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California Turtle & Tortoise Club

The Tortuga Gazette

Volume 58, Number 3 • May/June 2022

A Coahuila box turtle, *Terrapene coahuila*, photographed in habitat in Cuatro Ciénegas, Mexico. Photo © 2016 by Michael Price

featured species

Coahuila Box Turtle, *Terrapene coahuila* (Schmidt & Owens, 1944)

The Aquatic Box Turtle

by M. A. Cohen

Inhabiting wetlands in the Cuatro Ciénegas basin in the state of Coahuila in northern Mexico, *Terrapene coahuila* is by far the most aquatic of all the North American box turtles, spending up to 90% of its life submerged in permanent and ephemeral (seasonal) bodies of water within its range. In fact, *T. coahuila* is the only extant aquatic species of North American box turtle.

According to the Desert Fishes Council, the Coahuila box turtle's "aquatic lifestyle may not be ancestral to the genus, as previously thought, but rather independently evolved in response to the desert-spring ecosystem of Cuatrociénegas" (Coahuilan Box Turtle n.d.).

Scientifically described by American herpetologist Karl Patterson Schmidt (1890-1957) and his colleague D. Owens in 1944, the Coahuila box turtle belongs to the Emydidae chelonian family, the semi-aquatic or basking turtles.

T. coahuila is commonly known as either the Coahuila or the Coahuilan box turtle. Much of the species' life history, including breeding behavior and juvenile habitat preferences, is unknown (Coahuilan Box Turtle n.d.).

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There are no recognized subspecies of *T. coahuila*.

While the species is technically active all year around, the Coahuila box turtle tends to become less active during the cooler months, ordinarily from December through February, when they bury themselves in mud at night and are only minimally active during the day.

Because its natural history is quite unusual when compared with other North American box turtles, in his study published in 1969, William Milstead "speculated that *T. coahuila* evolved in response to increasing rigors of terrestrial life as the Cuatro Ciénegas basin, in which it was trapped, became increasingly more arid."

Description

While researchers have documented the fact that the Coahuila box turtle is likely to be closely related to the common box turtle (*T. carolina*), the spotted box turtle (*T. nelsoni*), and the ornate box turtle (*T. ornata*), *T. coahuila* diverges from other cogeners[1] both in appearance and in natural history (Coahuilan Box Turtle n.d.; Howeth and Brown 2011).

Chelonian researchers consider other *Terrapene* species to be primarily terrestrial, that is, they live mainly on land and only occasionally enter the water. In contrast, the Coahuila box turtle is, for the most part, aquatic and periodically basks or travels on land. Individuals may travel on across desert areas during periods of rainfall in late spring, summer, and early fall in order to move to different aquatic habitats (Coahuilan Box Turtle n.d.).

Hinged plastron of a Coahuila box turtle enclosed in its shell. **Photo © 2010 by EBobo**

Even though it is a small- to medium-sized turtle, *T. coahuila* has a greater body density than other *Terrapene* species, enabling it to stay submerged in its aquatic habitat more easily than its more buoyant terrestrial cogeners (Howeth and Brown 2011).

Unlike other *Terrapene* species that typically display yellow-orange markings on both the carapace and skin, the Coahuila box turtle has a uniformly dark olive-brown or gray carapace that is usually covered with algae. The carapace may display subtle darker markings.

Its plastron, which features a plastral joint that is often called a hinge, is generally a dull yellowish color and sometimes has irregular dark markings at the seams between the scutes or patterning on the scutes themselves.

The skin on the head, limbs, and tail of the Coahuila box turtle is typically brown or gray and often has small black spots or other markings (Harpine, 2020; Howeth and Brown, 2011). These turtles have five toes on their forefeet and four toes on their hind feet with a small amount of webbing between their toes.

Conspicuous differences, known as sexual dimorphism, exist between *T. coahuila* males and females. The male, averaging 6.6 inches (16.8 centimeters) in carapace length, is noticeably larger than the female, whose carapace averages 5.9 inches (15 centimeters) in length.

While the female Coahuilan box turtle has a flat plastron and a small tail, the male's plastron is concave and his tail is comparatively longer and thicker than hers. The carapace of the female is somewhat more domed than that of the male.

The irises of the species' eyes differ as well. The female has yellowish irises flecked with brown while the male's irises are brownish flecked with yellow (Terrapene Coahuila n.d.).

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[1] **cogener:** an animal in the same genus as another animal.

Range and Habitat

T. coahuila is restricted to the intermontane Cuatro Ciénegas basin, a valley surrounded by steep mountain ranges. Sometimes the two words of the name are combined into one: Cuatrociénegas. The name translates from the Spanish as "four marshes," referring to the wetlands in portions of the valley.

A Coahuila box turtle in very shallow water in its habitat. Notice the whitish layer of dried salts on the top of its carapace. **Photo © 2010 by Daniel Aguilar Bazán**

The whole Cuatro Ciénegas basin, designated by the Mexican government as an official nature reserve, covers a total of 324 square miles (840 square kilometers) while the fragmented, endemic *T. coahuila* populations in the basin occupy 139 mi^2 (340 km^2) [Harpine 2020].

Rainfall flows down from the surrounding steep mountains into the basin, collecting in grassy marshlands, ponds, and streams that provide the Coahuila box turtle with its habitat.

