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Male Gulf Coast box turtle, *Terrapene carolina major*. Photo by the National Park Service. Public domain.

featured species

Gulf Coast Box Turtle, *Terrapene carolina major* (Agassiz, 1857)

North America's Largest Box Turtle

by M. A. Cohen

As its common name implies, the Gulf Coast box turtle is indigenous to several southern states with coastlines on the Gulf of Mexico. The largest subspecies of the four living species in the *Terrapene carolina* (Eastern box turtle) complex, *T. c. major* belongs to the Carolina (eastern) Group, one of two regional groups into which North American box turtles are divided. Besides the Gulf Coast box turtle, the Carolina Group comprises the eastern box turtle (*T. c. carolina*), the three-toed box turtle (*T. c. triunguis*), and the Florida box turtle (*T. c. bauri*). The Ornata (western) Group of North American box turtles consists of the ornate box turtle (*Terrapene ornata ornata*) and the desert box turtle (*T. ornata luteola*) [Identification Guide to Eastern Box Turtles, n.d.].

The North American box turtles are all members of the Emydidae family, commonly known as pond or marsh turtles.

While most box turtles that are native to North America are described as terrestrial, the Gulf Coast subspecies is characterized as semiaquatic because it favors more humid ecosystems than other North American species, and it is never far

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from a riparian habitat feature, i.e., a pond, lake, marsh, stream, swamp, or other source of water.

T. c. major was officially described in 1857 by Swiss-American biologist/geologist Jean Louis Rodolphe Agassiz (1807-1873).

Description

At 8 to 8.5 inches (20 to 22 centimeters) in carapace length, the Gulf Coast box turtle is the biggest of the of the recognized subspecies of *T. carolina*.

The elongated, domed carapace of the Gulf Coast box turtle is typically dark olive, dark brown, or black, and it has a central keel and flared posterior marginal scutes. The most variable subspecies in appearance, its carapace may have markings that are yellow or orange spots or stria (linear markings) of various lengths, or there may be faint markings or none at all. Additionally, contrasting markings on the carapace generally fade with age, and mature individuals may be uniformly dark in coloration.

Plastron coloration varies from solid dark olive, brown, or black to light tan with dark blotches. Its hinged plastron affords the animal substantial protection, as the turtle can swiftly retract its head, tail and limbs under its carapace, and effectively "box" itself in to shield itself from many types of predators.

While *T. c. major* males may have colorful red, orange, or yellow scales on their limbs, the background skin color of both sexes is dark brown or black. The hind feet of the subspecies generally have four toes, although individuals with three toes on their hind feet do exist. Because hybrids are common among *T. carolina* subspecies with overlapping ranges, Gulf Coast box turtles with three toes on their hind feet may be hybrids of the Gulf Coast box turtle and the three-toed box turtle subspecies, *T. c. triunguis*.

The heads of both male and female Gulf Coast box turtles are generally dark in color, although the adult males may develop distinguishing white blotches or patches of skin on their heads.

Eye color, one way to distinguish males from females some subspecies of eastern box turtle, is not particularly reliable for determining the sex of Gulf Coast box turtles. While a female will typically have brown irises, a male may have either brown or red irises in his eyes.

T. c. major displays moderate sexual dimorphism, i.e., physical differences based on the sex of the individual. Males are somewhat larger than females. Moreover, males have concavity on their plastrons while those of females are flat. The tails of males are longer and thicker than those of females, and males tend to have claws on their hind feet that are thicker and more curved than those on the females' hind feet.

Intergrades, hybrids between subspecies, frequently occur in states such as Mississippi, Alabama, and Florida where the ranges of the subspecies overlap. The wide variation in appearance that results from introgression (repeated hybridization episodes) makes it impossible to identify any single subspecies in these hybrid individuals without genetic analysis (Animal Diversity Web, n.d.).

