



European Studbook Foundation

Advice for maintaining and breeding the following Chelonia:



Terrapene carolina carolina

Terrapene carolina major

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Introduction:

Description

These small american tortoises are technically defined as a turtle, owing to it having distinct webbed toes on the rear legs. It is not however a water turtle, living entirely on land. These two species' habitat is swampy ground, wetlands, forests with streams and in the locality of other water sources. Its soft skin loses moisture, which in turn requires regular bathing and drinking facilities for the animal. Defecation is also done in water. The box tortoise derives its name from its shell, whose plastron is hinged, allowing the shell to completely close up both front and rear in an insect tight seal against predation. All subspecies of this tortoise are omnivores, taking all manner of insects grubs and worms in the wild, as well as including fruit and fungi in their diet. All sub species lay soft shelled eggs which require warm damp conditions to develop. They are a secretive tortoise hiding away in scrapes or burrows for much of the time, feeding taking place at dawn or dusk, and egg laying taking place after dark. This tortoise is however highly intelligent, and responsive to its owners in captivity. It is usually gregarious, and pairs and groups can be kept together (as long as the groups are female heavy). Its small size and quiet habits makes it an ideal vivarium kept animal, where its focussed vision, and endearing attitude provide genuine interaction as a pet.

Origins:

Terrapene carolina carolina: United States: Georgia to Illinois, southern Michigan and Massachusetts

Terrapene carolina major: United States: Southern Mississippi, southern Alabama, peninsular Florida.

Identification

Terrapene carolina is divided into a number of recognised sub-species, of which T.c.major (the Gulf Coast box turtle), and T.c.carolina (the eastern, or 4 toed box turtle) are two. All of the sub species have intergrades however, and hybridisation in the wild, and more importantly for us, cross breeding in captivity is common. Identification therefore needs to be carefully made, along with all possible clues as to the provenance of the animal. Even after this, efforts should be made to only breed studbook animals with those showing the most classic features of their sub-species.



Two quite different looking *T. carolina major*. The last picture is of a direct *T. carolina carolina* / *T. carolina triunguis* cross

The sub species

***Terrapene carolina major*:**

Largest of the terrapene species, typically 20cm in length. The shell is elongated and low, with no clear keel. Carapace patterning and colouration highly variable, from plain buff to strong yellow/black patterning, but classically it is very dark or black with faint dots and streaks. Colours can get more melanistic with age. Captive bred animals shells can be butter yellow to brown in colouration. Rear feet have four toes. Flaring of rear marginal scutes in mature adults.

Skin is grey, with darker or sometimes more colourful markings on scutes and head, males having more colouration.



Plastron is plain dark yellow or marked with blurred dark irregular streaks and blotches. Seams are dark.

Most significant identification point- the 2nd/3rd vertebral scute length of the carapace, which reflect the elongated nature of this tortoise - being longer than they are wide.



NOTE: New hatched T.c.major have distinctive yellow legs.

Gender variations:

Adult male has a distinct dent in the abdominal area of the plastron.

Eye is always pale to bright red. Leg scales and head can be marked with colour patterns of red or yellow.

Rear claws are long and highly curled- they should NOT be clipped



Adult female's eye is deep red to brown in colouration.

Skin and legs less patterned than in the male, typically plain grey with dark markings.

Identification of gender by the size of the tail is dubious as the differences are small, and hard to see owing to the use of the plastron hinge to protect the tail when handled.

The sub species

Terrapene carolina carolina:

The nominate form, this tortoise has a highly patterned carapace of elongated yellow spots on a black (fading to brown) background.

The size of this tortoise varies from small (10cm) to medium (15cm). The keel is flattened, with patterning on the ridge.

Skin colouring is dark, with some yellow patterning on leg scales and head.

Often with a white throat.

Plastron has dark seams which can be quite broad, with a variable amount of dark blotches on the scutes.



Gender variations:

Males (below) are distinctive with a highly marked head of yellow blotches, yellow markings on leg scales, and with pale to bright red eyes
Rear claws are long and highly curled- they should NOT be clipped



Females (below) have less bright colouring, with heads being generally plainer and darker.

The eyes are dark red to brown. Females can be larger than the males.



Hatchlings and juveniles (below) begin life with less colouring.



