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An African pancake or crevice tortoise, *Malacochersus tornieri*, photographed in Tanzania, Africa. Photo © 2019 by Roberto Sindaco

featured species

African Pancake Tortoise, *Malacochersus tornieri* (Siebenrock, 1903)

The Crevice Tortoise by M. A. Cohen

Endemic to Tanzania, Kenya, and Zambia in East Africa, *Malacochersus tornieri* has several common names, including the African pancake tortoise, the soft-shelled tortoise, the crevice tortoise, and Tornier's tortoise.

In 1903, Austrian herpetologist Dr. Friedrich Siebenrock (1853-1925) scientifically described this new species and assigned it to the genus *Testudo*. In 1923, the Russian herpetologist Wilhelm A. Lindholm reassigned *T. tornieri* to the monotypic genus *Malacochersus*.

The genus name *Malacochersus* comprises two Greek word roots: *malaco-*, meaning soft, and *-chers-*, meaning dry land. Soft refers to the comparative flexibility of the crevice tortoise shell, and dry land describes its arid scrub habitat.

The species name, *tornieri*, commemorates the German zoologist and herpetologist Dr. Gustav Tornier (1858-1938) [Beolens et al., 2011]. The common name Tornier's tortoise also pays homage to Dr. Tornier.

The other common names of *M. tornieri* refer to aspects of its physiology or its habitat, describing the flatness of its carapace as an adult, its pliable skeletal structure, and its preferred retreat and refuge for escaping danger.

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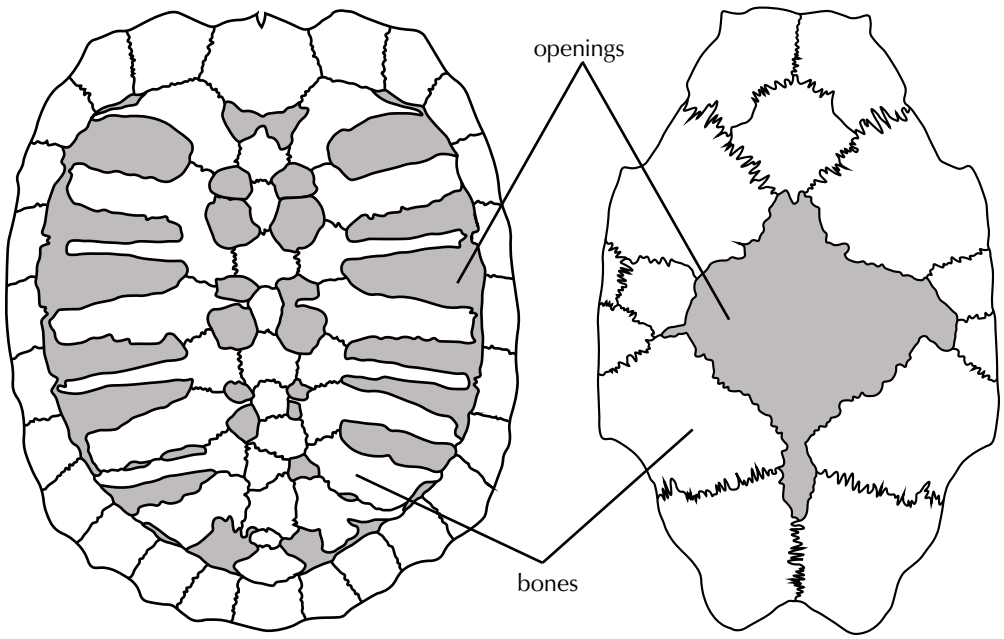
Description

The crevice tortoise is a remarkable species, unlike any other known tortoise. As the late Dr. Peter C. H. Pritchard observed in his 1979 classic *Encyclopedia of Turtles*, "the African pancake tortoise, *Malacochersus tornieri*, is surely the most extraordinary tortoise in the world."

In contrast to most tortoise species which have a thick, domed, rigid carapace, the crevice tortoise has a thin, flattened, pliable carapace. Measuring 6 to 7 inches (15 to 18 centimeters) at maturity, its thin carapace and small size do not offer much protection against predators or trampling by larger animals. Instead, the species relies on its extraordinary agility, speed, and lightweight skeletal structure to evade dangers such as predators and extreme weather.

The coloration of *M. tornieri* provides camouflage in its arid habitat, and the carapace markings of each crevice tortoise are unique. Each carapace scute typically has a light yellow or tan center (called an areole) surrounded by radiating brown and yellow or tan patterning.



The **bones** and **openings** (**fenestrae**) comprising the adult crevice tortoise's carapace and plastron. The bones are shown in white; the openings, in gray. The carapace and the plastron are each covered by a thin, solid, keratin-based layer of scutes. Drawings by M. A. Cohen based on illustrations in Mautner, et al., 2017.

Keratin-based scutes form thin but solid layers that cover the fenestrated carapace and plastron. Enclosing the entire shell, the scutes make the fenestration invisible in a living animal (Mautner et al., 2017). The scutes of the plastron of *M. tornieri* are typically yellow to tan with brown seams. The plastron also has fenestrae that persist into adulthood.

"The most unique feature of the carapace is the retention of the juvenile fenestra (windowlike openings between the carapacial bones) into adulthood" (Ernst & Barbour, 1989). These fenestrae (the plural of fenestra) occur in the hatchlings of all tortoise species, but, in other species, the openings close as the animal matures.

Conversely, these spaces stay open in the crevice tortoise as it matures, accounting for its minimal weight, speed, agility, and carapacial pliability. The openings in the skeleton of the carapace are comparatively small and numerous.