As the rainfall accumulates in the wetlands, some of it evaporates and salts concentrate, adding to the salinity of the wetlands habitat. When the turtle emerges from the water to bask or travel overland, these salts dry on its carapace, forming a thin whitish layer that dissolves when the turtle re-enters the water.

The preferred habitat of the Coahuila box turtle is typically marshland with abundant aquatic vegetation such as cattails (*Typha*), desert saltgrass (*Distichlis stricta*), sedges (*Carex*), swamp sawgrass (*Cladium mariscus*), reeds (*Phragmites*), and waterlilies (*Nymphea*) [Harpine 2020; Terrapene coahuila n.d.].

Shallow freshwater environments ± 2 feet (0.6 meter) deep, typically with a slow current, in streams, ponds, and marshes are preferred by *T. coahuila*. The water temperatures in these areas generally range from 81°F to 84°F (27°C to 29°C) [Harpine 2020]. When a seasonal water body in which the turtle is living dries out, the individual will travel overland in dry desert areas to reach another suitable aquatic habitat.

In addition to the Coahuila box turtle, the Cuatro Ciénegas Basin has other endemic turtle species, including the Cuatro Ciénegas slider (*Trachemys taylori*) and the Cuatro Ciénegas or black spiny softshell turtle (*Apalone spinifera atra*). Both these species are true aquatics, living exclusively in water and emerging from it only to thermoregulate by basking.

Foods and Feeding

Opportunistic in its feeding behavior, *T. coahuila* has an omnivorous diet and consumes its food both on land and in the water. The composition of the diet varies by season, and the types of food consumed by *T. coahuila* more closely resemble those of aquatic turtle genera than the foods of the other *Terrapene* species.

Animal foods comprise some 51% of the diet and includes beetles, crustaceans, fly larvae, snails, spiders, dragonfly nymphs, and small fishes. The turtle's diet consists of roughly 46% plant foods, including *Chara* species (a genus of green algae), beaked spikerush (*Eleocharis rostellata*), and mushrooms. The Coahuila box turtle is an active hunter, but likely also scavenges (Harpine 2020; Terrapene coahuila n.d.).

When it is not actively foraging, *T. coahuila* tends to bury itself in the mud in or near the wetlands in which it lives (Rouot 2019).

Reproduction

Comparatively little is known about the reproductive life of the Coahuila box turtle in the wild. Much of the knowledge about *T. coahuila* reproduction comes from the observation of captive animals.

Males reach mating age at about 6 years, and females, around 8 years. Mating may occur in fall, winter, and spring, and takes place in or out of the water. Mating typically occurs from September through June, reaching its peak in spring (Harpine 2020).

The female nests from May through September, laying as many as 2 to 3 clutches per season. Clutch size varies from 1 to 8 eggs per clutch, with 2 or 3 eggs being the average clutch size (Terrapene coahuila n.d.).

Hatchlings emerge from the nest in late summer and early fall and are usually more brightly colored and patterned than the adults (Terrapene coahuila n.d.). Their coloration becomes more muted and uniform as they mature.

Threats

Because its range is so limited and specific, the Coahuila box turtle faces numerous threats to its continued existence. Many of these threats are directly linked to human activities related to the ground water that supports its fragile habitat.

Howeth and Brown, in their article published in 2011, characterized the threat in this way: "Of all the Cuatro Cienégas aquatic habitats, the wetland habitats of *T. coahuila* are the most susceptible to drying due to their shallow nature, distance from source springs, and upstream diversions."

Pumping of ground water and its diversion into canals for agriculture and cattle ranching is lowering the water table in Cuatro Cienégas, causing significant portions of the box turtle's habitat to permanently dry up. Illegal collection and poaching for the

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black-market pet trade has contributed to the general decline trend in wild populations (Rouot 2019).

In addition to the threats already mentioned, wetland habitat loss due to "roads, railroads, pipelines and other infrastructure for industrial, logistic, tourism and recreational purposes have impacted the ecosystem" with a negative effect on the remaining populations of *T. coahuila* (van Dijk et al. 2007).

Coahuila box turtle photographed underwater in habitat. **Photo © 2017 by Anibal Diáz de la Vega**

As with many chelonian species, climate change poses a substantial risk to *T. coahuila*, particular as its habitable ecoregions warm and its aquatic habitats dry up permanently. As the water table drops in the Cuatro Cienégas basin, risks to the Coahuilan box turtle increase significantly because its continued existence is completely dependent on the existence of its aquatic habitats on the basin floor. As habitat quality diminishes, recruitment of younger turtles declines, and the population suffers as a result (Howeth and Brown, 2011).

Documented predators of eggs, juveniles, and adult Coahuila box turtles include coyotes, copperheads, opossoms, raccoons, and skunks.

Conservation

The Coahuila box turtle is legally protected from international trade through its listing as CITES Appendix 1, and it is listed by the U. S. Fish and Wildlife Service Endangered Species Act of 1973. The IUCN Red List designates the species as Endangered with the notation that this evaluation "needs updating."

According to the IUCN Red List, in Mexico "turtles in general are protected from exploitation under Mexican wildlife and natural resource legislation" (van Dijk 2007).

The entire range of the species has been legally preserved by the Mexican government as the Cuatro Ciénegas Flora and Fauna Protection Area since 1994. In 2001 the Mexican government's *Secretaría del Medio Ambiente y Recursos Naturales* declared the Coahuila box turtle to be a Species of Special Protection.