Jason M. Butler and his colleagues conducted a study of the DNA and the physical structure of Gulf Coast box turtles in the Florida panhandle, concluding that "the results of the present study indicate that box turtles traditionally assigned to *T. c. major* based on phenotype [editor's note: observable characteristics] are the result of introgression between eastern extant (predominantly *T. c. carolina*) and an extinct subspecies, *T. c. putnami*," according to their published paper (Butler et al, 2011).

Known only from fossil evidence, researchers theorize about the appearance of *T. c. putnami*. The fossils discovered to date indicate that, at 10.5 inches (27 centimeters) in carapace length, the extinct subspecies' size was larger than the contemporary Gulf Coast subspecies. Carapace patterning is unknown, but researchers surmise that *T. c. putnami* may have resembled *T. c. major* in coloration.

Range and Habitat

Although it is the most sizable subspecies of *T. carolina*, the Gulf Coast box turtle has the smallest range of any living subspecies. Found throughout the Gulf Coastal Plain in the United States, the Gulf Coast box turtle is indigenous to a relatively narrow strip of land stretching from eastern Texas, eastward through Louisiana, Mississippi, Alabama, and the Florida panhandle.

Typically found in estuaries, marshes, and swamps, *T. c. major* prefers ecosystems that offer considerable humidity. While the species is not "aquatic" in the traditional sense, the Gulf Coast box turtle is never far from a water source, including such aquatic microhabitats as brooks, marshes, farm ponds, and vernal pools (Ernst and Lovich, 2009), often traveling through shallow bodies of water.

Foods and Feeding

For the first five or six years of its life, the Gulf Coast box turtle is primarily carnivorous, becoming more herbivorous as it matures (Animal Diversity Web, n.d.).

Gulf Coast box turtle, *Terrapene carolina major*. Photo © 2006 by LA Dawson. Source: Wikimedia Commons; license CC-BY-SA 2.5.

A true omnivore, *T. c. major* is an opportunist when feeding, consuming all suitable prey and plant parts. Invertebrate prey includes ants, beetles, centipedes, millipedes, cockroaches, crickets, grasshoppers, grubs, slugs, snails, spiders, and worms. Vertebrate prey includes birds, fish, frogs (tadpoles and adults), lizards, small mammals (young mice, rabbits, and shrews) salamanders, snakes, turtle eggs, and carrion.

Plants consumed include wild berries, flowers, fruits, fungi (mushrooms and bracket fungi), grasses, mosses, roots, seeds, and stems of various plants (apples, blackberries, blueberries, cherries, elderberries, mulberries, etc.), and vines (Box turtles, n.d.; Ernst and Lovich, 2009).

Reproduction

The Gulf Coast box turtle reaches reproductive maturity between five and 10 years of age. Maturing first, males generally reach mating age at five to six years old, while females usually begin breeding at seven to eight years of age.

The mechanism of temperature-dependent sex determination (TSD) is present in box turtles. Incubation temperatures ranging from 72.5 to 80.6°F (22.5 to 27°C) produce predominantly males, while temperatures above 84.2°F (29°C) produce all-female clutches (Farrell, Dodd, Jr. and May, 2006).

Females may lay up to five clutches of eggs per year, but two or three clutches per year are more common, and some females do not lay every year (Ernst and Lovich, 2009). Clutch size ranges from one to 11 eggs; females typically oviposit three to eight eggs per clutch. Nesting generally occurs between April and July at night.

Emerging from the nest in September and October, and sometimes as late as December, hatchlings have very low-domed shells compared with the high-domed shells of adults. The plastral hinge, while present at hatching, becomes fully functional when the box turtle is approximately 2 inches (5 centimeters) in carapace length (Ernst and Lovich, 2009).

Threats

Habitat degradation, fragmentation, and destruction are significant threats to box turtles. Agricultural, recreational, residential, and infrastructure developments alter habitats within their range. Pollution and pesticides from industrial and agricultural sources also negatively impact box turtle populations.

Mortality caused by vehicular traffic and subsidized predators such as crows, foxes, raccoons, and feral dogs take a toll on wild populations, as do invasive species of fire ants.

