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TORTOISES AND TURTLES

## Radiated Tortoise

# *Astrochelys radiata*

*Astrochelys radiata* is a large, long-lived tortoise from southern Madagascar. The high, black shell is decorated with yellow rays from the centre of each scute, and the animal is regarded as one of the most beautiful tortoises in the world. The species is critically endangered in the wild and requires a great deal of space, warmth and an outdoor enclosure in summer.

Family: Testudinidae  Former name: *Geochelone radiata; Testudo radiata*

KEY FACTS

### THE ANIMAL

| | |
|---|---|
| Adult size | **26-40 cm**<br>total length incl. tail |
| Weight | **2,500-8,800 g** |
| Lifespan | **60-80 years** |
| Active | **By day** |
| Lifestyle | **Terrestrial** |
| Habitat | **Semi-desert and dry forest** |
| Difficulty | **Experienced** |

### CARE

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|---|---|
| Min. enclosure | **300 × 150 × 60 cm**<br>L × W × H for 1 adult |
| Temperature, day | **24-30 °C** |
| Basking spot | **32-38 °C** |
| Temperature, night | **18-22 °C** |
| Humidity | **50-70%** |
| Water | **Water dish** |
| UVB | **Essential**<br>Ferguson zone 3 |
| Diet | **Plants** |
| Kept | **Singly or in pairs** |

### BREEDING

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|---|---|
| Reproduction | **Egg-laying** |
| Clutch size | **1-12 eggs** |
| Incubation | **90-231 days**<br>at 29-30 °C |

### PROTECTION AND PAPERWORK

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|---|---|
| CITES | **Appendix I** |
| EU annex | **Annex A** |
| IUCN | **Critically Endangered (CR)** |

## About the species

*Astrochelys radiata* is a large tortoise with the classic, high-domed carapace, a blunt-nosed head and elephantine legs. The shell is black with fine yellow lines that radiate from the centre of each scute and give the species both its name and its pattern. The legs, feet and head are yellow, apart from a black patch of varying size on the crown. The pattern is finer and more intricate than in other star-patterned tortoises such as *Geochelone elegans*, and the scutes are smooth and not raised into pyramids. Young animals are pale, white to greyish white when they hatch, but have the high shell from the start.

Adults typically have a carapace length of 26-38 cm, the largest up to about 40 cm, and weigh 2.5-8.8 kg. The sexes are about the same size. The male has a longer tail and a more distinct notch in the plastron under the tail. The young are 3-4 cm at hatching, grow about 5 cm a year and become sexually mature at a plastron length of 25-28 cm.

The species was described by Shaw in 1802 and is named after the rays that the pattern forms. The genus name *Astrochelys* comes from Greek astron, star, and chelys, tortoise, and refers to the star pattern of the shell. The species was formerly listed as *Geochelone radiata*, and that name is still seen in the trade and in older literature. The species can hybridise with

*Chelonoidis carbonarius*. *A. radiata* is very long-lived: in captivity it typically reaches 60-80 years, and one individual is estimated to have reached about 188 years.

## Distribution and habitat

*Astrochelys radiata* is found only on Madagascar, in the far southern and south-western corner of the island. The range is concentrated on the Antandroy area between the Mandrare and Menarandra rivers, and the species is most numerous in the south. There are introduced populations on Réunion and Mauritius, which are not shown on the map.

The species is assessed as Critically Endangered. Populations have fallen sharply because of habitat loss to agriculture, grazing and logging, prolonged drought, climate change and intensive collection for food and the pet trade. The population is estimated to have fallen by more than 75 %, and there is a risk that the species will disappear from the wild.

> **Native range:** Madagascar.

### HABITAT

The species lives in the dry south, in the characteristic dry spiny forest with many spiny and succulent plants, in scrub on dry plateaus, in coastal dunes and in rocky bushland. The climate is hot and dry, and the animals are most active during and just after rain, when they drink from puddles. The rest of the time they get their fluid from their food.

The species is herbivorous and grazes the same areas regularly, so the vegetation is kept closely cropped. Grass makes up about 80-90 % of the diet, and the rest is fruit and succulent plants; *Opuntia* cactus is a favourite food. The animals prefer new shoots, which are rich in protein and low in fibre. They forage during the day. The female digs a hole of 15-20 cm, lays the eggs and leaves the nest, and the eggs develop for several months before the young hatch.