Several United States zoos established successful assurance colonies to propagate the species in the 20th century. Regrettably, some of these colonies have been disbanded, but fortunately the animals have been transferred to experienced private keepers who have been successful in their breeding efforts.

Both public and private breeders are encouraged to maintain studbooks documenting their breeding efforts with the Coahuila box turtle.

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"When you add COVID, extreme heat, wildfires and air pollution all together, they're all detrimental to public health, and it just makes things worse. These stressors are happening at the same time. So the impact is cumulative and maybe even synergistic to each other. People may not directly connect local air pollution to global climate change, but they are intertwined. They are two sides of the same coin."

— Yifang Zhu, professor of environmental health sciences at UCLA Fielding School of Public Health who studies air pollution and its effects.

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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

General Guidelines for Desert Tortoise Diet Requirements

original article by Don Williams

GRASSES (native and non-native)			
common name	**botanical name**	**common name**	**botanical name**
Bermuda	*Cynodon dactylon*	Curly Mesquite	*Hilaria belangeri*
Mediterranean	*Schismus barbatus*	Big Galetta	*Hilaria rigida*
Orchard	*Dactylis glomerata*	Purple Needle Grass	*Nasella pulchra*
Desert Indian Wheat	*Plantago ovata*	Indian Rice Grass	*Eriocoma hymenoides*
Narrow Leaf Plantago	*Plantago lanceolata*	Fescue	*Festuca* species
Mexican Feather Grass	*Stipa tenuissima*	St. Augustine	*Stenotaphrum secundatum*
Arizona Cottontop	*Digitaria californica*		

ASSORTED WEEDS, LEAVES AND FLOWERS (native and non-native)			
common name	**botanical name**	**common name**	**botanical name**
Desert Dandelion	*Malacothrix glabrata*	Evening Primrose	*Oenothera biennis*
Dandelion	*Taraxacum officinale*	Mojave Spurge	*Euphorbia incisa*
Chickpea	*Cicer arietinum*	Rock Hibiscus	*Hibiscus denudatus*
Common Mallow	*Malva neglecta*	Hibiscus Flowers	*Hibiscus rosa-sinensis*
Apricot Globemallow	*Sphaeralcea ambigua*	Trailing Four O'clock	*Allionia Incarnata*
Desert Chia	*Salvia columbariae*	Sweet Alyssum	*Lobularia maritima*
Desert Plantain	*Plantago ovata*	Goldfields	*Lasthenia californica*
Heron's Beak, filaree	*Erodium cicutarium*	Nasturtiums	*Tropaeolum majus*
Owl's Clover	*Castilleja exserta*	Plains Coreopsis	*Coreopsis tinctoria*
Desert Thistle	*Cirsium neomexicanum*	Desert Marigold	*Baileya multiradiata*
Sage	*Salvia* species	California Poppy	*Eschscholzia californica*
Sowthistle	*Sonchus oleraceus*	Tidy Tips	*Layia platyglossa*
Shepherd's Purse	*Capsella bursa-pastoris*	Mojave Coreopsis	*Coreopsis californica*
Cassia (Senna)	*Cassia nemophila*	Mulberry Leaves	*Morus* species
Redstem, Stork's Bill	*Erodium cicutarium*	Rose petals	*Rosa* species
Fremont's Pincushion	*Chaenactis fremontii*	Grape leaves	*Vitis* species
Brown-eyed Primrose	*Camissonia claviformis*	Beavertail Cactus	*Opuntia basilaris*

ACCEPTABLE GREENS

- Chicory
- Dandelion
- Endive
- Kale
- Turnip greens

These greens should be supplemented with dried or ground-up Bermuda, Orchard, or Timothy grass hays because the greens alone are not as nutritious as the natural graze items listed in the tables above.

Supplementation with calcium is required. Cuttlebone with the hard backing removed is ideal as it facilitates beak health and allows the tortoise to self-regulate calcium ingestion.

SOURCES for NATIVE PLANTS and SEEDS

Native seeds, seed mixes, and plants listed above may be available from various resources, including:

- Theodore Payne Foundation
- Eastern Kern County Resource Conservation District
- Tree of Life Nursery
- Plants of the Southwest
- Las Pilitas Nursery
- Palos Verdes Peninsula Land Conservancy

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These new feeding guidelines, generated by the last 15 years of Desert Tortoise Diet research, are provided to replace outdated feeding guidelines. A desert tortoise should be allowed to forage and graze on a variety of naturally growing plants to facilitate exercise, muscle development, and beak and nail growth control.

In the wild a desert tortoise may consume up to 150 types of plants in a season, with preferences (per habitat environment) for 7 to 15 plants. For captive desert tortoises, the basic diet should be 80-90 percent grasses and forbs (herbaceous flowering plants). The only fruit they should be given is the "tuna" (the edible fruit) from the *Opuntia* (prickly pear) cactus.

In this article, you will find tables of recommended food plants including native and non-native grasses and forbs that can be easily grown to provide a balanced diet.

There is also a short list of acceptable greens that may be purchased from the grocery store or farmers market to supplement your tortoise's diet should you be unable to grow a large enough variety of foods.

There is no replacement for a natural diet.

Desert tortoises **NEED to LIVE OUTDOORS** in sunshine with shade, a burrow, and water. If a tortoise has to be kept indoors due to health or other reasons, it is recommended that calcium with Vitamin D_3 be used on all foods 2 or 3 times a week. Do **not** use the Vitamin D_3 if the tortoise is housed outdoors. Should you need to use a calcium dust, be sure it is **phosphorus free**.