Collection for the pet trades, both domestic and international, has dropped significantly with the implementation of legal protections afforded by state regulations and international conservation measures (van Dijk, 2011).

Conservation

The Red List of the International Union for the Conservation of Nature lists the *T. carolina* complex as "Vulnerable" (meaning subject to extinction), and the complex is listed in CITES Appendix II, affording it some international protection from over-exploitation. ♧

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Feds Propose Increasing Destructive Off-road Vehicle Access in Mojave Desert

— Plan Disregards Court Order to Protect Desert Tortoise

Moreno Valley, California—16 March 2018—The U.S. Bureau of Land Management today proposed increasing off-road vehicle access in the western Mojave Desert, despite a court order that required the agency to reanalyze ORV routes to ensure this fragile ecosystem is protected.

"This plan is a death sentence for threatened desert tortoises and their fragile habitat," said Ileene Anderson, a senior scientist at the Center for Biological Diversity. "Uncontrolled ORV use kills animals and tears up the delicate desert ecosystem with tire tracks that last for decades. The BLM should be reducing ORV routes, not increasing them."

Previous court rulings have found that the BLM failed to adequately justify the existing off-road vehicle route system and sent the agency back to the drawing board twice. Today's BLM proposal tries to legitimize illegal user-created routes and adopt them into the system.

"There are at least 11,000 miles of illegally created roads in addition to the 5,000 miles of authorized ones. This clearly shows the BLM can't manage what it has," Anderson said. "The Trump administration is starving the agency of the resources it needs to do its job. Officials need to go back to the drawing board and create a system that protects the desert's plants and animals while allowing reasonable access."

The BLM's West Mojave Plan covers 3.1 million acres of public lands in the western portion of the Mojave Desert in southern California, including parts of San Bernardino, Los Angeles, Riverside, Kern and Inyo counties. ♧

—Center for Biological Diversity press release

Wild Mojave desert tortoise, *Gopherus agassizii*, in habitat. Photo by London Rachel, USFWS. Public domain.

Texas Proposes Ending Unsustainable Commercial Wild Turtle Trapping

— List of States Curbing Commercial Turtle Harvest Grows

Austin, Texas—21 March 2018—In response to a petition filed by the Center for Biological Diversity (CBD) and several Texas-based conservation organizations, the Texas Parks and Wildlife Commission today approved publication of a proposed rule that would prohibit commercial collection of the state's wild turtles.

"We're so grateful these badly needed protections for Texas' rare, native turtles are moving forward," said Jenny Loda, a Center attorney and biologist who works to protect vulnerable reptiles and amphibians. "For-profit collectors shouldn't be allowed to put the state's turtles at risk of extinction."

Texas is the latest in a growing list of states — including Missouri, New York and Iowa — that have put an end to unlimited commercial collection of freshwater turtles.

Under current Texas law, unlimited collection of four native, freshwater turtle species is allowed on private property: common snapping turtles, red-eared sliders, smooth softshells and spiny softshells.

Texas modified its regulations in 2007 to protect freshwater turtles from collection on the state's public lands and waters. But this only resulted in protections for turtles in 2.2 percent of the water bodies in Texas. Recent studies concluded that current turtle collection in Texas is likely not sustainable.

At today's Texas Parks and Wildlife Commission meeting, staff from the state Parks and Wildlife Department presented their findings based on a review of the petition, along with scientific literature and the department's own data. Department staff determined that there is sufficient scientific justification to prohibit the commercial collection of the common snapping turtle, red-eared slider, smooth softshell and spiny softshell.

Department officials further explained that turtles are among the nongame species of greatest concern in Texas. Turtles' slow reproduction makes it unlikely that populations can remain stable when high numbers of adults and older juveniles are steadily removed from a population.

"This is great news for Texas' freshwater turtles as commercial trapping is devastating to turtle populations that are already suffering from multiple other threats, including habitat loss, water pollution and vehicular collisions," said Evelyn Merz, conservation chair for the Sierra Club's Lone Star Chapter. "We hope that the state will finalize the proposed rule and ban commercial turtle trapping; otherwise, Texas' turtle populations will continue to plummet."