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A crevice tortoise in Tanzania rests in a patch of shade. Photo © 2016 by Elliot Kinsey

On the other hand, the opening in the bones of the plastron, shaped something like a diamond, is sizable. "The viscera thus exposed are protected by extremely thick, soft, dermis of a very tough nature" (Procter, 1922), meaning that a leathery layer of skin between the skeleton and the scutes safeguards the internal organs. This observation is part of an extensive study of the skeletal structure of *M. tornieri* Joan Beauchamp Procter published in which she describes the development and form of the species' shell.

The limbs and head of the tortoise are yellowish-tan. The toes of the species lack webbing, and its feet have claws that are thick and strong for digging into nearly vertical surfaces. The jaws of the crevice tortoise are slightly serrated.

Although there is very little difference in appearance between male and female crevice tortoises, males have longer, thicker tails than females. In some populations, females tend to be modestly larger than males (Mwaya, et al., 2018).

There are no recognized subspecies of *M. tornieri*. There is some speculation about the existence of another species of *Malacochersus,* named *M. procterae,* that exhibits several physiological differences when compared to *M. tornieri*. However, this unproven "species" is not generally recognized because only a single type specimen (known as a holotype) is present in the British Museum of Natural History (Ernst & Barbour, 1989).

Chelonian genetic studies indicate that *M. tornieri* is most closely related to the Asian genus *Indotestudo* and the Eurasian genus *Testudo* (Mwaya, et al., 2019).

Range and Habitat

M. tornieri inhabits small, fragmented home ranges in East Africa, specifically in southern Kenya, northern and eastern Tanzania, and a single location in Zambia known as the northern Nakonde District that borders Tanzania. Crevice tortoises live in the Afrotropic bioregion in arid scrub ecosystems known as thornbush thickets.

The crevice tortoise inhabits tropical and subtropical grasslands, savannas, and woodlands on low, craggy hills featuring ancient rocky outcrops known as kopjes, small, solitary hills located in open areas or savannas. These kopjes contain the crevices into which *M. tornieri* retreats for shelter from extreme weather and safety from predator threats (African pancake tortoise, n.d.; African pancake tortoise, 2019).

The species typically occurs at 100 to 6,000 feet (30 to 1,800 meters) above sea level in semi-desert regions with 10 to 20 inches (250 to 500 millimeters) of annual rainfall (Mwaya et al., 2019).

Population densities of *M. tornieri* differ depending on several habitat variables, including the orientation of rock crevices, the amount of herbaceous vegetation cover over the crevices, the degree of anthropogenic (human-related) alteration of suitable habitat, and the depletion of local populations by commercial collectors (Mwaya et al., 2019).

Foods and Feeding

Generally herbivorous in its diet, the crevice tortoise consumes a variety of dry grasses, forbs (herbaceous flowering plants), and succulents such as aloes. (Mwaya, 2009). Fallen fruit, seeds, nuts, and the occasional insect are on the menu. The species appears to rely primarily on its food sources for the water it needs to survive in its dry habitat.

In studies conducted in Tanzania, researchers analyzing crevice tortoise scat identified "fragments of grasses, including star (*Cynodon* sp.), drop seed (*Sporobolus* sp.), and red oat grass (*Themeda triandra*), ... small pieces of aloe, ... the grass *Panicum* ... and the leaves of *Achyranthes aspera* (prickly chaff flower)" [Moll & Klemens, 1996].

Some field biologists report that the crevice tortoise emerges from its retreat to seek food only in the comparative cool of the early morning. Other researchers indicate that the tortoise also leaves its crevice to for-

Malacochersus tornieri photographed in Tanzania. Photo © 1997 by Lorenzo Vinciguerra

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age in the late afternoon after the heat of the day subsides.

Reproduction

M. tornieri has a low reproductive rate, meaning it produces comparatively few offspring. Laying one egg (rarely two) per clutch, females may produce two or more clutches at six-week intervals during summer. The incubation term varies from four to eight months. The hatchling *M. tornieri* has a slightly domed carapace that flattens as the tortoise matures.

Most turtles are subject to temperature-dependent sex determination of their hatchlings, meaning that the incubation temperature of the eggs in the nest determines the sexes of the hatchlings.

A few turtle species reproduce by chromosomal, or genetic, sex determination, one of which is the crevice tortoise. The joining of chromosomes from parent tortoises determines their hatchlings' sexes rather than the incubation temperature in the nest.

Male crevice tortoises become aggressive and engage in combat during mating season. Larger males tend to prevail in combat, resulting in more opportunities for mating.

Natural History

The carapace of *M. tornieri* has a uniquely flexible structure that enables the tortoise to take refuge in fissures, which are narrow cracks in the rock formations that comprise its habitat. The tortoise retreats into these crevices to shelter from "predators, overheating, and dessication" and to rest at night (Moll & Klemens, 1996).

Even though the species is usually solitary, male-female pairs or small groups of tortoises may occupy a single crevice. Although *M. tornieri* may occupy several crevices throughout its lifetime, the species displays high site fidelity, meaning it tends to return to the same small range and its familiar crevices.

Look closely at this image photographed in Tanzania, and note the crevice tortoise tucked into a fissure in the rocks. **Photo © 2018 by mattpilkington**

Because of its harsh habitat and threats from predators, the tortoise spends most of its life protected within its crevice. *M. tornieri* emerges from its hideaway to bask, forage, and seek a mate.

Unlike many tortoise species, the crevice tortoise is an excellent climber, enabling it to scramble into a nearby sheltering fissure when threatened. Biologists initially theorized that the crevice tortoise inflated its lungs to increase its volume and wedge itself into a confined space for protection against predators.

However, a 1972 paper described a different technique: once it slipped into a crevice, *M. tornieri* "dug in the foreclaws and rotated the forelimbs outward, wedging the body into place" (Ireland & Gans, 1972).