For more information on desert tortoise care, visit these websites:

California Turtle & Tortoise Club

Don's Desert Tortoises

Arizona Game & Fish Department

Collaborative Effort Creates Seed Islands to Restore Desert Tortoise Habitat — Bureau of Land Management press release

Ely, Nevada — 17 December 2021 — State and county agencies and a non-profit organization are establishing "seed islands" around wildlife guzzlers to restore desert tortoise habitat on southeastern Nevada's fire-scarred public lands.

"We're taking advantage of birds and small mammals to disperse seed produced by newly-outplanted native species to enhance the surrounding desert," said Matt Flores, wildlife biologist for the Nevada Department of Wildlife, or NDOW.

This fall, NDOW relocated or outplanted 800-plus nursery-grown native plants to approximately eight acres of Bureau of Land Management-administered lands surrounding four small game guzzlers burned in the 2005 Duzak Fire, about 25 miles southeast of Caliente, in Lincoln County.

The post-fire landscape is dominated by non-native and invasive annual grasses that provide poor forage for the threatened tortoise. Non-native, grass-dominated ecosystems also lack the taller perennial shrubs that provide the tortoise with shade they need during the summer. Younger tortoises are especially vulnerable to the change in ecosystem composition.

"The Mojave ecosystem is not fire adapted. Invasive species, such as red brome – a relative of cheatgrass – interrupt the natural succession process and lacking a native plant component will reburn before natural succession can occur. We transplanted 12 native species that have strong lateral root systems in an attempt to outcompete red brome," Flores said.

The year-old plants were cultivated at a Nevada Division of Forestry state tree nursery in Las Vegas from seed collected just outside the burned area. The seed was purchased by the Southeastern Lincoln County Habitat Conservation Office with renumeration fees collected by the county for the purpose of mitigating impacts to desert tortoise. "This desert tortoise conservation project is the county's first since the Southeastern Lincoln County Habitat Conservation Plan, or HCP, was signed in 2010," said HCP Administrator Ronda Hornbeck.

The outplanting was conducted over four consecutive Saturdays beginning in October by Friends of Nevada Wilderness and federal, state and county agency volunteers.

What is a Water Guzzler?

Also known as game guzzler, a water or wildlife guzzler is basically a man-made watering device that provides drinking water to wildlife. Man-made water sources range from comparatively simple homemade devices to complex, professionally manufactured equipment.

The basic concept of a water guzzler relies on the harvesting of rain and snow and storage in a catchment basin, making the water available to wildlife in arid regions and at times of low rainfall and drought. Some equipment is plumbed to replenish the water from an adjacent storage tank as needed.

Minimal maintenance and some type of escape ramp for small animals are important considerations when installing a water guzzler. The escape ramp allows the smallest animals to drink as well as to avoid being trapped and drowning.

According to the manufacturer Rainmaker Wildlife, "if you make water available in a desert area, all animals large and small will eventually find it."

the Turtle's Garden
planting for chelonians
by M A Cohen

Eriocoma (=*Achnatherum*) *hymenoides*
Indian Ricegrass, Sand Grass

Indian ricegrass showing its decorative, edible seedheads and cool-season coloration. Photo by U.S. Department of Agriculture. Public domain.

A highly drought tolerant native bunchgrass, Indian ricegrass is a member of the family of true grasses, the Poaceae. Although it does bear edible seeds, *Eriocoma hymenoides* is **not** a species of rice. *Oryza sativa*, another member of the Poaceae family, is the botanical name of the cereal grain commonly called rice, a native of Asia that was domesticated as early as 13,000 years ago.

Ranging from Yukon Territory, Canada in the north and south to Sonora, Mexico in North America, Indian ricegrass grows east of the Cascades Mountains from Washington to Minnesota and Wisconsin, and south to Texas in the United States. The species is widely distributed throughout the western and midwestern states from the Canadian border southward to the desert southwest.

The species commonly known as Indian ricegrass has been assigned to several genera since it was scientifically described in 1906, including *Oryzopsis*, *Stipa*, *Achnatherum*, and its current genus *Eriocoma*. These genus names can still be found in the literature, as well as in the catalogs and on the websites of vendors that sell seeds of Indian ricegrass. The species name *hymenoides* has endured since the original description was published.

The habitats in which Indian ricegrass grows are dry grasslands, deserts, and foothills within the species' range. The plant also occurs in moist areas within its dry environments (Gauna n.d.) The coarse-textured, shallow soils, primarily composed of sand and gravel, in which the species grows prompted another of the species' common names, sand grass. Because its seeds are an edible grain, the species is also commonly known as Indian millet.

Closely related to the Stipae family of grasses, *E. hymenoides* can form naturally-occurring hybrids with *Stipa* grasses. In fact, at one time, the genus name of *Eriocoma* was *Stipa*, and it can still be found listed as such in some resources (Ogle et al. 2013).

E. hymenoides was such an important food crop to the Native Americans of Nevada and Utah that the species is now recognized as the official state grass of both states. See the Ethnobotany section of this column for more information about Native American uses of the plant.