Basking red-eared slider (*Trachemys scripta elegans*), one of the species proposed for protection from commercial collection in Texas. Photo © 2017 by Björn S. Source : Creative Commons; license: CC-BY-SA-2.0.

The petition that spurred today's action was submitted last year by the CBD, Sierra Club's Lone Star Chapter, Texas Rivers Protection Association and Texas Snake Initiative.

Background

As part of a campaign to protect turtles in the United States, the Center for Biological Diversity has been petitioning states that allow unrestricted commercial turtle collection to improve their regulations. Earlier this month, in response to a Center petition, the Missouri Department of Conservation banned commercial collection of the state's wild freshwater turtles. In September of last year, Nevada created a statewide ban on the destructive commercial collection of all reptiles and New York halted all commercial terrapin turtle harvesting.

Before that, in March 2017, Iowa adopted new regulations setting closed seasons and possession limits for commercial turtle trappers. In 2012 Georgia approved state rules regulating the commercial collection of turtles, and Alabama completely banned commercial collection. And in 2009 Florida responded by banning almost all commercial collection of freshwater turtles from public and private waters.

Texas is in a regional hotspot for commercial turtle collectors, and reform is needed. If the state ends commercial collection within its borders, adjacent states would likely follow its example; the region would be better equipped to protect its turtle populations by making clear to turtle traders that trade is strictly regulated and enforced.

The Center recently petitioned for a ban on unlimited commercial trapping in Arkansas, Louisiana and Oklahoma, three states that share a border with Texas. ♧

—Center for Biological press release

The Turtle Extinction Crisis

— Nearly half of all freshwater turtles and tortoises are at risk of disappearing forever, a new report warns

by John R. Platt, Editor, ***The Revelator***

12 March 2018—It's not easy to be a turtle in the 21st century. A new report warns that freshwater turtles and tortoises are among the world's most threatened groups of species, with more than 40 percent at risk of extinction due to habitat loss, the illegal pet trade, and consumption for food and traditional medicine.

Among the most threatened species are the Yangtze giant Asian softshell (*Rafetus swinhoei*), which is down to its last three individuals in China and Vietnam; the ploughshare tortoise (*Astrochelys yniphora*) of Madagascar, which fetches enormous prices in the illegal pet trade and could disappear from the wild as soon as this year; and the three-striped box turtle (*Cuora trifasciata*), ownership of which "has become a financial investment and status symbol in China," according to the report.

The critically endangered painted terrapin, *Batagur* (=*Callagur*) *borneoensis*, one of the species profiled in the 2018 *Turtles in Trouble* report. Photo © 2009 by Ltshears. Source: Wikimedia Commons; license: CC BY-SA 3.0.

Also considered highly at risk: the Nubian flapshell turtle (*Cyclanorbis elegans*), not seen in the wild in at least 15 years and feared extinct by some conservationists.

All told about half of all tortoise and freshwater turtle species and subspecies are threatened or at risk of extinction.

The authors of the report, which was issued last week by a partnership of 10 turtle conservation organizations, call it "an effort to publicize the plight of tortoises and freshwater turtles by highlighting those species that are at the highest risk of extinction." Sadly that's obviously needed, as not much has changed since the previous edition of this report in 2011, which contained a very similar list of turtles. Conservation efforts have benefited a few of these species during that time period, but not enough to improve their overall outlook. In fact the only species from the 2011 list that doesn't appear in the 2018 edition is the Pinta giant tortoise (*Chelonoidis abingdonii*) of the Galápagos, which went extinct in 2012 with the death of world-famous tortoise Lonesome George.

So why should we care? Well, other than the fact that this list contains some stunningly beautiful and interesting species, tortoises and freshwater turtles also serve vitally important ecological roles in their native habitats. As the report points out, various species help to shape rivers and waterways, assist plant populations by dispersing seeds and fungi, and even keep water clean by scavenging dead animals. They're also significant in human culture and art — which is one of the reasons they're at risk.