Husbandry:

Indoor habitat

These two subspecies of tortoise can be vivarium kept. Their requirements include a large water bowl, heat in the source of a bulb or heat mat, bark substrate and a hide away box or corner. High strength UV lighting is not recommended owing to the soft and sensitive skin of these species, whose natural inclination to hide away for much of the time rules out the effective use of a UV tube to deliver vitamin D. Much better to ensure vitamin D delivery in the diet (see feeding).

A 'tortoise table' is also not recommended, owing to the low humidity and also the extreme abilities of these animals to climb. Allowing floor space in a tropical house, or conservatory could be done, but this will limit the opportunity to observe and interact with the animals, as they will remain well concealed.



Outdoor habitat

The prime consideration for an external area for box turtles is security Sun and shade should also be available in equal measure.

Terrapene species (below) catch the early morning sunshine, and (as ever), trying to escape!



As with the indoor quarters, a hide and a large water bowl are essential. The example below shows wire mesh laid under a 5cm of soil to prevent a) burrowing out by the box tortoise and b) rodent ingress into the area. A removable wire top to prevent a) escape by climbing and b) ingress by birds, cats and rodents.

The result will soon establish itself with plenty of wild cover- which in turn attracts a natural food source into the area.



Feeding:

Box tortoises are omnivorous in the wild and will take a wide variety of foods in captivity. As a result owners will all have their own secret (and not so secret) recipes for successful feeding. Typically, the feeding of worms, crickets, mealworms, bloodworms etc will be common. Slugs and snails from the garden are also offered. The author will only feed the above as treats and supplements to a staple diet however. After advice from Elmar Meier, German breeder of rare Cuora species of box turtles, we have developed the following simple regime for the bulk feeding of Terrapene:

60% lean steak mince. 4 bananas added per 900g steak mince.

40% vegetables and some mushrooms blended in a food processor (including broccoli and or carrots).



These are then blended together, with 100g Limestone flour per 900g mince, and 15g Nutrobal added. 60ml Cod liver oil is stirred into the mix. Just prior to feeding 1 handful dried shrimp are stirred into the mix. Served with optional live food sprinkled on top. This mix can be frozen in portion sizes for future use.



Having fed a variety of other diets over 20 years this current combination ticks all the boxes as far as Vitamin A and D supplements, natural colourings for breeding condition animals, and calcium sufficient to ensure full egg production (see breeding).

Hibernation:

Terrapene carolina carolina's range extends into northerly climes where hibernation is required for a part of the year. Terrapene carolina major's range is more southerly, and they would not expect to hibernate in the wild. However, many reports suggest that T.c.major is able to hibernate successfully when transferred to more northerly areas of America. The author has not personally hibernated his T.c.major. For both sub-species, hibernation cannot be

considered mandatory, and not hibernating does not seem to reduce fertility in the males. More important is to provide seasonal temperature variation during the year, to allow a natural breeding cycle to be established. This can be done by moving the turtles to outside or greenhouse quarters in May, and leaving them there until first frosts in early November. Brought back inside, mating and egg laying will then occur with the first eggs hatching late December.



As these two sub species of box turtles are not a desert reptile, and require regular drinks and a water supply, hibernation must be done in damp conditions. One such solution is illustrated above. This comprises of of a wooden box filled with shredded damp leaves. Left in the turtle area with ramp access provided, as the temperature drops, the box turtle will disappear into the leaves and settle down for the winter. The box can then be moved to an electric cooler or cold stable position for a controlled hibernation at 5 degrees C. Regular checks must be made to ensure the leaves remain damp. Alternatively, similar conditions could be provided in a greenhouse, and left there, giving the box turtle control over its hibernation. Care must be taken however that temperatures in a natural hibernaculum do not fall below zero.

Illness issues:

As we are not now dealing with animals fresh from the wild, most issues related to capture and importation such as bot fly strike, stress, and gastric issues etc are no longer seen. Most issues therefore are going to be ones created by the owner as a result of poor diet or husbandry:



Sore Eyes

Swollen eyelids (which can be pink or angry red) are an indication of Vitamin A deficiency. This can be treated in the short term by providing drinks with ACE HIGH multivitamin preparation added to the water. In the long term, changes must be made to the diet, by including foods which contain Vitamin A (such as broccoli or carrot). Use of vitamin supplements such as Nutrobal is also recommended, or adding cod liver oil in small quantities to the food.