Description

E. hymenoides grows in tufts or clumps, rather than spreading like a lawn grass, hence the descriptive term "bunchgrass." Depending on the authority consulted, the mature height of the species varies from 4 inches to 2.5 feet (10 to 76 centimeters) tall. Most sources state that the tufts grow to about 1 to 2 feet (30 to 60 centimeters) in height. Thread-like, rolled leaves are tightly clustered near the base of the clump and more widely spaced toward the tips of the leaves.

Indian ricegrass is a cool-season perennial bunchgrass with an upright growth habit and distinct seasonal appearances. In cooler weather, when it is actively growing, its thin, tubular leaves are bright green. During hot weather, Indian ricegrass goes dormant and its leaves turn the color of straw.

When the weather cools, the cycle begins anew. Green shoots sprout and grow in late winter and early spring, followed by flowering in spring and summer, and seed production occurs thereafter.

Each leaf of Indian ricegrass bears a loose cluster of flowers called an inflorescence. Each hair-like branch of the inflorescence is tipped with a single flower. Each flower contains a fruit that surrounds a single round or elongated seed, this being the edible grain borne by the plant. High in protein, the seeds provide nutrition for many species of animals such as domestic livestock and wild mammals, both large and small, as well as birds (Indian Ricegrass 2017).

Each Indian ricegrass flower yields a single seed. These edible seeds are black or brown in color, and are covered with short, dense, white hairs attached to the hardened skin of the seed (Ogle et al. 2013).

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Because the bases of the leaves can remain somewhat green even when the plant is dormant, *E. hymenoides* provides excellent cool-season forage for a wide variety of both domesticated and wild animals.

Cultivation

In drought-tolerant gardens, Indian ricegrass is an excellent addition, providing its basic requirements are met. Requiring full sun, the species is intolerant of shade. Requiring excellent drainage, the species will not tolerate wet soil or overwatering, so it is important to improve drainage at the planting site as needed.

The ripened seed of Indian ricegrass. The brown or black seedhead contains a single seed which is the edible grain the plant produces. Photographed by Patrick Richmond in Grand County, Utah. Public domain.

E. hymenoides does not tolerate competition from other grasses, particularly invasive, non-native species, so it is important to give it plenty of room to grow. From an ornamental standpoint, groupings of ricegrass tufts are more effective than single plants, and allowing at least 24 inches (61 centimeters) between plants will provide for proper spacing as the plants mature.

Indian ricegrass is adaptable, tolerating a variety of soil types as long as drainage is good. It does well in alkaline soils, and tolerates cold, heat, and drought once established. It does best when receiving rainfall or irrigation early in the growing season to promote vegetative growth, flowering, and seed production (Indian Ricegrass 2017).

In addition to its ornamental value, *E. hymenoides* is useful for reclamation projects, soil stabilization, and control of wind erosion because it has a fibrous root system that binds the soil.

Edibility

Palatable to wildlife throughout its range, biologists have documented the consumption of Indian ricegrass by elk, deer, antelope, rabbits, mice/rats, ground squirrels, and prairie dogs. Wild birds ingest the nutritious seeds of the species (Ogle et al. 2013).

Human use of the cereal grain dates back thousands of years to Native American tribes of the Southwest and the Great Basin. The seeds of Indian ricegrass were parched or roasted to remove the hairs prior to processing.

A company in the state of Montana produces a type of flour milled from *E. hymenoides* that is gluten-free and has been commercially marketed under the name Montina since 2002. This "baking supplement" is typically combined with other gluten-free flours to prepare foods for those on specialized diets.

Indian ricegrass seeds are very nutritious, being high in both fiber and protein as well as naturally gluten free.

Ethnobotany

The study of ethnobotany refers to the traditional customs and knowledge of a people regarding plants and their various uses.

The Native Americans of the United States' Southwest and Great Basin valued Indian ricegrass as a cereal grain that they harvested and prepared for use in bread, tortillas, porridge, soup, and dumplings.

The leaves of the plant were harvested as hay for the tribes' horses. Ethnobotanists have documented the use of *E. hymenoides* by the "Apache, Gosiute, Havasupai, Hopi, Kawaiisu, Navajo, Paiute, and Zuni Indian tribes of western North America" (Ogle et al. 2013).

Dormant-season Indian ricegrass photographed in the desert in Clark County, Nevada. **Photo © 2021 by Joe Tuvell**

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Court Upholds Protections for California's Western Joshua Trees

Judge Rejects Effort to Strip State Endangered Species Act Safeguards

Fresno, California — 16 February 2022 — A Fresno County Superior Court judge today rejected an effort by construction and real estate interests, along with the city of Hesperia, to strip away legal protections for the imperiled western Joshua tree.

"Joshua trees and their fragile desert ecosystem just scored a huge victory," said Brendan Cummings, the Center for Biological Diversity's conservation director and a Joshua Tree resident. "Before state protections took effect, developers were bulldozing Joshua trees by the thousands to build roads, powerlines, strip malls and vacation rentals. If these beautiful plants are to have any hope of surviving in a warming world, we have to stop killing them."

Today's ruling by Judge Kristi Culver Kapetan upheld current protections for the species. A year ago the same judge rejected a similar effort to block the state's protective rules from taking effect.

In September 2020 the California Fish and Game Commission voted unanimously to grant western Joshua trees candidate status under the California Endangered Species Act (CESA), giving them interim legal protections and triggering a status review by the Department of Fish and Wildlife.

The department's status review will be made public in April, and the commission is scheduled to make a final decision in June about whether to permanently protect the trees or end their current protections.

