

Keeping and breeding Leopard Tortoises (*Geochelone pardalis*). Part 1. Egg-laying, incubation, and care of hatchlings

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THIS captive-breeding/husbandry article on a very beautiful — indeed magnificent-looking — tortoise, resulted from a discussion at Council in October 2001 on the inadequate number of practical articles on keeping the various species of reptiles and amphibians being submitted to *The Herpetological Bulletin*. I at once had a 'whip round' getting everyone present to undertake to write an article on some topic of their competence. I then asked Council what they wanted me to write. I think it was Barry Pomfret who actually 'roped me in' for this topic as he said there were a lot of people keeping 'leopards' these days. Partly I was to blame, as I had said that they were 'boring', and didn't do much and — insult of insults — that one would be as good with some garden gnome leopards as with the real thing! That, of course, only made Barry keener that I should write about keeping leopards. My comments were more than a little unfair to the leopards as will hopefully become clear below.

In this first article (of a two-part series) I deal specifically with reproduction and the care/rearing of hatchlings — this has been intentionally provided first as it will appear at a time in the UK when leopards will be breeding and hatchlings will start becoming available. Information on husbandry will follow in the second part.

Leopard tortoises, well looked after (see Part 2), will breed naturally each year once they are of breeding size/age. In the (unfortunate) case of imports, because of their treatment prior to reaching you (Part 2), together with adjustment to our seasons for southern hemisphere races, this may take a year or more. As is the case with all/most reptiles studied, size not age is the key factor in sexual maturity. Reptiles do not commence breeding until they have reached a certain minimum size irrespective of their age. Male leopards are sexually active at a flat shell

length of about 15cm (6"). At this time they will court females assiduously. Females are considerably larger, however, before they commence breeding with the result that these newly sexually mature males have trouble in mounting them successfully. Although female leopards take on average a couple of years longer than males to reach sexual maturity, size/weight is always a much more reliable guide than age in reptiles and females can be expected to commence breeding around a weight of 8kg.

Because of the leopards' highly-domed carapace males need to be sufficiently large to be able to successfully mount any given female. Enthusiasm is not enough! As is common in tortoises, optimistic males will usually select the largest female on offer. Although there are good evolutionary reasons for this (larger females lay more eggs so more surviving progeny can be expected) mating for leopards with too disproportionate a size difference is physically impossible. A colleague in the southwest, who regularly breeds leopards, told me that he found he was able to overcome this problem of size discrepancy by wedging a piece of brick below the rear of the plastron of females to raise them up and so allow mating to take place. This story, which I believe to be true, although I have never tried it personally, provides an excellent illustration of the passiveness of leopards. Leopards will happily dig in grass unlike many tortoise species which seek out clear areas of soil. Furthermore, they will regularly nest in the open whereas many other species are attracted to secluded areas. I have recorded nesting in the middle of my 8m square pen. This must reflect their nesting habits in the wild. The greatly elongated claws on the club-like feet of female leopards are an invaluable aid not only in acting like a fork to break through the grass roots but also in digging the nest; indeed it would

seem impossible for them to succeed without them due to the club-like hind feet of adults. As the nest construction proceeds, the piles of soil on both sides grow larger and the female raises herself up on her front legs in order to reach further down with each hind limb in turn. Chelonians dig the egg chamber as deep as they can reach, the reach obviously becoming greater as the tortoise grows which automatically provides more space for the increasing egg clutch.



Plate 1. A large adult leopard egg-laying in the middle of the paddock. Note the large amount of soil excavated and its spread — it is well placed to each side to prevent it falling back into the egg chamber. Photograph by author.

I collect the eggs as soon as I am sure that egg-laying has finished. To be quite certain I wait until the first covering-in movements commence then I lift the female forward, collect the eggs as described below, and then return the female to her former position over the egg chamber. Moving the female in no way interrupts her covering in behaviour which is entirely automatic. The eggs, marked so that they are not rotated, are removed to a rigid container (so that the eggs do not come together when it is lifted), containing slightly moistened vermiculite for incubation and the female left to cover up the nest site. Covering and disguising the nest site is an immensely more difficult task in grass compared to a nest dug in soil. However, by the end of the process you can see from Plate 1 that they make a very good effort. As with other chelonians the females move forwards as covering up progresses so that the actual site of the nest is disguised. The time taken from the start of digging to the completion of covering up and disguising the nest-site varying widely depending on the type of ground in which they are digging, the size of the female, and the number of eggs laid. There are also marked differences in the time that different females spend disguising the site. Some seem to go on forever.

‘Average’ timespans for the whole procedure, based on my own observations of females digging in established grass would be between one and a half and two hours.