Here's the list of the 27 most threatened tortoise and freshwater tortoise species. You can learn a lot more about each of them by downloading the **full report here**.

1. Yangtze giant softshell turtle (*Rafetus swinhoei*)
2. Ploughshare tortoise (*Astrochelys yniphora*)
3. Yunnan box turtle (*Cuora yunnanensis*)
4. Northern river terrapin (*Batagur baska*)
5. Myanmar roofed turtle (*Batagur trivittata*)
6. Zhou's box turtle (*Cuora zhoui*)
7. McCord's box turtle (*Cuora mccordi*)
8. Geometric turtle (*Psammobates geometricus*)
9. Golden-headed box turtle (*Cuora aurocapitata*)
10. Dahl's toad-headed turtle (*Mesoclemmys dahli*)
11. Nubian flapshell turtle (*Cyclanorbis elegans*)
12. Three-striped box turtle (*Cuora trifasciata*)
13. Burmese star tortoise (*Geochelone platynota*)
14. Roti Island snake-headed turtle (*Chelodina mccordi*)
15. Southeast Asian narrow-headed softshell turtle (*Chitra chitra*)
16. Bellinger River snapping turtle (*Myuchelys georgesi*)
17. Vietnamese pond turtle (*Mauremys annamensis*)
18. Central American river turtle (*Dermatemys mawii*)
19. Madagascar big-headed turtle (*Erymnochelys madagascariensis*)
20. Southern river terrapin (*Batagur affinis*)
21. Red-crowned roof turtle (*Batagur kachuga*)
22. Sulawesi forest turtle (*Leucocephalon yuwonoi*)
23. Western swamp turtle (*Pseudemydura umbrina*)
24. Hodge's side-necked turtle (*Mesoclemmys hogei*)
25. Palawan forest turtle (*Siebenrockiella leytensis*)
26. Magdalena river turtle (*Podocnemis lewyana*)
27. Painted terrapin (*Batagur borneoensis*)

This story was originally published by ***The Revelator***. It is part of a series entitled "Extinction Countdown." It is reprinted here with permission from the author.

Restrictions Sought on Unsustainable Export of America's Imperiled Turtles

— More than 17 Million Turtles Exported from 2011 to 2016

Washington, DC— 27 March 2018—The Center for Biological Diversity today submitted extensive comments asking the U.S. Fish and Wildlife Service to seek increased restrictions on the unsustainable export and trade of 15 imperiled turtle species under the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).

Turtle traders exported more than 17 million freshwater turtles from the United States between 2011 and 2016. Most are used to supply food and medicinal markets in Asia, where turtle consumption rates have soared and native populations of turtles have already been decimated.

"The indiscriminate commercial capture and export of millions of our turtles to Asian markets is placing these important animals at serious risk," said Chris Nagano, senior scientist at the Center. "Alligator snappers and map turtles desperately need strict protections from international trade, so U.S. wildlife officials should seek global safeguards immediately."

The two alligator snapping turtle and 13 map turtle species are native to the southern, midwestern and northeastern United States and are severely imperiled by trapping and export. Overharvest has caused population declines in almost all the species.

In response to a 2012 petition from the Center, the two species of alligator snapping turtles and four species of map turtles are under consideration for protection under the Endangered Species Act in large part because of massive exploitation.

"The Trump administration should not stand back and watch as these animals are pushed toward extinction," said Nagano. "Our turtles are already suffering from habitat loss, water pollution and other threats. They just can't withstand commercial exploitation."

Alligator snapping turtles and map turtles are currently listed under CITES Appendix III, which requires certain permits or certificates for the international trade of listed species. The Center's proposal asks that the western alligator snapping turtle, Suwannee alligator snapping turtle and 13 species of map turtles be listed on CITES Appendix II, which would only allow international trade with a permit if it can be shown that the trade would not be detrimental to their survival. CITES-listed species are also subject to mandatory reporting requirements.