The commission's interim protection decision came in response to a 2019 petition from the Center seeking to protect the species in the face of threats from climate change, fire and development.

The growing popularity of Joshua Tree National Park had spurred a building boom in Joshua Tree and adjacent communities, resulting in the widespread removal of the namesake trees to make way for vacation rentals and second homes. A similar construction boom is occurring in Hesperia and adjacent areas where new warehouse projects and other industrial facilities are being proposed in Joshua tree woodlands. The current state protections make killing Joshua trees illegal without special permits.

In October 2020 a coalition opposed to protecting the Joshua tree, including the High Desert Association of Realtors, filed a lawsuit in Fresno County Superior Court seeking to overturn the tree's candidate status.

Today's ruling marks an end to that challenge and means the status review and the commission's final protection vote will proceed as scheduled.

"It's a sad irony that the very real estate agents marketing the iconic beauty of Joshua trees are also leading the charge to kill them," said Cummings. "Their lawsuit was misguided, greedy and, thankfully, unsuccessful."

The lawsuit resolved today was filed by the California Construction and Industrial Materials Association, California Business Properties Association, California Cattlemen's Association, California Farm Bureau Federation, California Manufacturers and Technology Association, High Desert Association of Realtors and the city of Hesperia. The Center intervened in the lawsuit to defend the commission's decision.

If the western Joshua tree wins permanent protection under the CESA, state and local agencies will have to manage threats to them, including developing a recovery plan outlining a strategy to protect the species in the face of climate change and other threats.

Western Joshua tree, *Yucca brevifolia*, photographed in Lost Horse Canyon in Joshua Tree National Park by Brad Sutton of the National Park Service. Public domain.

Background

While the killing of western Joshua trees by developers is the most visible threat, climate change and fire are also pushing the species towards extinction.

Recent studies show Joshua trees are dying off because of hotter, drier conditions, with very few younger trees becoming established. Even greater changes are projected over the coming decades. Scientists in 2019 projected that the Joshua tree will be largely gone from its namesake national park by the end of the century.

Prolonged droughts are projected to be more frequent and intense over the coming decades, shrinking the species' range and leading to more tree deaths. Higher elevations, where Joshua trees might survive increasing temperatures and drying

article continues on page 11 ▶

conditions, are at risk of fire because of invasive non-native grasses.

Approximately 40% of the western Joshua tree's range in California is on private land, with only a tiny fraction protected from development. Current projections show that virtually all this habitat will be lost without stronger legal protections for the trees.

Joshua trees comprise two distinct species: the western Joshua tree (*Yucca brevifolia*) and the eastern Joshua tree (*Y. jaegeriana*). The two species occupy different areas of the desert, are genetically and morphologically distinguishable, and have different pollinating moths. Only the western species is currently a candidate under the California Endangered Species Act.

—Center for Biological Diversity press release

Joshua Tree Facts

- The Joshua tree is the largest species in the *Yucca* genus.
- Joshua trees only grow in Mojave Desert of California, Nevada, Utah, and Arizona between 2,000 and 6,000 feet of elevation.
- Joshua trees can live for an estimated 500 years.
- Joshua trees grow slowly, adding just 2 to 3 inches a year. The trees require 50 to 60 years to reach their mature height of 15 to 40 feet tall.
- Persistent drought caused by climate change in southern California is causing problems for Joshua Trees. Drought frequently results in wildfires that cause extensive damage.
- Yucca moths pollinate Joshua trees by collecting their pollen and transferring it from blossom to blossom.

– Facts excerpted from *The Environmentor*

Support CTTC When You Shop at Amazon.com

When you shop at Amazon.com you can now support the California Turtle & Tortoise Club (CTTC) at the same time.

Simply click on the **AmazonSmile link** or on the logo to the right confirming the charity of your choice, and then select and purchase your item(s). Amazon will make a charitable donation to CTTC based on your eligible purchase(s). There is no additional charge to you, the buyer.

The **AmazonSmile** program offers the "exact same low prices, vast selection and convenient shopping experience as Amazon.com" plus the opportunity to support CTTC through the donations made by Amazon to the Club. Thank you for your support!

Earth Day Celebrated in Florida Keys with Sea Turtle Release

Florida Keys & Key West press release

Bette Zirkelbach, right, manager of the Florida Keys-based Turtle Hospital, observes "TJ Sharp," a juvenile green sea turtle, crawl into the ocean Friday, April 22, 2022. Photo by Andy Newman/ Florida Keys News Bureau via AP.

Marathon, Florida Keys — 22 April 2022 — Staff from the Florida Keys-based Turtle Hospital released a rehabilitated green sea turtle back to the ocean to mark Earth Day Friday.

Several hundred onlookers gathered on Marathon's Sombrero Beach to cheer the release of "TJ Sharp," a 65-pound juvenile sea turtle that was rescued in February. The endangered reptile was discovered floating offshore, unable to dive and visibly affected by fibropapillomatosis, a condition that causes cauliflower-like tumors and affects sea turtles around the world.

TJ's condition upon arrival at the Turtle Hospital required surgical removal of the tumors and treatment with broad-spectrum antibiotics, fluids, vitamins and a nourishing diet of greens and mixed seafood.

"Sea turtles are the oldest animal known to man -- to be able to take a sea turtle, rehabilitate it and return it to its ocean home on Earth Day, it's just an amazing day," said Bette Zirkelbach, manager of the Turtle Hospital.