Moll and Klemens surmised that the crevice tortoise "can 'inflate' a balloon-like unossified area in the plastron by drawing the legs back into the shell." This theory seems to support the original opinion of how the animal wedges itself in its crevice (Moll & Klemens, 1996; Mautner et al., 2017). See page 2 for the diagram of the roughly diamond-shaped "unossified" area of the species' plastron.

As stated by Moll and Klemens in their 1996 paper, "pancake tortoises exhibit complex social behavior with more wide-ranging males possibly circulating among crevices inhabited by relatively sedentary females."

Several researchers have observed that *M. tornieri* occasionally shares its refuge with lizard species such as "agama lizards (*Agama agama elgonis*), gekkos (*Hemidactylus squamulatus* and *Pachydactylus tuberculosus*), skinks (*Mabuya striata* and *Mabuya* v. *varia*), and plated lizards (*Gerrhosaurus* [=*Broadleysaurus*] *major*)" in commensal[1] relationships (Moll & Klemens, 1996).

Threats

Because of its unique appearance, the crevice tortoise is subject to overexploitation in the wild for the international exotic animal trade. The illegal collection of the species is the single greatest threat to the fragmented populations of *M. tornieri*.

Habitat degradation and destruction due to human activities seriously impact crevice tortoise populations. Slash-and-burn agriculture, charcoal production, rock destruction for construction purposes, and wildfires reduce the amount of suitable habitat and vegetation available to the tortoise, thus increasing predation and thermal stress (Mwaya et al., 2019).

Summarizing the threats to the crevice tortoise, Reginald Mwaya and his co-authors indicate that "the species is highly vulnerable to extinction by virtue of its restricted distribution, specialized habitat requirements, low densities and fragmented populations, reduced reproductive potential, and overexploitation for the international live animal trade"

[1] **commensalism:** an association between two organisms in which one organism benefits and the other is unaffected.

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(Mwaya, et al., 2018).

Conservation

Population data from the wild is insufficient at best. Currently, the CITES listing of the crevice tortoise is Appendix II, and recent proposals to uplist the species remain under consideration.

"Observed and estimated population reductions of about 80% have been noted over a combination of the past two generations (30 years) and predicted for the next 15 years (45 years total for three generations), qualifying the species for an assessed conservation status of Critically Endangered" and the population trend is "decreasing," according to the IUCN Red List of Threatened Species (Mwaya, et al., 2019).

In 1981 Kenya terminated the export of *M. tornieri* from the wild. An estimated 22.6% of wild populations exist in protected areas such as national parks, but most of the remaining wild crevice tortoises inhabit regions that are outside protected areas, making them susceptible to illegal collection (Mwaya, et al., 2018).

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Carapace view of a crevice tortoise photographed in Kenya. **Photo © 2019 by marcusmoney**

Joan Beauchamp Procter (1897-1931)

Marble bust of Joan Beauchamp Procter, sculpted by George Alexander, on permanent display at the Reptile House of the London Zoo. Public domain.

A British zoologist and internationally recognized herpetologist, Joan Beauchamp Procter began working at the Natural History Museum in London in 1917 and became the first female Curator of Reptiles at the London Zoo in 1920.

Plagued by chronic illness throughout her short life, Procter refused to let ill health interfere with her work. She made significant contributions to the taxonomy (classification) of reptiles and amphibians as well as veterinary practice and zoo exhibits.

Procter published scientific and popular articles on zoological topics, becoming known worldwide for her informative writing and insightful design of the new Reptile House at the London Zoo.

Her most famous scientific paper is her 1922 study of *Malacochersus tornieri* known at the time as *Testudo loveridgii*. This paper, titled "A study of the remarkable tortoise, Testudo loveridgii Blgr., and the morphogeny of the chelonian carapace," was published in the *Proceedings* of the Zoological Society of London.

Procter was the first person to describe the proper captive care of the Komodo dragon (*Varanus komodoensis*) based on her personal experiences keeping the species.

Her life ended in 1931 when she succumbed to cancer.

To Burrow or Box Your Hibernating Tortoise?

By Heather Ponek, President, CTTC Kern County Chapter

To burrow or box, that is the question?
"Whether 'tis nobler in the mind to suffer"[1] the unknown of what cannot be seen,
or disturb the sleep of one who in dream may be.

Author Heather Ponek with Gobi the desert tortoise (*Gopherus agassizii*).

I took the first part from Shakespeare's play *Hamlet*. It seemed fitting in deciding how best to take care of your tortoise. This article refers to **brumating tortoises** only, including desert tortoise (*Gopherus agassizii*), Texas tortoise (*G. berlandieri*), and Russian tortoise (*Testudo* [=*Agrionemys*] *horsfieldii*). This article does **not** pertain to **non-brumating** species such as sulcatas (*Centrochelys sulcata*). Wild desert tortoises hibernate in burrows during the winter, typically from October through March.

Brumation = Hibernation = Winter Dormancy

My default answer is to "mimic," as best we can, the wild desert tortoise's way of life in a captive habitat. A question I ask myself: What is best for the tortoise?

What is best for you and your tortoise might not be good for others. Each habitat is unique; however, some conditions are critical such as:
1. Location, location, location
2. Temperature/Moisture
3. Predators/Toxins

I am not a herpetologist specializing in *tortugas* – who is right? I am a lover of this creature who crawled into my yard almost ten years ago. My first call was to the California Turtle & Tortoise Club of Kern County – Don Williams answered the phone. So, a lot of my knowledge came from him, and I consider this to be "expert advice." Also, I've done a lot of watching, reading, and monitoring! I received my Bachelor of Science in Animal Science, but I don't remember turtles being mentioned.

Dig, dig, and dig some more in my clay soil; box-in-box; even keeping a sick one up all winter long in my bedroom – I did it all.