In separate comments, the Center also requested that the Fish and Wildlife Service seek increased protections for the polar bear, walrus, narwhal, hippopotamus and several species of sea horses and sea cucumbers.

The Service sought comments from the public on species that need additional protection under CITES. The agency may propose species for additional protections in preparation for the next CITES meeting of the parties in Sri Lanka in May 2019.

Background

The United States is a turtle biodiversity hotspot, home to more types of turtles than any other country in the world. As part of the Center's campaign to protect this rich natural heritage, the group petitioned states with unrestricted commercial turtle harvest to improve harvest regulations.

Many states, including Alabama, Florida and Georgia, responded by banning or regulating commercial harvest of freshwater turtles. More recently, Missouri banned commercial collection of wild freshwater turtles and Iowa adopted stricter regulations. In March, Texas proposed banning all commercial turtle harvest.

The Center has also petitioned to list several species of imperiled freshwater turtles under the Endangered Species Act. Mounting scientific evidence shows that amphibians and reptiles (together called "herpetofauna") are among the most imperiled species on Earth.

Ubiquitous toxins, global warming, nonnative predators, overcollection, habitat destruction and disease are key factors leading to demise of amphibians and reptiles in the United States and worldwide. ♧

— Center for Biological Diversity press release

Herpetology 2018 — Abstracts prepared by the staff of the Chicago Herpetological Society

Bog Turtle Hatching Success

R. T. Zappalorti et al. [2017, Chelonian Conservation and Biology 16(2):194-202] note that in most turtles nest-site selection affects the survival of females and their offspring. Although bog turtles (*Glyptemys muhlenbergii*) do not typically leave their wetlands for nesting, nest-site selection can impact hatching success and hatchling survival. Between 1974 and 2012, the authors monitored the fates of 258 bog turtle eggs incubated in the field and 91 eggs incubated in laboratory conditions from 11 different bogs, fens, or wetland complexes in New Jersey and Pennsylvania. Laboratory-incubated eggs exhibited the greatest hatching success (81%) but no significant difference in hatching success was found between nests protected with predator excluder cages (43%) and unprotected nests. However, significantly lower predation rates were found, suggesting that while lower predation rates were found in protected nests, other environmental factors persisted to reduce egg survival in the field. Natural hatching success was potentially reduced by poor weather conditions, which may have resulted in embryo development problems, dehydration, or embryos drowning in the egg. These results suggest that egg depredation, coupled with embryo development problems and infertility, are limiting factors to hatching success in the study populations. Using predator-excluder cages to protect bog turtle eggs in the field, or incubating eggs in the laboratory and releasing hatchlings at original nesting areas may be an effective conservation tool for recovering populations of this federally threatened species. ♧

Wild bog turtle, *Glyptemys muhlenbergii*. Photo by Gary Peeples, USFWS. Public domain.

Ringed Sawback Demographics

R. L. Jones [2017, Chelonian Conservation and Biology 16(2)215-228] notes that effective management of long-lived species required demographic and life history data that are best acquired from long-term studies. The ringed sawback (*Graptemys oculifera*), endemic to the Pearl River watershed of Mississippi and Louisiana, is a species of management concern at both the state and federal levels. Population sizes, trapping success, basking counts, sex ratios, survivorship, and growth of this species were investigated at 5 sites on the Pearl River in Mississippi over a 25-year period. Estimates of age at maturity were 4.5 years for males and 9.1 years for females. Mean annual survivorship for males, females and juveniles were 0.88, 0.93, and 0.69 respectively. Maximum logevity estimates were 48.8 years for males and 76.4 years for females. Average longevity estimates were 8.5 years for males and 13.9 years for females. The sex ratio of captured turtles was male-biased before 2000 but unbiased after 2000. Realized population growth estimates indicated that four populations were stable over the 25-year period and one population had declined. Population estimates and basking counts trended downward through time at most sites. Trapping success after 2000 for all sites combined declined by 77%, 45%, and 25% for juveniles, males, and females, respectively. Taken together, these data indicate that one population of *G. oculifera* has declined, three appear to be in the initial stages of decline, and one is relatively stable. Additional monitoring of these populations will be necessary to determine if these trends continue into the future. ♧

Juvenile ringed sawback, also called the ringed map turtle (*Graptemys oculifera*). Photo by Eekhoorntje. Public domain.