Many people breed tortoises — of various species — without ever realising that they have done so, and others only realise when they come across eggs in the autumn whilst turning over the ground. By that time, of course, the eggs will not hatch as they have not been warm enough. If you breed tortoises, it is vital to know when egg laying has taken place so that you can remove the eggs to a suitable incubating environment as soon as possible. People use various techniques to know when a tortoise has laid. These work much better, however, with tortoises which lay in open areas of soil as precise nesting sites with all the preferred attributes — including a warm area with open southerly exposure — can be prepared. This is much more difficult with species which will nest in the middle of an area of grass rather than in a prepared nesting site. With leopards, unless you think



Plate 2. Hatchling emerging from the egg. Note the highly-domed carapace and strongly contrasting coloration even at this age. Photograph by author.

nesting has occurred and search very carefully for tell-tale signs, the nesting may easily be overlooked in a sizeable outdoor pen. If you are at home during the day it is a good idea with breeding tortoises to check them very regularly. A watch alarm set to go off hourly and switched on each morning and off in the afternoon is a foolproof method. Tortoises will normally be outside in the sun for some time in the morning before commencing to nest and are also unlikely to nest late in the day. For, most species the vast majority of nests will be made during the heat of the day say between 11am and 3pm. If you cannot check during the day you will have to rely on other cues. One is differences in the female's behaviour. Pre-nesting females frequently wander more and appear restless in the days preceding egg-laying. Secondly, very careful checks of the outdoor pen will need to be carried out daily for the least sign of disturbance to the ground.

If you are present at the egg-laying then the tortoise can be moved a short distance off the nest immediately egg-laying is complete. The best technique is to wait until the very first signs of filling in just in case there are one or more 'late' eggs. This movement will not disturb her and the eggs can be carefully removed into a container set up with vermiculite. As each egg is lifted a small mark is made on the top so that the egg is not



Plate 3. Emerging hatchling with a substantial yolk sac still to be absorbed (see text). Photograph by author.

subsequently rotated. This is crucial with reptile eggs. The egg clutch in its container is then placed without delay in the (prepared) incubator.

Clutch sizes increase with the size of the tortoise and females breeding for the first time may lay only a few eggs; with leopards clutches of about 6-10 eggs are average. Leopard eggs are fairly circular and of a good size averaging about 42-43 mm in diameter with weights of about 45g. There is a good possibility of multiple clutches (two or even more) being laid each year where the females are kept under ideal conditions with plenty of warmth, sunshine and a good varied diet. Since each clutch is not onerous for the female in biomass terms (that is the weight of the clutch as a proportion of the female's weight) it seems probable that in nature several clutches are laid each season. Ideal conditions should replicate this in captivity.

Prior to anticipated egg-laying the incubator should always have been tested to ensure that it is in working order and that the thermostat is correctly set. There are many forms of 'incubator' with some DIY ones doing excellently and varying from those in which the temperature is provided by an aquarium heater in a tank partly filled with water, through polystyrene fish boxes with small thermostatically-controlled heaters to professional incubators of which the 'Brinsea' range are

probably the best known. I use exclusively Brinsea incubators, but whatever you use the key thing is to have a reliable incubator.

I do not think the substrate is important as tortoise eggs will hatch in a wide range of mediums. I use vermiculite which is convenient and sterile. It is kept slightly dampened throughout the entire incubation period as the humidity is beneficial. Vermiculite does not 'compact down' like some soils and some sands. This can be important as it could trap the hatching tortoise if the eggs are completely buried. I do not completely bury the eggs but leave just the tops projecting so that I can readily check hatching through the glass window of the 'Brinsea' incubator.

In nature, leopard eggs, because of the wide distributional and altitudinal range of the species, may hatch over very variable, and often lengthy, periods. There are genetic factors involved so that even at the same temperature there may be widely different incubation timespans for eggs from different populations of the same species as I discovered long ago in Australian geckos (Bustard, 1969).

Leopard eggs incubate well at 30°C or just below this, and incubation at this temperature averages about 150 days. It is important to appreciate that not all eggs may hatch together so late-hatching eggs should not be discarded. They may well hatch a week or two later.

Neo-natal care — As with many reptiles the baby tortoises do not emerge immediately after slitting the shell. Slitting the shell provides them direct access to air for breathing but often considerable amounts of yolk are still present at this time. This yolk should be absorbed prior to emergence. Furthermore, the baby tortoise, which is curved round in the egg, has to 'straighten out'. This process, depending on the amount of yolk still present externally when the shell is slit, may take only a matter of hours or may take a day or more. If the incubator environment is too dry, there is danger of egg residues, such as mucus, which can dry in sheets like 'clingfilm' adhering to the baby with possible risk of suffocation. This would not

be a problem in nature as at this stage the hatchling is still underground and consequently at higher humidity levels. The solution to this problem is to remove hatching tortoises to another container at the same temperature but with damp kitchen towel on the bottom thus increasing humidity and preventing problems. Tortoises which emerge from the egg with the egg-sac still protruding should be given the same treatment. It is not safe to allow them to walk around on a rough, dry substrate in such a state. In all but extreme conditions, where a little longer may be required, the eggsac will be fully absorbed after 24 hours. At hatching baby leopards average about 42mm in flat shell length and weigh 25-35g.