I will not get into details around brumation, so please seek out other articles on this subject. I will say this: because of the importance of **"fasting"** at least two weeks **before** brumation, stop all feeding – self-grazing is fine.

Encourage the tortoises to drink by soaking them often in a shallow pool of water. If your tortoise has not properly digested its food before hibernation, the food can decay in the stomach and bring about asphyxiation or cause bacterial infection.[2]

Location

If your tortoise has a good deep, safe burrow, away from possible flooding – or broken sprinklers – I would recommend keeping them outside.

"The best place for a tortoise to pass the winter is in a natural underground burrow. A burrow that you and or your tortoise dug for protection. Substitute situations are likely to be too warm or too cold, too damp, or too dry.

The outdoor burrow is preferred. There are psychological adjustments that occur prior to dormancy. These vary with day length, temperature and the tortoise's internal clock. Only an outdoor situation can their adjustment periods proceed normally. In the fall, the tortoise may not be ready for artificial confinement that you impose and, in the spring, you cannot predict with certainty the tortoise's schedule; hence we recommend you provide adequate outdoor burrows for year-around use."[3]

A burrow naturally dug by Gobi underneath a California fuchsia, *Zauschneria californica* (= *Epilobium canum*), a perennial California native subshrub.

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A plastic half-round shoring up the burrow entrance.

If you are worried (like any good tortoise owner would be), there are some tips – one I just learned – that can really help.

- To help see deep in a burrow, place **reflective tape** near the Department of Fish & Wildlife tag;
- A **GPS locator** epoxied on the shell. Note: if the tortoise is deep in a burrow, the locator might not be readable;
- Invest in **monitoring equipment**, such as temperature gauges.

Box-in-Box: Sometimes there are good reasons to keep your tortoise "boxed," including moving, fostering, sick animal, or in a new environment. This is definitely not as easy as outside.

The box-in-box method consists of two boxes, one box two to three inches larger than the other. In between the boxes place insulating material such as shredded newspaper, kraft paper, etc. Make certain the boxes are deep enough that the tortoise cannot climb out.

"The box width and opening (door) [should be] just wide enough for the tortoise to turn around."[3] Like the outside burrow, the box should be snug but with freedom to move.

Temperature and Moisture

42 to 55°F (6 to 13°C) is the crucial temperature range for survival. Deviations from this can be life-threating! Make sure the housing is at a constant, stable temperature by checking regularly that it remains around 50°F (10°C) degrees.

An infrared thermometer gun, or another device to measure temperature, is a good tool for any tortoise keeper to have. A hygrometer measures humidity (more important for box-in-box). Combination thermometer/hygrometer units are available.

If your tortoise poops in its box, do not remove it because the droppings can help keep moisture in. If the tortoise urinates and saturates the paper, remove the paper, dry the tortoise, replace the box if needed, and replace the insulation with fresh paper.

Predators/Toxins

Other animals share tortoise burrows. At the California State University Bakersfield Tortoise Habitat, we have a wildlife camera. I see cats, squirrels, and even a skunk go in and out of burrows without harming or disrupting the tortoise. Also, the burrowing owl (*Athene cunicularia*) survives by using desert tortoise pens.

On the other hand, predators such as raccoons, rats, and coyotes can cause harm by biting on the sleeping tortoise. A fence will keep out some predators. There is a lower incidence of these threats when living in the city.

However, this is another reason I love tortoises – they get you to be in touch with nature. You have to be aware of toxic plants and what goes in and out of your yard.

The biggest killer of a wintering tortoise in a box in a garage is carbon monoxide from a running car. If you have your tortoise in a garage with the car, you have to open up the garage doors, start the car, and immediately drive out of the garage. Have the container boxes deep enough so the tortoise cannot climb out, or fall out and get hurt or run over.

A carbon monoxide sensor/reader detector is a very good idea; you can even have it hooked up to your phone for alerts. If multiple people use the garage, I suggest keeping your tortoise outside in its burrow. Rats and or mice can get in containers and "chew" on a sleeping tortoise, resulting in injury or worse.

This article is written in hopes of helping to guide the tortoise owner; it was never meant to be absolute. You decide what is best for your family and habitat.

In the Kern County chapter, we are happy to be a part of the California Turtle & Tortoise Club.

Heather beside one of the tortoise burrows at the California State University Bakersfield Tortoise Habitat.

Endnotes and References

[1] The first 8 words, from William Shakespeare's play *Hamlet*, from this Soliloquy: "To be, or not to be, that is the question (1599-1602).

[2] A tortoise hibernation guide by James Alston. August 2022. ExoticDirect

[3] How to Adopt and Care for Desert Tortoise, *Gopherus agassizii*, Published by TORT-Group, Inc. of Las Vegas. 456-1776. Revised 1985".

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Brumation Location	PROS	CONS
OUTSIDE	Natural regulation of temperature	Predators
	Moisture regulation	Flooding
	Tortoise control	Burrow Collapsing
	Accessibility to water (rain)	
INSIDE	Ease of accessibility when checking on tortoise	Dehydration
	More control over elements	Freezing/Overheating
	Sick/injured watch	Chemical Toxins
		Cannot get out when awake

California Turtle & Tortoise Club CTTC. Hints on Hibernation by Michael J. Connor

Heather Ponek is honored to be the President of Kern Chapter CTTC since 2017 and currently, and CTTC Executive Board Secretary since 2021 and currently. She had a snake and a ferret at a young age (unknown to her mother). She is a lover of all animals and those who care for them.

Outdoor underground tortoise burrow with two layers of protection at its entrance.