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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**

Bangladeshi Elongated Tortoises in Trouble | Habitat destruction, herbicides, and witch doctors are all taking their toll.

Almeria Spur-thighed Tortoise Populations Seem Stable | Biologists in Spain's Almeria province counted 25 tortoises in the latest survey.

April 10 Was Gopher Tortoise Day | Florida gopher tortoise "Grumpy Gertrude" tells all in this short piece from National Geographic.

Utah Politicians Determined to Build Highway Through Red Cliffs | Red Cliffs Desert Reserve was set aside as mitigation for urban sprawl on desert tortoise critical habitat in St. George, Utah, yet local politicians are determined to build a 4 lane highway right through the tortoise habitat!

New Alabama Musk Turtle | Turtle biodiversity in the southeast USA just increased!

"Royal Turtle" Nest Found in Cambodia | Recent find of a Batagur affinis nest containing 25 eggs marks the third nest found in Cambodia since 2016.

Mary River Turtle at High Risk | One of many media stories on Australia's imperiled "butt breathing, punk turtle".

Sea Turtles Use Their Flippers to Manipulate Food | Monterey Bay Aquarium study finds that like terrestrial species, sea turtles use their flippers to manipulate food items in their environment.

Local Magnetic Fields Are Predictors of Loggerhead Turtle Population Genetics | Loggerheads seek nesting beaches that have local magnetic fields similar to their natal beach, so populations from beaches with magnetic similarities tend to be genetically similar too.

The Tale of the Turtle and the Plastic Jellyfish | Sarah Nelms story for young people about the travails of a hawksbill who eats a plastic bag is now available for free download.

Video

- **Drones Used For Sea Turtle Monitoring**
- **Releasing Endangered Bell's Turtle Hatchlings**
- **Snapping Turtles Threatened By Harvesting**

New Publication

Archie Carr Center for Sea Turtle Research Newsletter

CTTC On Facebook | For breaking news updates, visit and "like" us on Facebook!

Gopher tortoise entering a burrow near Ft. Pierce, FL. Photo by Gary Foster. Public domain.

Request for Information and Photos for an Article about Max and Lillian Greene

Max and Lillian Greene raised a variety of tortoises at their home near Ojai, in Meiners Oaks, CA. They called their place "Turtletown," sometimes spelled "Turtle Town." Many of us CTTC members visited Turtletown and were treated to talks by Lillian and a tour of their collection. I am hoping that some members might have taken photographs while visiting Turtletown, and if so, would you be willing to share copies of them? Any photographs will receive full photo credit in the article.

I would also like to receive any recollections or anecdotes you might have of your visit for a future article in the *Gazette*.

The Greenes started their involvement with tortoises when Max retired. Lillian kept Turtletown going by herself after his death in 1993 until she died in 1999.

Please send your responses directly to Ralph Hoekstra via email at **rhoekstra@aol.com**

CTTC Foothill Chapter Event

June 22, 2018 at 7:00 PM: Annual Health Clinic and Silent Auction

Health clinic includes **de-worming** and **micro-chipping** for turtles and tortoises

- De-worming fee: 10^{00}
- Micro-chipping fee: 25^{00}

Free veterinarian check-ups provided by Dr. Fees.

Silent auction: come join the festivities with fellow Club members, friends and neighbors to continue our mission and support of our "shelled friends!" Silent auction donations come from restaurants, businesses, stores, gift cards, and include specially selected items.