Zirkelbach said that although Earth Day is recognized once a year, humans can take daily steps to protect marine resources and the survival of sea turtles.

"What people need to do to make every day Earth Day is to reduce single-use plastics, keep trash out of our oceans and help keep our planet clean," Zirkelbach added.

Galápagos Conservancy News

New Taxon of Giant Tortoise Discovered in Galápagos Islands

9 March 2022 — New DNA analysis of century-old tortoise bones published this week in Heredity, one of the world's leading journals of genetics, contained a startling revelation: the extant Giant Tortoise species on San Cristóbal Island in Galápagos represents a genetically distinctive and undescribed group of organisms, or "taxon," new to science. The San Cristóbal Giant Tortoise (*Chelonoidis chathamensis*) described over a century ago is now likely an extinct species.

Until now, it has been presumed that the tortoises living on San Cristóbal belonged to a single species, *C. chathamensis*, which was described on the basis of bones and shells collected in a cave during a 1906 California Academy of Sciences expedition to the southwestern highlands of the island. That expedition never reached the northeastern lowlands of San Cristóbal where tortoises currently live.

However, researchers from University of Newcastle, Yale University, Galápagos Conservancy, and other institutions extracted DNA from these bones and made a remarkable discovery: The DNA does not match that of the tortoises currently inhabiting the island.

This means that:

1) The 8,000 tortoises living on San Cristóbal today may not be rightly called *C. chathamensis* at all, since they are another taxon (or lineage) entirely that has no formal description or scientific name;

The extant San Cristóbal giant tortoise, assumed to be *Chelonoidis chathamensis*, photographed in habitat. **Photo © 2019 by ajott**

2) The taxon that the name *C. chathamensis* belongs to [may be a species] from the San Cristóbal highlands is almost certainly extinct; and

3) San Cristóbal Island had not one but two different taxa of tortoises living together — one in the highlands and one in the lowlands, each likely with different nesting areas — until the extinction of the highlands species in the middle of the 20th century.

The authors are currently working to recover more DNA from the extinct taxon to clarify the taxonomic status of the San Cristóbal tortoises and better understand how the current living species is related to the extinct one. It seems likely that there were two species on San Cristóbal, not one, and if this is the case, the name of *C. chathamensis* should be assigned to the extinct species, and the extant taxa should be given a new name.

San Cristóbal Island consists of two parts that, during times of high sea levels millions of years ago, may have been separate islands, each likely with its own tortoise species. Once sea levels dropped, the two islands merged, as perhaps did their tortoises. Today, the southwestern highlands section, where tortoises once flourished but were killed off by whalers and early-twentieth-century settlers, is moist and lushly vegetated. The northeastern section, where tortoises currently live, is lower and more arid.

A recent Galápagos Conservancy-Galápagos National Park Directorate joint expedition estimated 6,000 to 8,000 giant tortoises on San Cristóbal, recovering rapidly from a low of 500–700 individuals in the 1970s thanks to the cessation of poaching and removal of goats.

Click this link **A new lineage of Galapagos giant tortoises identified from museum samples** to access the full publication published in the journal *Heredity*.

— Galápagos Conservancy news release

2022 Slate of Officers and New Chapter Email for CTTC Santa Barbara–Ventura Chapter

The CTTC Santa Barbara–Ventura chapter has a new email address for contacting the chapter and a 2022 slate of new and returning officers.

The new email for chapter information is **SB.Ventura@tortoise org**

Officers for 2022 include:

President: **Trent Barnhart**
Vice-president: **Sue Alvarez**
Treasurer: **Vel Muskat**
Secretary: **Chuck Alvarez**

Meeting and event information will be posted on the **Chapter website** as details become available.

CTTC wishes the Santa Barbara–Ventura Chapter every success as it reorganizes and moves forward.

Galápagos Conservancy News

Dire Situation for the Last Fernandina Giant Tortoise

22 March 2022 — Galápagos Conservancy scientists and Galápagos National Park Rangers have just completed a series of intensive searches of Fernandina Island in an effort to locate more Fernandina Giant Tortoises (*Chelonoidis phantasticus*), a species believed extinct for more than 100 years prior to the 2019 discovery of a lone female tortoise known as Fernanda.

The 18-person expedition team conducted a meticulous search that covered approximately 65 square kilometers (25 square miles) of the remaining unexplored habitat on the island. Park Rangers had been optimistic about finding additional animals after tortoise tracks not belonging to Fernanda were reported several years ago.

The world's foremost experts at finding tortoises in these harsh conditions have now explored nearly all habitat on the island that could be suitable for tortoises. Tortoises leave abundant signs — tracks, droppings, trails, and bite marks on vegetation — wherever they occur. Lacking any further sign of tortoises after exhaustive searches of the island, hopes are dimming for finding more Fernandina tortoises.

Fernandina tortoise, *Chelonoidis phantasticus*. Photo by the Galápagos Conservancy. Provided for media use.

The Fernandina Giant Tortoise was long believed to be extinct due to natural causes, in particular, due to habitat destruction as a result of the recurring eruptions of La Cumbre Volcano. The volcano that forms Fernandina Island is one of the most active in the world and much of the island is covered by recent lava flows.

"Park guards and our staff had to overcome immense challenges," said Dr. Jorge Carrión, Conservation Manager of Galápagos Conservancy who planned and participated in the expedition. "Fernandina Island is covered by dozens of razor-sharp lava flows that cut through the prime tortoise habitat — teams had to navigate across these treacherous areas while searching for a tortoise."