Giant Tortoise Crusader, Dr. Linda J. Cayot, Dies

Galápagos Conservancy news release

27 September 2022 — Dr. Linda J. Cayot, best known to all who knew her simply as much beloved "Linda," passed away on September 26, 2022. Linda dedicated most of her professional career – four decades — to tortoise and iguana conservation in Galápagos. After completing a Ph.D. focused on the behavior and ecology of Galápagos tortoises, Linda took a position as a herpetologist at the Charles Darwin Research Station, where she supervised the Giant Tortoise and iguana breeding and repatriation programs. Recognizing that conservation takes a long time, and requires capable, dedicated people, Linda devoted much of her time to mentoring young conservationists, especially local Galapagueños, many of whom lead conservation efforts in Galápagos today. Before leaving Galápagos in 1998, Linda also helped initiate and manage Project Isabela – a complex project to eradicate feral goats, a nemesis for Giant Tortoises – that was ultimately successful.

From 2008, Linda worked for Galápagos Conservancy, where she became familiar to many of its members through her inspiring presentation on tortoise conservation and while serving as their guide on cruises. At Galápagos Conservancy, Linda launched *Iniciativa Galápagos* (originally called the Giant Tortoise Restoration Initiative), a collaborative effort with the Galápagos National Park to restore all Galápagos Giant Tortoise populations, which continues to this day. Linda retired in 2020 but continued to work and complete a book on Galápagos Giant Tortoises to capture all that was known about these animals she loved.

The tortoises Linda worked so hard to restore are recovering well today due in no small part to her commitment to Galápagos, its people, and its wildlife. Undoubtedly, Linda's contributions were enormous and to celebrate her life, we will continue working hard and tirelessly to perpetuate her legacy for Galápagos conservation. We shall all miss her deeply.

Alcedo Volcano giant tortoises (*Chelonoidis niger* ssp. *vandenburghi*) photographed on Isabela Island, Galápagos. **Photo © 1984 by Floyd E. Hayes**

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A CRITICALLY ENDANGERED TORTOISE ENJOYS ZOO MED GRASSLAND TORTOISE FOOD

The Radiated Tortoise *(Astrochelys radiata)* is the 6th rarest tortoise in the world, and the heroes at Turtle Survival Alliance (TSA) are fighting for its future. As a non-profit, the TSA relies on support from the community. Zoo Med has pledged to donate pallets of their Natural Grassland Tortoise Food to TSA's Madagascar location 3 times a year. This food prevents shell and spinal growth deformities by matching the nutrient profile and high fiber content of a wild tortoise diet.

Join Zoo Med in supporting the TSA's conservation efforts; visit their website to learn more and how to contribute: turtlesurvival.org

TSA
turtle survival alliance

Mike's Turtle Net Picks by Michael J. Connor, Ph.D.

A varied selection of recent articles, stories and sites on the Web that some of you may find as interesting as I did. This list is also posted at tortoise.org/turtlenetpicks/turtlenetpicks.html

USFWS Finds Gopher Tortoise ESA Listing Not Warranted…

Gopher tortoises have lost 80% of their habitat and threats are growing but the USFWS thinks listing them on the Endangered Species list is unwarranted.

Read the Federal Register notice.

…Too Little, Too Late - Why the Endangered Species Act Fails

Of the thousands of ESA listed species only 54 have recovered enough to be delisted. A new Columbia University study finds that species are not receiving protection until their populations are precariously small, dimming their prospects of recovery.

Gopher Tortoise Hatchling Range Further Than Was Thought

Researchers shed new light on the home range of young gopher tortoises using GPS.

Use of Different Quality Habitats by Female Desert Tortoises

New study explores the trade-offs made by female desert tortoises living in lower quality habitat.

Aldabra Tortoise Genome

Scientists have partially sequenced the Aldabra tortoise genome.

Galápagos Tortoises Rescued in Aftermath of Hurricane Ian

Giant tortoises are not what you'd expect to find on a beach in Fort Myers, Florida!

Galapagos Tortoise and Iguana Traffickers Jailed

An Ecuadoran court sentenced 3 smugglers to a year in prison for trafficking 84 giant tortoises and five golden iguanas from the Galapagos.

Lonesome George

It's been 10 years since the death of Lonesome George, the last known male Pinta Island tortoise.

Farewell Linda Cayot

Long time Galápagos tortoise maven Linda Cayot passed away on September 26, 2022.

Counting Eastern Box Turtles

Jeff Corwin short video on counting box turtles in Massachusetts.

Camouflage Strategies in Asian Box Turtles

The shape and color of individual carapace components can reduce detectability in *Cuora galbinfrons* and *C. mouhotti*.

Painted Turtle Defrost…

Very cool video clip of overwintering painted turtle hatchlings from the BBC.

Chitra indica Hatch at San Diego Zoo

Video of 41 hatchling Indian narrow-headed softshell turtles hatched at the San Diego Zoo.

Los Angeles Parks' Turtles

The trouble with turtles, mainly sliders, found in park ponds in Los Angeles.

Where Do Sliders Spend the Winter?

Short Nature Notes podcast on where sliders in South Carolina spend the winter.

Over 1.1 Million Sea Turtles Illegally Killed In Last 30 Years

Researchers find demand for luxury goods drives global trade in hawksbill and green turtles.

Inner Ear Evolution in Turtles

Turtles have large inner ears relative to their head size. A new study suggests that enlarged inner ear size may be connected to improved visual acuity in turtles.

What Turtles Have Taught Us

New Yale University robot is inspired by water and land turtles.

Marine Turtle Newsletter

MTN issue 165 is now available for a free download.

Galápagos Post Magazine

Download of the latest issue for free from the Galápagos Conservancy Archives.

CTTC's Turtle and Tortoise Listserve

To talk with other turtle and tortoise fans in a friendly atmosphere join **CTTC's Turtle and Tortoise list** or send an email to: <CTTC-TurtleAndTortoise-list+subscribe@groups.io>.

CTTC On Facebook

For breaking news updates follow CTTC on Facebook!

