature

and undesirable drafts. Pens may be placed near east-facing windows for natural light as long as care is taken to provide adequate cool shady retreats in warm weather. Pens should not be placed near windows in cold weather; air near even closed windows may be chilly.

Many homes commonly experience relative humidity of 30% or less in the winter. This is much too low for box turtles. Consider using a warm air humidifier in the room holding the box turtle pen to increase the ambient humidity to at least 50%.

■ Substrates

In the wild, box turtles spend a considerable amount of time partially or totally buried in the substrate to thermo- and hydro-regulate and to hide from potential predators. In captivity they may become highly stressed if deprived of the opportunity to burrow or hide and may suffer serious medical problems if the substrate is too dry.

The substrate should be loose for easy digging, nonabrasive, have a low dust content and be free of chemical additives. Inexpensive substrates that work well include very finely shredded hardwood mulch (e.g., "ICBIN" mulch by Banff, Barrington, NJ) or high quality loam compost. Add hardwood leaf litter and/or rehydrated sphagnum moss to increase moisture-holding capacity and to keep the substrate from packing. Rehydrated processed coconut shell (e.g. "Coconut Bark" by T-Rex, Chula Vista, CA) may also be used as a substrate amendment.

Unacceptable substrates include roughly milled hardwood mulch containing wood shards; all pine, fir, and cedar mulches/shavings; corncob litter; processed walnut shells; orchid bark; play sand; alfalfa pellets; recycled paper pellets/litter; indoor/outdoor carpeting (except as a pool edge mat) and newspaper. (If a box turtle is undergoing medical treatment that requires it to stay clean, the animal may be housed temporarily on several layers of moist newspaper and given a thick, fluffy layer of crumbled, wet shredded newspaper as substrate. The shredded paper will satisfy the turtle's need to burrow and hide in a humid environment.)

The moisture content of the substrate is very important to the health of a box turtle. If it is too dry, the animal may develop swollen eyes, respiratory irritation and dry, flaky skin. If the eyes swell shut, the turtle will stop feeding and drinking and ultimately will die.

Eastern box turtles do well in very moist but well-drained substrate. The relative humidity should be about 80% just above the surface of the substrate (head level) and close to saturation (about 98%) below.

Ornate box turtles do well in enclosures where most of the substrate is slightly moist with a surface relative humidity of about 80% and a subsurface value of 85%. There also should be several very moist areas created by the addition of wet sphagnum moss or chopped leaves. Here the subsurface humidity should approach saturation. One of the moist retreats should be located under the basking light (this retreat will require daily rewetting) in order to provide the turtle with a choice of temperature and humidity.

■ Hydration

Box turtles must have daily access to water for drinking, soaking and eliminating wastes. Plastic plant saucers and plastic paint roller trays sunk into the substrate are commonly used as pools. However, since the water depth should not exceed 1-1½ inches (2.5-4.0 cm) (shallower for juveniles), even large saucers hold little water and become polluted quickly. Moreover, most plant saucers are steep-sided and can be especially difficult for smaller turtles to negotiate. (Grosfilex makes a 16-inch diameter plant saucer with short, sloping walls that is suitable for all but hatchling box turtles. It is distributed through Wal-Mart stores.)

Better options than plant saucers and paint trays are large, shallow photograph development trays (available online from photographic supply companies selling darkroom equipment and at some camera supply stores) and large, shallow cat litter pans. Add a gently sloping access ramp on all sides that can be approached by the turtle.

Whatever the choice of pools, remember to sand the inside surface to make it less slippery. Keep the pool scrupulously clean, and fill it with water at room temperature.

■ Enclosure Enrichment

Box turtles are shy animals that are easily stressed if they do not have access to adequate cover. Silk ferns and other soft silk plants with a similar arching shape work well. Plastic plants can be substituted for silk ones; the former are easier to clean and more durable but sometimes are too stiff and may poke an overly rambunctious turtle in the eye. Living plants are another option; they have the added benefit of adding humidity to the environment. However, active turtles can be extremely hard on vegetation and trample small plants. Take care to select only plants that are free of sharp edges or spines and that offer significant cover, such as thick ferns with arching fronds. If the turtle cannot hide underneath the plant, it serves little value.

The authors are not aware of any cases of box turtles becoming ill from eating plants known to be toxic to humans. However, to err on the conservative side seems prudent and still provides many choices for enriching an enclosure with live plants (see a list of toxic plants at www.tortoise.org).

Pieces of wood from the forest or driftwood can be added to break up the landscape, act as visual barriers between cage mates and provide objects to nestle up against. (In the wild, box turtles often wedge themselves under pieces of fallen wood to rest.)

In the case of ornate box turtles, add several cork or wood cave retreats. These turtles are particularly shy and appear to do best when given access to such hideouts. Be sure that one of the retreats that is not near the basking light overlays an area with moist hardwood leaves or sphagnum moss. It can serve as a high humidity refuge. Remember to keep any hard enrichment away from the perimeter of the pen where a turtle might use it to scale the wall.

■ Lighting/Heating

Turtles living indoors should be maintained under full-spectrum fluorescent lights (e.g., 5.0 ReptiSun, ZooMed Laboratories, www.zoomed.com). Place the lights no more than 18 inches (45 cm) above the substrate, and replace them every 9 months to 1 year to ensure that sufficient UVB radiation is reaching the animals. (This light is important for Vitamin D synthesis, calcium metabolism and

the prevention of metabolic bone disease.) Add a 50-watt spotlight to create a daytime basking spot at 85-88°F (29-31°C); do not use hot rocks. The background temperature should be 72-75°F (22-24°C) in the daytime, and several degrees cooler during the night.

Keep the animals under a diurnal cycle of 12-14 hours of light and 10-12 hours of darkness. Use a separate timer for the basking light, so it turns on 15-20 minutes before and off 15-20 minutes after the overhead lights, to simulate dawn and dusk.

In the wild, North American box turtles hibernate during the winter, except in the extreme southern portions of their range. If these turtles are overwintered indoors, they must be maintained under summer-like conditions or they will cease eating and possibly become ill. Even if a summertime environment is provided, some individuals will attempt to hibernate, remaining buried and inactive much of the time with little or no appetite. They are not in a true state of hibernation, however, and their physiologic need for food and water remain high. The situation can become life-threatening if they 'hold out' too long.

■ Social Grouping

North American box turtles are mildly social or at least tolerant of each other. However, it is incorrect to assume that a pet box turtle needs a companion to thrive. They do very well living alone in captivity.

It is best not to mix the species and to house adult males separate from adult females. Males may incessantly follow females around, attempting to mount them. This can be stressful for the females. Also, a male may injure a female's shell, actually boring holes into it where he repeatedly grasps it with his claws. Adult males should be kept solitary as they may fight, bully or attempt to mount one another. Usually females may be successfully housed together, assuming there is sufficient space. A 12-square foot (111 dm²) pen can comfortably hold two compatible females. In the case of aggressive cagemates, extra logs and plants can be added as visual barriers and retreats so as to reduce confrontations. But incompatible turtles should not be forced to cohabit an enclosure in the longterm. The stress can negatively affect the animals' health.