"Hope is fast running out to find a mate for Fernanda, the sole known survivor of her species," stated Dr. Paul Salaman, President of Galápagos Conservancy. "And in a tragic twist of fate, her life may mirror the plight of Lonesome George, the last of his kind from Pinta Island, who died alone just ten years ago in Galápagos, unless we are able to find alternatives to fully or partially recover this species."

Danny Rueda, Director of the Galápagos National Park, said that "as an environmental authority we have to take the necessary actions to find other tortoises on Fernandina Island and recover the species. Still, we remain hopeful that a new expedition later this year, utilizing a helicopter, will allow us to reach inaccessible locations and find another tortoise."

— Galápagos Conservancy news release

Satellite image of the main Galápagos Islands captured by the National Aeronautics and Space Administration. The Spanish names of the visible main islands were overlaid by Storpilot. Public domain.

Fernandina, the westernmost of the main islands, is the site of the searches for additional Fernandina giant tortoises, *Chelonoidis phantasicus*.

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

Aldabra Tortoise Behavior During Human-Tortoise Interactions

Study finds that many tortoises chose to interact with their keepers during training and approach tests, and suggests that human-tortoise interactions may have enrichment value.

Fernandina Island Giant Tortoise Search

The recent hunt for another Fernandina giant tortoise came up short. A new expedition to survey smaller habitat patches is in preparation.

Highway through Red Cliffs Opposed by Natural Resources Committee Members

Democrats on the House Natural Resources Committee are urging the Secretary of Interior to rescind approval of a highway that would eliminate key desert tortoise habitat in Utah's Red Cliffs Reserve.

Desert Tortoise Predators Identified by DNA Analyses of Scat

Genetic analysis is being used to detect desert tortoise remains in canid scat and raven pellets.

RIP Cecil Schwalbe

Renowned herpetologist Dr. Cecil Robert Schwalbe passed away April 3rd.

Supporting Turtles in Post-industrial Baltimore

Turtles (and people watching them) in Baltimore Harbor can now enjoy a 100-square-foot floating platform designed and built just for turtle basking.

Underwater Noise Causes Hearing Loss in Turtles

Study finds that turtles are vulnerable to hearing loss from underwater noise pollution.

Video - Hatchling European Pond Turtle Heads for the Pond

One tiny European pond turtle... one epic journey...

Video - Snake-Necked Turtle Video

Uber cool, 18 second video of an Australian snake-necked turtle swimming at night.

Sea Turtle Receives Acupuncture to Treat Jaw Injury

Bassoon, a Kemp's ridley sea turtle, is eating on his own again after several weeks of daily acupuncture treatments at Baltimore's National Aquarium.

New Genetic Clues Could be Key to Understanding Fibropapillomatosis

Scientists are looking at the role that gene variants in sea turtle immune systems play in potentially protecting them from fibropapillomatosis.

Rebuilding Green Sea Turtle Populations

A controversial green sea turtle reintroduction program started 50 years ago in the Cayman Islands may be paying off.

Qatar Hawksbill Headstart Program

In the last three years Qatar has released over 31,000 young hawksbill sea turtles at Fuwairit Beach as part of the nation's project to protect endangered species.

Protection Paying Off for Aldabra's Green Sea Turtles

Green turtle numbers continue to rise in the Aldabra Atoll where the species has now been protected for more than 50 years.

Protecting West Africa's Green Sea Turtles

A network of West African marine protected areas running from Cape Verde to Sierra Leone – is protecting vital habitats for green sea turtles.

Deep Water Port Threat to Congo's Sea Turtles

Rising sea levels and erosion have consumed almost a quarter of Congo's sea turtle nesting beaches. Now a new concern is emerging in the form of a proposed deep water port.

Mexico's Supreme Court Acts to Protect Veracruz Reef From Port Expansion

This decision preserves habitats for endangered hawksbill sea turtle and protects the largest reef system in the Gulf of Mexico from the destructive construction of new navigation channels, land access points, and other port facilities.

Cretaceous Turtle Burrows

I can't resist a good turtle fossil study. This one is a little different because the "fossils" are Cretaceous Era turtle burrows. The study findings support the hypothesis that turtle shells evolved as an adaptation to burrowing behavior.

New Cretaceous Era Softshell

A newly identified softshell turtle, *Hutchemys walkerorum*, lived in North Dakota alongside *Tyrannosaurus rex* and *Triceratops*.

Calls for USFWS Reform

Coalition of 140 groups is calling for major reforms at U.S. Fish and Wildlife Service to end political meddling and restore scientific integrity to the endangered species listing process.

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-Turtle-AndTortoise-list+subscribe@groups.io>.

CTTC On Facebook

For breaking news updates follow CTTC on Facebook!

Meeting Schedule: May/June 2022

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

Chino Valley
20 May; 17 June

Foothill
27 May: in-person meeting at the L. A. County Arboretum's Palm Room

High Desert
9 May; 13 June

Inland Empire
6 May; 3 June

Kern County
9 May; 13 June

Low Desert
Meeting information to be announced.

Orange County
6 May; 3 June

Ridgecrest
9 May; 13 June

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)
21 May; 18 June

Valley
20 May; 17 June

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.

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

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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 below).

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 2371, San Bernardino, CA 92406-2371

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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