Salmonella Outbreak Linked to Small Turtles

An Investigation Notice Posted by the Centers for Disease Control and Prevention and Updated 31 August 2022

Update on the Source

An online retailer, myturtlestore.com, has been identified as a source of illnesses in this multistate outbreak. Five people report buying pet turtles with shells less than 4 inches long from myturtlestore.com before getting sick. The strain of Salmonella making people sick in this outbreak was also found at the myturtlestore.com facililty. CDC continues to advise people not to purchase small turtles with shells less than 4 inches long from myturtlestore.com or from any other seller.

Salmonella Outbreak
Fast Facts

Illnesses: 21
Hospitalizations: 8
Deaths: 0
States: 14
Investigation status: Active

Turtles and Salmonella

A federal law bans the sale and distribution of turtles with shells less than 4 inches (10 centimeters) long as pets because they have caused many illnesses. However, these turtles can sometimes be found illegally online and at stores, flea markets, and roadside stands.

Pet turtles of any size can carry Salmonella germs in their droppings even if they look healthy and clean. These germs can easily spread to their bodies, tank water, and anything in the area where they live and roam.

You can get sick from touching your turtle or anything in its environment and then touching your mouth or food with unwashed hands and swallowing Salmonella germs.

What You Should Do

If you are thinking of getting a pet turtle:

- Only buy turtles with shells longer than 4 inches and buy them from a reputable pet store
- Reputable pet stores do not sell turtles with shells less than 4 inches long.
- Pick the right pet for your family.
- Pet turtles are not recommended for children younger than 5, adults aged 65 and older, and people with weakened immune systems. These people are more likely to get a serious illness from germs that turtles can carry.

Always take these steps to stay healthy around your pet turtle:

- Wash your hands
- Always wash hands thoroughly with soap and water right after touching or feeding your turtle and after touching or cleaning the area where it lives and roams.
- Adults should make sure young children are washing their hands properly.

Play safely

- Don't kiss or snuggle your turtle, and don't eat or drink around it. This can spread Salmonella germs to your mouth and make you sick.
- Keep your turtle out of your kitchen and other areas where you eat, store, or prepare food.

Keep things clean

- Clean your turtle supplies outside the house, if possible. These supplies may include its tank, toys, and feeders.
- If you clean the supplies indoors, don't clean them in the kitchen or other areas where you eat or prepare food. Use a laundry sink or bathtub, and thoroughly clean and disinfect the area right after.

Salmonella symptoms:

Call your healthcare provider right away if you have any of these severe Salmonella symptoms:

- Diarrhea and a fever higher than 102°F
- Diarrhea for more than 3 days that is not improving
- Bloody diarrhea
- So much vomiting that you cannot keep liquids down
- Signs of **dehydration**, such as:
  - Not peeing much
  - Dry mouth and throat
  - Feeling dizzy when standing up

If you decide pet turtles are not the right fit for your family:

- Don't release your turtle outside.
- Call your local reptile rescue, animal shelter, or pet store about options for safely rehoming your turtle.
- Releasing pets into the wild can disrupt wildlife and may be prohibited by law in certain states.

What Businesses Should Do

- Do not sell or distribute turtles with shells less than 4 inches long.
- A federal law bans the sale and distribution of these turtles as pets.
- Educate customers about how to stay healthy around turtles.
- This poster provides information on how to stay healthy around turtles.
- Consider putting the poster right by the turtle area and giving a copy to customers who are buying them.
- Learn more about how to protect your customers and employees from Salmonella and other diseases shared between animals and humans.

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- Read A Compendium of Measures to Prevent Zoonotic Diseases Associated with Non-Traditional Pets.

Symptoms of Salmonella

Most people infected with Salmonella experience diarrhea, fever, and stomach cramps.

Symptoms usually start 6 hours to 6 days after swallowing the bacteria. Most people recover without treatment after 4 to 7 days.

Some people – especially children younger than 5 years, adults 65 years and older, and people with weakened immune systems – may experience more severe illnesses that require medical treatment or hospitalization.

For more information about Salmonella, see the Salmonella Questions and Answers page.

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The Centers for Disease Control Salmonella website provides a wealth of information on Salmonella and related subjects. These materials were developed by the CDC and are provided at no charge.

Special thanks to Javier Gonzalez for providing the link to this information.

What is a Zoonotic Disease?

Zoonotic diseases, also known as zoonoses, are illnesses caused by germs that jump from other animals (typically vertebrates) to humans. These harmful germs can be bacteria, parasites, viruses, or fungi.

Zoonotic diseases are very common throughout the world. Science has identified over 200 types of zoonoses worldwide with effects ranging from mild infections to serious illnesses to death.

Sources: Centers for Disease Control and Prevention and the World Health Organization.

Gopher Tortoise Denied Lifesaving Endangered Species Act Protection

Tortoise Threatened by Habitat Destruction, Fragmentation Across Southeast

Florida gopher tortoise by Craig ONeal / Wikimedia Commons. Image provided for media use.

St. Petersburg, Florida — 11 October 2022 — Following a petition and lawsuit by the Center for Biological Diversity, the U.S. Fish and Wildlife Service today denied Endangered Species Act protections to the eastern population of gopher tortoise [*Gopherus polyphemus*]. The eastern population of animals are found in Florida, Georgia, South Carolina and most of Alabama.

"Denying gopher tortoises the protection they need to survive is indefensible," said Elise Bennett, Florida director and an attorney at the Center. "It ignores devastating urban sprawl that's decimated the tortoise's habitat and will continue to drive the species ever closer to extinction."

The Service reached its decision despite projecting range-wide population declines over the next 80 years. The greatest declines are expected in the species' core range in Florida, and the western portion of its range.