Swollen eardrum

The eardrum is swollen and inflamed, showing as pink or deep red. This is an infection of the jaw (hinge end), and is often caused by providing too much sweet food (such as fruit). The turtle will need the eardrum pierced, and the puss removed. A vet should perform this. A review of the foods given should then take place, and any sweet items reduced or removed.

Bites

Whereas most box turtles will live together harmoniously, biting will occur at times. This may be a result of overcrowding, male v's male aggression, hunger or just plain meanness on the part of an individual. Tails are a common target, and the toes of the front legs are also targeted. In extreme cases, infection can risk the life of the animal.

Treat the injuries with a suitable safe antiseptic such as 'Betadine'. Continue to treat until the scar tissue sloughs off, and pink new growth is observed. If biting is regular, treat the cause: Isolate a problem individual (the author has one such which just cannot live with any other box tortoise). Review feeding regime (i.e. ensure food is left between feedings to enable everyone in a group has a chance to feed), and separate males. If one has several groups of box turtles, the dynamics of these groups can be adjusted until everyone is happily settled with the colleagues that they are spending 24/7 with.



Shell rot (wet)

Wet shell rot occurs to the plastron of the box tortoise. It can develop after damage to the shell as a result of poor hygiene (sitting in own excrement), damage from abrasions occurring on a rough surface (concrete) or chip injury to the edge of the plastron. Infection then egresses via a minute hole made in the plastron scute. Wet shell rot manifests itself as pink blistering to the scute, which has distinct discoloured edges. Pressing the affected area will show the movement of clear liquid puss under the surface of the scute, which swishes back and forth with pressure.

Treatment must be aggressive, as this is a fatal condition if left. The original site of the infection must be identified, and the dead scute picked away to reveal the underlying bone. Use soft tools such a fingernail for this task. The scute will peel off quite easily until healthy material is reached. This must be done to allow treatment of the active edge of the spreading infection. Once healthy material is reached, dilute antiseptic is used to wash the plastron. Ensure it is brushed into all crevices using a toothbrush or similar. Repeat treatment weekly until no further loss of plastron scutes to the infection is seen. Continue to monitor regularly until new plastron growth is observed.

Shell rot (dry)

Dry shell rot occurs on the carapace of the box tortoise, and is usually associated with impact damage from chips or falls. This usually identifies itself as a peeling of one or two scute edges away from the shell. As with shell rot of the plastron, the scute must be picked back to hard firm material, and then treated topically with antiseptic. Unlike plastron shell rot, shell rot of the carapace is 'dry', owing to better access to ventilation. It is therefore less aggressive, and unlikely to be fatal. Without early identification and treatment however, large areas of the carapace can eventually peel back to the bone. If left in this state, re-growth may not occur.

Sunken eyes, wasted appearance

The chelonian keepers worst nightmare is the vague signs of turtle inactivity, muscle wasting and sunken eyes. These can sometimes be the harbinger of doom for the box tortoise. Worst case scenarios can include organ failure, tumours, heart and muscle issues in elderly animals, all of which are not treatable. Other causes of course, must be tested for, or even treated for on the off chance that it may bring a recovery.

Steps to take (not necessarily in this order):

- a) Re-hydration: give regular water baths which are dosed with 'Critical Care' or similar reptile friendly glucose and vitamin supplement.
- b) Test faecal matter for worm eggs (using a microscope). If no faecal matter is available, dose as a precaution, either using granules of 'Panacur' mixed with a tempting food (banana), or tube feed it in liquid form.

- c) Test faecal matter for flagellates (using a microscope). Treat with MDZ if present.
- d) Run a course of antibiotics against a potential infection such as peritonitis.
- e) At any of the above stages, consult an able and experienced reptile vet.

Illness in hatchlings: Deformities, dwarfism, overgrown toes and beaks.