## Care

### THE ENCLOSURE

*Astrochelys radiata* is a large and heavily built tortoise that requires a great deal of space. Keep it outdoors for as long as the weather allows, in a secure enclosure with shade, shelter and edible vegetation. Plants, weeds and wild herbs provide both food and places to retreat to. In a cool northern European climate the season is short: when the temperature falls to about 13 °C or below, the animal must come indoors into the warmth, and a heated shed or greenhouse by the enclosure lengthens the season. The wall must be opaque and solid, buried in the ground, and the top must be covered against predators.

For indoor use there must be a tortoise table without glass walls. The length must be at least 8 times and the width 4 times the shell length of the largest animal. Less space is often used successfully, but the general recommendation is 8 × 4 times the shell length. For an adult of 38 cm that gives about 300 × 150 cm with sides of about 60 cm. The size applies to up to two animals. For a third and fourth animal at least 10 % more floor area is added, from the fifth animal 20 %, and more space is always better. Young up to about 10 cm can initially live in a box of about 100 × 60 cm, but must be out in fresh air and sun as early and as often as possible.

The floor should be a firm but diggable substrate that holds moisture while giving good footing: a mixture of topsoil and wood chips, about 10 cm deep. It should be changed every 3-4 weeks. Provide a dry, closed hide, flat stones to bask on and edible plants. Avoid fine sand and small stones, which the animal may end up eating.

### TEMPERATURE

Fixed figures for air and night temperature have not been documented for the species. The figures here and the Ferguson zone under Light are borrowed from related tortoises from dry regions, e.g. *Stigmochelys pardalis*. By day there should be 24-30 °C, and under a heat lamp there must be a basking spot of 32-38 °C, so that the animal can warm itself to at least 30 °C. Directly under the lamp the surface can locally reach about 45 °C. At night the temperature falls to 18-22 °C. Measure the temperature on the basking deck with a probe or an IR thermometer.

Young animals indoors need an even temperature at night, which a ceramic heat emitter without light can maintain. Below about 13 °C it is too cold to be outside. Overheating is at least as dangerous as cold, so the animal must always be able to reach shade. The species does not hibernate and needs warmth and light all year.

Read more: Lighting and UVB Read more: Heat and temperature

### HUMIDITY AND WATER

The species comes from a dry climate, and the humidity should be moderate: at least about 50 %, highest for the young and in the hatching box. This is achieved by keeping the substrate lightly damp and occasionally misting water in the enclosure. A constantly wet floor causes shell and skin infections, so the surface of the substrate must be dry.

There must always be a shallow, stable bowl of fresh water, and it is changed daily. The species gets much of its fluid from its food and drinks especially during and after rain. A misting system or a sprayer imitates rain, and the animal is most active during and after rain. Young animals can be given a lukewarm bath several times a week.

Read more: Humidity, misting and ventilation

### LIGHTING AND UVB

*A. radiata* is diurnal and needs natural sunlight or strong UVB light in order to make vitamin D3 and avoid bone disease. Outdoors in the sun the animal gets UVB directly, but glass and acrylic block most of it. Indoors a mercury vapour lamp, which gives both heat and UVB, is a suitable light source and imitates natural sunlight best. Alternatively a powerful T5 tube for desert species (Ferguson zone 3) is used, mounted 25-40 cm above the animal.

Replace the light source according to the manufacturer's instructions, because the UVB output falls long before the bulb burns out. The light is switched on for 10-14 hours a day and preferably follows the season. Young and newly hatched animals have a particular need for both light and heat, and the day and night rhythm must be kept stable.

Read more: Calcium, vitamins and supplements

### FEEDING

*A. radiata* is a grazer, and the diet should be high in fibre, low in protein and rich in calcium. The staple food is grasses, weeds and wild herbs such as dandelion, clover and plantain, as well as succulent plants, picked fresh or grown in the enclosure. The species readily eats large quantities and spends much of the day grazing. The greater the variety, the better, and there should always be food available. Fruit and vegetables such as sweet potato, carrot, apple and melon are readily taken, but are not natural food and are given only rarely and in small amounts. The species seems to prefer red food items.

Keep a cuttlebone available so that the animal can gnaw at it itself, and sprinkle a calcium supplement over the food. Females need more calcium in the period leading up to egg-laying. Commercial tortoise food can be included as a supplement, but not as the staple. Fast growth gives a lumpy shell, so do not give protein- and energy-rich food, and let the animal grow steadily.