Rearing the young — Baby leopards are not difficult to rear. Like all babies they should initially be kept at higher temperatures than the adults. I recommend a background day temperature of 26°C (80°F) with a hot spot area reaching 32°C (90°F) falling to 20°C (68°F) at night when the hot spot lamp is switched off. An under-tank heat mat should be used to achieve these temperatures. The babies should only be outside on warm sunny days when shade must always be available. For baby tortoises a sun/shade mosaic is ideal, failing which there should be readily available 'tufty' vegetation into which they can burrow. The purpose of these arrangements is to ensure that the baby tortoises can always readily find shade and avoid overheating. The heating and cooling curves of hatchling tortoises are totally different from adults in that due to their tiny weights and comparatively huge surface areas they can heat up to lethal temperatures dangerously fast. Cooling under adverse conditions is also rapid.

Baby leopards tend to be very active. This is perfectly normal and is no cause for concern. As with all baby tortoises when newly hatched/very small the food should be cut up very finely so that they can ingest it readily. As with adults there should be good variety in the food provided. Nutrobal should be given regularly (initially every other day; after 3-4 months twice weekly). This is on the basis that the baby tortoises have access to

growing food and sunshine. It should be increased if this is not the case. Water should always be available. For baby tortoises I use jam jar lids as they are easy to access and due to their shallow nature even the smallest baby cannot drown in them and can readily move out. These factors are important as tortoises often drink from 'puddles' in nature and will actually enter the puddle to drink. The babies may actually climb into the jam jar lid to drink. Where water is often at a premium tortoises will drink dew, scooping it off the grass in the mornings. After a couple of years or so you will have superb juvenile tortoises, and if you obtained captive-bred youngsters in the first place, you will have come full circle.

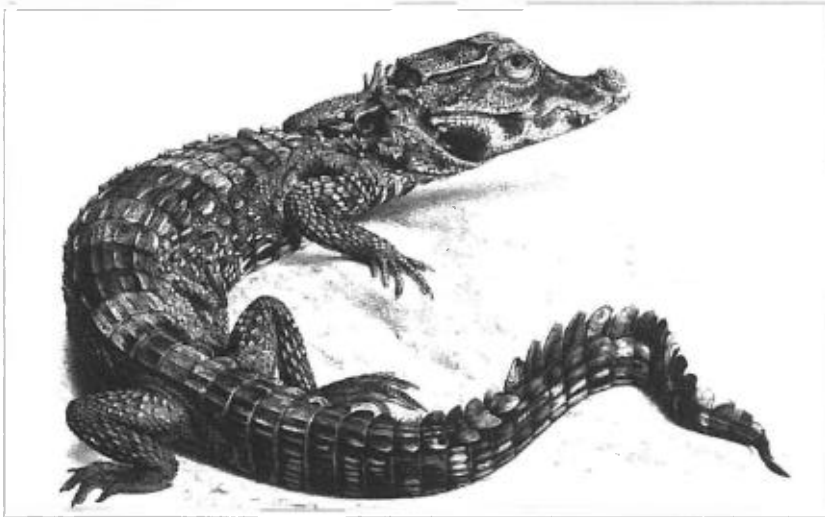
I urge you NOT to sell newly hatched 'leopards' or newly hatched tortoises of any species. These are delicate and need what to ordinary people amounts to special care. I agree entirely with the Tortoise Trust view that captive-bred European tortoises should ideally be obtained/sold at about two years old and I grow my captive-bred European tortoises on to this age before letting them go. Leopards should similarly be grown on. This need not be for so long due to

their rapid growth rate and the fact that they remain active throughout the year as opposed to undergoing hibernation. Young of the year can safely be passed on in the spring of the following year.

To aid procurement of captive-bred youngsters I intended giving a list of leopard tortoise breeders either within or known to the Society at the end of this article and holding contact telephone numbers for those who did not wish their details published. Unfortunately not a single breeder of this tortoise has responded to my recent request in the *Natterjack* that they provide me with their details despite confidentiality being assured if required. In order to obtain captive-bred youngsters I suggest you place a 'wanted' advertisement in the *Natterjack* or the IHS Newsletter.

REFERENCE

- Bustard, H.R. (1969). The ecology of the Australian geckos *Diplodactylus williamsi* and *Gehyra australis* in northern New South Wales. Parts I and II. Koninkl Nederl. Akad. Wet. Amsterdam Proc. Series C 72(4), 451-477.



Crocodylus frontatus (*Osteolaemus tetraspis*). From *Proceedings of the Zoological Society of London*, 1862. Reproduction courtesy of the Zoological Society of London.