Gopher tortoises are severely threatened by development-caused habitat loss and fragmentation. This limits food availability and options for burrow sites, which exposes them to being crushed in their burrows during construction, run over by cars or senselessly attacked by people. Tortoises are also threatened by disease, invasive species like fire ants, and climate change.

"This denial is a blow to the gopher tortoise and all the people who care deeply about this humble creature's future, but we won't give up," said Bennett. "We'll review this decision closely and fight to get the tortoise the protections it needs to survive."

Florida, the heart of the tortoise's range, requires that most tortoises be relocated out of the way of development. But habitat is not protected, meaning tortoises are being squeezed into increasingly smaller areas of available habitat. This past winter, booming development led Florida wildlife officials to issue an emergency executive order because of a shortage of suitable places to put relocated tortoises.

Gopher tortoises have shovel-like front legs and strong, thick back legs that help them dig intricate burrows, which are also used by more than 360 other species. They need large, unfragmented uplands like long-leaf pine forests to survive.

Gopher tortoises in limited parts of Louisiana, Mississippi and western Alabama continue to be protected under the Endangered Species Act. Those in eastern Alabama, Florida, Georgia and South Carolina have been waiting for protection since 1982.

— Center for Biological Diversity press release

Rare Turtles Hatch from Eggs Rescued from Nepal's Flood-prone Rapti Riverbank

By Abhaya Raj Joshi as published on Mongabay, 16 September 2022

- Conservationists in Nepal successfully rescued and hatched hundreds of Indian narrow-headed softshell turtles (*Chitra indica*) from a riverbank in Chitwan National Park.
- The nesting sites were hit by a flash flood three weeks after the eggs were removed; 375 of the 496 eggs hatched successfully at Chitwan's gharial breeding center after nearly seven weeks.
- Narrow-headed softshell turtles are an endangered species, threatened by hunting for their meat and consumption of their eggs, as well as degradation of their habitat, but aren't the subject of any dedicated conservation programs in Nepal.
- Conservationists have called on the government to focus more attention on the species, saying it wouldn't cost much and would require only the will to act.

Kathmandu, Nepal — 16 September 2022 — When conservationist Bed Bahadur Khadka roamed the banks of the Rapti River near Chitwan National Park to monitor gharials [Ed. note: a fish-eating crocodilian] released from a breeding center in August 2020, he came across a turtle nest.

"We saw that the nest was very close to the flood zone of the river," said conservationist Santosh Bhattarai, who visited the site following the discovery. "After looking at the eggs, we concluded that it belongs to *Chitra indica*."

They could have left the eggs to fend for themselves, as they were in their natural state, the conservationists wrote in a recent study in the journal Tropical Natural History.

"However, we decided to rescue the eggs, which would most likely be swept away by the monsoon-swollen river and hatch them at the gharial breeding center nearby," Bhattarai said, adding, "We decided to rescue the eggs as it belonged to a species listed as endangered by IUCN," the global wildlife conservation authority.

C. indica, or the Indian narrow-headed softshell turtle, is found in large rivers across the Indian subcontinent, such as the Ganges, Sutlaj and Indus. But it faces a host of threats. "We don't know much about their numbers as we haven't had a lot of studies on them," said conservationist Prakash Chandra Aryal, co-author of the book *Turtles of Nepal: A Field Guide for Species Accounts and Distribution*.

According to the field guide, the turtles are found on the sandy banks of large rivers, near deep and flowing water. They spend the day in the water and come ashore to lay eggs during the monsoon season, from August to September. They feed on fish and mollusks, attacking them at high speed, as well as on carrion.

Adult Indian narrow-headed softshell turtle, *Chitra indica*.
Photo © 2010 by Shailendra Singh

A key threat to the species is being caught by humans, whether as bycatch or deliberately. In the latter case, they're considered a delicacy, Aryal said. In some parts of the turtle's range, people raid the nests for the eggs, which can number from 60 to nearly 180. They then consume the eggs much like they would chicken eggs, Bhattarai said.

"There is a myth among local people that when someone cooks turtle meat, it can be used to feed everyone in the household, regardless of the number of people — everyone gets to eat until they are satisfied," he said.

Another threat comes from the degradation of river ecosystems across the subcontinent. In Nepal in particular, rivers are under a lot of stress due to human activities such as sand mining, construction of dams, and pollution, Bhattarai said.

Back in Chitwan, when the team patrolled the river again on Sept. 2 and 3, they found two more nests. The first one contained 120 eggs, the second one 197 and the third 179, said Saneer Lamichhane, another co-author of the study.

"It is not every day that we find such nests with so many eggs," he added.

"Previous studies have shown that the maximum number of eggs in a nest is around 178, but we found 197 in one of the nests," Bhattarai said. "This could indicate that the mother turtle was in a healthy state."

The team then collected all the eggs and brought them back to the gharial breeding center to hatch them there, citing the need to "prevent any damage from the flood and to reduce mortality." Sure enough, three weeks after moving the eggs, there was a flash flood in the Rapti River; the average hatching time for the species is nearly seven weeks.

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The study highlights that although the narrow-headed soft turtle is among several threatened species, it's not on the government list of highly protected wildlife. And while the government has established a turtle breeding center in Chitwan National Park and allowed an NGO to rescue and conserve turtles in eastern Nepal, dedicated conservation actions are still not a priority, the study says.

Bhattarai and his team have called on the government to establish turtle zones within their habitat range, such as the section of the Rapti River that runs through Chitwan National Park, and to prohibit the extraction of resources such as gravel and sand in such areas, as well as limit activities such as bathing, washing of clothes and fishing.

At the Chitwan Gharial Breeding Center, the 496 turtle eggs that the team recovered eventually hatched after an average of 54 days. They produced 375 hatchlings, all of which were then released in the Rapti.