To successfully raise a box turtle hatchling from the egg, to adulthood, extreme care must be taken over all aspects of husbandry for at least the first 5 years of life. As these chelonian are omnivores, the protein v's vitamins and minerals balance is critical. There are also two more extremely important factors to ensure good growth of shell in comparison with the rest of the skeleton- humidity and warmth. Get one of these three wrong, and cute hatchling grows up to be horror movie style 'Igor' creatures.

a) If the female laying the egg is insufficient in calcium, then calcium weakness will be transmitted to the embryo. After hatchling, bone growth will be hampered by this, despite the best efforts of the tortoise keeper, and deformities will occur. Above left, is an ornate hatchling, one of a twin in a single egg. The loss of calcium and nutrients to the smaller, non-viable twin has been responsible for early and irreversible deformities in growth.

b) If the new hatchling is kept too long (i.e. for a year or more) constantly at too low a temperature, body development can be stunted, leading to a dwarf animal with an oversized head (Centre above). The author provides a heat mat under the hatchlings area (covering half, and using spacers to raise the vivarium off the heater) to ensure 25 degrees C and above at all times. This ensures smooth and rapid growth of the hatchling.

c) Carapace curling, and other shell deformities occur if the hatchling is kept too dry. This seems to stunt shell growth. Use a moist substrate in which the hatchling can bury itself, or provide a humid atmosphere in a glass or Perspex box by providing a water bowl (as in all cases), but with limited ventilation.

d) Refer to the feeding regime above to ensure that the hatchling has sufficient nutrients, minerals and vitamins, in the correct balance. Too much protein for instance can lead to raised carapace issues (such as above right), which although are not crucial, will spoil the intrinsic value of the animal.

Breeding:

Mating



Courtship between a male and female box tortoise is often short, consisting of a direct intention to mount (as seen in above left). The female will signal her acceptance by raising her head as seen, rather than withdrawing into her shell. The male will use this time to insert his rear feet into the females shell between carapace and plastron. He will use his long hooked claws to aid this move, and also using them to avoid his toes being crushed if the female tries to close her shell up. Once in position, the male will fall over onto his back, to allow cloacae to vent meeting, and intercourse takes place (above middle). They can remain in this position for hours. The gulf coast box tortoise is particularly fond of mating in shallow water (above right).

Seasons

Egg laying is seasonal. Although mating takes place throughout the year, there will only be a three month period in which female box tortoises will lay their eggs. (Giving 1 – 3 clutches, a clutch every 6 weeks). In the wild, this season will be determined by spring weather. In captivity, other factors can change the timing of this cycle. In northern European climates, where a box tortoise spends the summer and autumn outside, it can often be noticed that when brought indoors for the winter, the warmer, more humid indoor environment will trigger egg laying in November through to February. The primary requirement for successful egg laying therefore is a yearly routine to be laid down. This will enable the female to choose between clues, and from which she will determine when to lay her eggs. A lack of routine will cause confusion in the female's understanding of the seasonal cycle, resulting in higher instances of discarded eggs. Hibernating your box tortoise will of course assist the female to identify spring at a more natural time (but sometimes at not such a good time for egg laying).

Egg laying



Female box tortoises are extremely shy when it comes to egg laying. In the garden, they will lay in concealed places, such as in deep grass (above left), or most commonly, during the hours of darkness. Under these conditions, finding the eggs is a difficult proposition, especially as, owing to the soft shelled nature of the eggs, time is of the essence before the risk of damaging levels of dehydration set in. The author counters this problem by restricting the area in which a box turtle can lay to a manageable area to be searched. The author uses indoor egg laying facilities to capture the eggs with minimum time lag or damage. This consists of a hollow box or pot, either raised or sunken into a vivarium, and full of moss, moss/peat, or peat. A removable top, with a circular hole just too small to allow bodily access by any occupant of the vivarium fits the top of the box (above centre). The act of digging a pit for egg laying by the box tortoise is immediately noticeable the next morning, as not all of the material can be returned via the circular hole when 'filling in', and a simple finger probe can be made to check for eggs. The cover can then be raised, allowing easy and safe access to the slippery and fragile eggs (above right).

Incubation



As the eggs laid are soft shelled, they must be handled with care. Slight dents in the egg when first laid can be ignored. Deeper dents (occurring between laying and discovery) are a result of dehydration. As long as the surface of the egg has not torn, these can be recovered by immersing in warm water (within the incubator) until the egg re-swells up. The incubator itself should be able to give near 100% humidity without dripping onto the eggs. The author uses a small fish tank, with an aquarium heater set to 32 degrees C. (above left). The fish tank cover is expanded polystyrene with a further, waterproof cover over this.