### BEHAVIOUR AND HANDLING

The species is calm and hardy and adapts well to captivity. Young and newly hatched animals are easily stressed by too much handling and by frequent changes in their surroundings, so keep handling to a minimum. With a fixed routine of daily feeding, weekly cleaning and regular health checks, the animal gradually becomes very trusting towards its keeper. Always lift from under the plastron, and hold the animal low, so that a fall does not damage the shell.

The males can be violent during mating (see Breeding), so keep an eye on the animals, and give the female places to hide. Keep only one animal in small enclosures. Do not mix the species with other tortoises, because they can infect each other.

## Breeding

### SEXUAL MATURITY AND SEXING

The difference between the sexes is small, and the sex can be determined reliably only in adults. The male has a longer tail and a more distinct notch in the plastron under the tail. Males begin to mate at a shell length of about 31 cm, and females must be slightly longer. Age at sexual maturity is not documented; maturity depends on size rather than age, and the animals grow about 5 cm a year.

### MATING

The male eagerly tries to mate once he has reached size. He bobs his head, sniffs the female's hind legs and vent and may lift the front of the female to stop her from walking. He then mounts from behind and thrusts his plastron against the female's carapace. Hissing and grunting are common, and the mating is violent. The female's shell can crack, so she must be able to get away, and the animals must be kept under supervision. The species can lay eggs all year round if food and surroundings are right.

### EGG-LAYING AND CLUTCHES

The female digs a nest 15-20 cm deep in loose, moist soil, lays the eggs and leaves the nest. A clutch is 1-12 eggs. The female can lay several clutches, and egg-laying can take place in any month. Give her a sunny slope with deep, loose soil, calcium supplements and a quiet enclosure, so that she is not disturbed.

### INCUBATION

Incubation is very long. In the wild and at fluctuating temperatures it typically lasts 145-231 days, corresponding to 5-8 months. At a constant 29-30 °C in an incubator the eggs hatch after 90-120 days. A period of lower temperature during incubation, a so-called diapause, can give more hatchings, but a fixed procedure has not been documented.

Sex depends on temperature: at 29-30 °C almost all the young are female. The temperature that gives males has not been documented. The eggs are moved carefully, without turning them, to an incubator with a damp but not wet substrate, e.g. vermiculite and water in the ratio 2:1. Give eggs that do not hatch on time extra time.

Read more: Incubating eggs

### REARING THE YOUNG

The young are 3-4 cm at hatching and pale yellow to white, but quickly get the high shell. In captivity most hatchings fall in March-June. Young animals require warmth, humidity, UVB and a shallow water bowl, and newly hatched animals must be protected against drying out. Give them the same herbs as the adults, finely chopped, and leave a cuttlebone available. Keep handling to a minimum and avoid frequent changes in their surroundings. Animals that grow too fast develop a pyramided shell.

## Health and common mistakes

The species is hardy, but some diseases have been documented in the species itself, and the rest apply to tortoises in general:

- Intranuclear coccidiosis: a parasitic disease that can cause serious illness throughout the body. Among captive tortoises, *A. radiata* is the species most often infected. Requires a vet and tests.
- Mycoplasma: the bacterium *Mycoplasma agassizii* has been detected in animals from Madagascar. It causes respiratory disease with a runny nose and discharge from the nostrils.
- Pyramiding: the shell grows in knobs if the diet is too rich in protein and energy or too dry, or if calcium and UVB are lacking.
- Metabolic bone disease: soft shell and deformed legs and jaws with too little UVB, D3 or calcium.
- Respiratory infection: runny and bubbling nose, especially in cold and draughts. Requires a vet.
- Stomatitis: yellow coatings or bleeding in the mouth.
- Parasites and stomach problems: slimy or very loose droppings and weight loss.
- Dehydration, especially in young animals, and injuries from falls or during mating.

New animals are quarantined, and a faecal sample is taken before they are put together with other tortoises. Contact a vet with reptile experience if the animal does not eat for a couple of weeks, loses weight or has fluid from the nose.

Read more: Common diseases and signs of illness

### Always ask someone who knows

This guide is a good place to start, but it cannot replace experience. Animals differ, and much of what matters most is learned from people who have kept the species for years. Talk to a breeder, an experienced keeper or a vet who knows reptiles and amphibians before you get the animal - and again if anything looks wrong.