"They were lucky that we found them and hatched them at the breeding center," Bhattarai said. "But many other eggs laid during the monsoon … may have been swept away by the river. We desperately need a separate program to save these turtles. It's not going to cost a lot; all we need is the will to do that."

Citations

Khadka, B. B., Lamichhane, S., & Bhattarai, S. (2022). Notes on successful nest relocation of Chitra indica (Gray, 1831) from Chitwan National Park, Nepal. Tropical Natural History, 22(1), 51-55. Retrieved from https://li01.tci-thaijo.org/index.php/tnh/article/download/255984/174837

Aryal, P. C., Dhamala, M. K., Bhurtel, B. P., Suwal, N. K., & Rijal, B. (2010). Turtles of Nepal: A field guide for species accounts and distribution. Kathmandu, Nepal: Environmental Graduates in Himalaya (EGH), and Companions for Amphibians and Reptiles of Nepal (CARON).

TOOSLO Chapter Accepting New Memberships

The CTTC TOOSLO chapter is once again accepting new memberships. This is the new email address to request a membership form and other information from the chapter: TOOSLO@tortoise.org

The chapter website is currently being updated and will be up and running in the near future.

Classified Advertisements

Classified advertisements run for one issue at 5^{00} for up to four lines. Ads are accepted at the discretion of the Editor. Classified ads are available to members and subscribers only and are run as a service to our members. California Turtle & Tortoise Club is not responsible for merchandise placed for sale in the *Tortuga Gazette*.

Please make your check payable to the California Turtle & Tortoise Club.

Please send ad fee to: CTTC Tortuga Gazette, attn Treasurer, P. O. Box 7300, Van Nuys, CA 91409-7300. Mail fee with ad copy to the *Tortuga Gazette* mailing address; OR, mail fee to the postal address above, and email the ad copy to the Gazette Editor.

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FOR SALE: Young Leopard tortoises for sale. Approximate age is 6 months. 75^{00} each. Contact Richard Roosman: richardinwalnutpark@msn.com

Celebration of the 50th Anniversary Desert Tortoise Research Natural Area Saturday, 25 March 2023

The Desert Tortoise Preserve Committee (DTPC) will celebrate the 50th Anniversary of the establishment of the Desert Tortoise Research Natural Area (DTRNA) on site on 25 March 2023 with an event featuring speakers, trail walks, and refreshments.

According to DTPC President Ron Berger, "...in 1973, the BLM published the boundaries of what became the DTRNA, as part of its management plan entitled, 'Management of Recreational Vehicle Use' published by the U.S. Department of the Interior. This act was followed by fencing of the perimeter and posting signs to help direct OHV riders and others, including sheep grazers, to keep out of the area in order to protect the tortoise as well as the plants it needs to survive. The following year saw the establishment of your DTPC by Dr. [Kristin] Berry, Laura Stockton, and others.

DTPC is a nonprofit charitable organization established in 1974 to promote the welfare of the desert tortoise in the wild through land acquisition and management, scientific research, and educational outreach. The DTPC currently owns and manages over 29,991 acres of habitat for the desert tortoise and other sensitive species in the Mojave and Colorado deserts."

Additional details about this event will be published as they become available.

Meeting Schedule: November/December 2022

Click on your Chapter's website link for the latest program information which is posted as it becomes available.

Chino Valley
18 November; **NO** meeting in December

Foothill
Meeting information to be announced.

High Desert
14 November; 12 December

Inland Empire
4 November; 2 December

Kern County
14 November; 12 December

Low Desert
Meeting information to be announced.

Orange County
4 November; 2 December

Ridgecrest
14 November; 12 December

Santa Barbara-Ventura
Meeting information to be announced.

Santa Clarita
Meeting information to be announced.

TOOSLO (San Luis Obispo)
Contact the chapter for meeting information.

TTCS (Long Beach)
19 November; 17 December

Valley
18 November; 16 December

California Turtle & Tortoise Club: a Society Dedicated to Turtle & Tortoise Preservation, Conservation and Education since 1964. Promoting and Facilitating the Care, Rehoming, and Adoption of Native and Nonnative Turtles and Tortoises.

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Membership in the CTTC and subscriptions to the *Tortuga Gazette* are handled through the CTTC Chapters. The Chapters also manage membership renewals (see postal addresses to the right).

Many members choose to join a nearby Chapter to participate in Chapter meetings and other activities. Print membership forms from the CTTC website.

Your Chapter and your renewal date (month/year) are displayed on your newsletter notification. Mail your new or renewal membership/subscription to the Chapter of your choice.

Membership fees

- Student membership 15^{00}
- Individual membership 25^{00}
- Family membership 35^{00}
- Life membership 500^{00}

CTTC Mailing Addresses

Chino Valley Chapter: P.O. Box 1753, Chino, CA 91708-1753

Foothill Chapter: P.O. Box 51002, Pasadena, CA 91115-1002

High Desert Chapter: P.O. Box 163, Victorville, CA 92393

Inland Empire Chapter: P.O. Box 7205, Redlands, CA 92375

Kern County Chapter: P.O. Box 81772, Bakersfield, CA 93380-1772

Low Desert Chapter: P.O. Box 4156, Palm Desert, CA 92261

Orange County Chapter: P.O. Box 11124, Santa Ana, CA 92711

Ridgecrest Chapter: P.O. Box 1272, Ridgecrest, CA 93555

Santa Barbara-Ventura Chapter: P.O. Box 3086, Camarillo, CA 93011-3086

Santa Clarita Chapter: P.O. Box 4012, Castaic, CA 91310

TOOSLO Chapter: P.O. Box 763, Grover Beach, CA 93483

Turtle & Tortoise Care Society Chapter: P.O. Box 15952, Long Beach, CA 90815

Valley Chapter: P.O. Box 7364, Van Nuys, CA 91409-7364

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