The fish tank is half filled with water, and a wire mesh fitted just above the waterline. Eggs are placed on soaked Perlite* in small trays. A temperature probe is placed next to the eggs. This will read an air temperature a few degrees less than the water- 29-30 degrees C in this case. Fertility of the egg will show within 48 hours. It is noticeable as a bright white patch, which starts at the top of the egg, before enlarging to a saddle shape over the middle of the egg after a few weeks (above, centre). The ends of the egg will remain dirty grey/pink and seemingly more see-through until close to full term (above right). Incubation time, at the temperature suggested above will take 55 to 65 days, and give mainly females. To obtain males, the temperature needs to be significantly lower, at around 26 degrees C, resulting in a longer incubation period (70-90 days).

Eggs that are sweating during incubation are too wet, and the humidity needs to be slightly reduced. Eggs that dent in during incubation are too dry, and need to have the humidity increased (spray the egg with warm water). Eggs that turn butter yellow have died, or gone rotten. Near to full term, eggs *will* sweat and look dirty, or discoloured. Do not be tempted to interfere too much at this stage, as any handling of the egg could introduce enough squeeze to the hatchling inside to kill it.



The hatchling will begin to break out of the egg by pipping- i.e. cutting a small hole with its egg tooth. This stage could last 2 days or more. Further tears in the egg will be made, until the hatchling is visible. Do not be tempted to remove it at this time, as the yolk sac is likely to be still significant (and is best supported within the egg shell). Do however ensure that the sides of the tray in which the hatchling is being kept are high enough to prevent escape. Once the hatchling has exited the egg, and its yolk sac has been absorbed, it can be removed from the incubator.

*Many substrates can be used, including moss, peat, and Vermiculite.

Raising the hatchlings



Ensuring that the hatchling is drinking and eating is a major priority during the first few months of life. As they are such secretive creatures, spotting direct drinking and eating will be rare. During these months, the author keeps the hatchling(s) in small opaque containers no more than 20cm by 15cm. They are kept on damp tissues, with a nearly sealed lid to ensure high humidity. An ambient temperature of around 25 degrees C is provided. Small amounts of the food (indicated in 'feeding' above), are fed 3 times weekly, and a bath is given once a week. The tissue paper (or the water bath) will provide evidence of faecal matter, indicating that feeding is going on. As the hatchlings begin to grow, and be more energetic, slightly larger quarters can be provided, including a water bowl, and bark mulch substrate. Weekly baths can be reduced. If a hatchling is not thriving, the baths should be continued, the animal isolated from competitor hatchlings, and 'Critical Care' added to their water baths. Only when next year's hatchlings arrive will it be appreciated how much the hatchling (still so small) has grown. Gradually increase the size of their environment in line with their growth. The first signs of gender will occur at around three years- i.e. the male will develop different colouring from the female, which is the standard form from hatching.

ESF:

Bloodlines

The importance of recorded bloodlines will become more and more important as the years go on. With no more stock being imported from the wild, it is likely that a few keeper/ breeders will dominate the captive bred market with their animals. Once raised, and when it comes time to breed these animals, it is imperative that further animals are not acquired that come from the same breeding stock (however unwittingly). To ensure that this does not happen, keeping a studbook, in which the provenance of each animal is known, even after several owner changes, is essential. Simple records can be passed on with the animal when traded, which marks its place in the captive family tree. This

will then ensure that genetic diversity is present in your breeding (and bred) stock.

Registering with the ESF

You are not signing away your animals when joining the European Studbook Foundation. They are still yours to keep, breed and sell. As Studbook keeper for these two subspecies, I will simply give you your animal's identification number, which can be passed on when sold. These identification numbers will identify the bloodline of your animals, so that others may make informed choices when breeding them. All we would ask is that any animals re-homed to you via the ESF (or bred from ESF animals in some cases) are voluntarily offered to ESF members first when sold on.

To register a *Terrapene carolina major*, or *Terrapene carolina carolina* with me, please log in to www.studbooks.eu Select studbook overview, and then click on the species that you have. The first selection on the pop up page is 'registration form'. Select it, fill in as much (or as little) as is known about each animal, and after step 4, press 'send'. I will receive your notes, and pass back a registration number for the individual animal.

Enquiries: contact me at paul@ukchelonia.info for further advice.