Foothill Chapter Meeting Location: Los Angeles County Arboretum (Palm Room), 301 North Baldwin Ave., Arcadia, CA. 91007

Contact: Robin Robb, Foothill Chapter president (951) 359-3003; **sgrpilot@hotmail.com**

Missouri Bans Destructive Commercial Trapping of Wild Turtles

— Center for Biological Diversity press release

Jefferson City, Missouri—1 March 2018—In response to a petition filed by the Center for Biological Diversity (CBD) and Great Rivers Environmental Law Center, the Missouri Department of Conservation today banned commercial collection of the state's wild freshwater turtles — following a national trend of ending unsustainable turtle trapping.

"This ban saves thousands of turtles from trappers seeking to make a quick buck," said Collette Adkins, a biologist and senior attorney at the CBD. "That's a big victory for all of us who care about the health of the state's wildlife and waterways."

Prior to the amendment that went into effect today, holders of a commercial fishing permit could take unlimited numbers of common snappers, spiny softshells and smooth softshells from portions of the Missouri and Mississippi rivers with no closed season. According to the state conservation department, 1,100 river miles were open to commercial turtle collection. Thousands of Missouri's turtles were caught and sold over the past 10 years.

Scientists have repeatedly documented that freshwater turtles cannot sustain any significant level of wild collection without leading to population declines. For example, in a 2014 Missouri study researchers found that no commercial collection could be sustained for softshells, and common snappers could withstand only minimum rates of juvenile collection and no adult collection.

"Much gratitude to Missouri's Department of Conservation for preserving Missouri's wildlife for future generations," said Bruce Morrison, general counsel for Great Rivers Environmental Law Center. "It followed through with protecting these animals as a vital part of our state's ecosystems."

Close-up of the face of a common snapping turtle, *Chelydra serpentina*, one of the species native to Missouri that is now protected by a ban on commercial collection. Photo by the USFWS. Public domain.

Background

Millions of turtles classified as wild-caught are exported from the United States every year to supply food and medicinal markets in Asia, where native turtle populations have already been depleted by soaring consumption. Adult turtles are also taken from the wild to breed hatchlings for the international pet trade.

As part of a campaign to protect turtles in the United States, the CBD has been petitioning states that allow unrestricted commercial turtle collection to improve regulations. Of the states that share a border with Missouri, only Arkansas still allows unlimited commercial collection of turtles.

As a result of the Center's campaign, last fall Nevada created a statewide ban on commercial collection of all reptiles and New York halted all commercial terrapin turtle trapping. Before that, in March 2017, Iowa adopted new regulations setting closed seasons and possession limits for commercial turtle trappers. In 2012 Georgia approved state rules regulating the commercial collection of turtles, and Alabama completely banned commercial collection. And in 2009 Florida responded by banning almost all commercial collection of freshwater turtles from public and private waters. ♧

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

Common Hollyhock, *Alcea rosea*

Hollyhock blossoms with a visiting bee. Photo © 2006 by Stephen Czuratis. Source: Creative Commons; license: CC-BY-SA-2.5.

Hollyhock, a member of the Mallow family, the Malvaceae, is related to several plant species previously profiled in "Turtle's Garden" columns, including tropical hibiscus (*Hibiscus*), blue hibiscus (*Alyogyne*), Chinese lantern (*Abutilon*), apricot mallow (*Sphaeralcea*), and island mallow (*Malva*, formerly *Lavatera*).

Some 60 species comprise the genus *Alcea*, with all being native to Asia and Europe. Only one hollyhock species is a native of the Western Hemisphere; its common name is the streambank wild hollyhock, and it belongs to a different genus, *Iliamna*, with a species name *rivularis*.

This column will focus on the common hollyhock, *Alcea rosea*. Imported into Europe from China before or during the 15th century, the hollyhock subsequently became a fixture in cottage gardens in temperate regions worldwide.

An old-fashioned, venerable, ornamental species, *A. rosea* is a prolific flower producer with a distinctively informal aspect. Although the generic name of hollyhock is occasionally spelled "*Althea*," it is typically written as "*Alcea*."

Description

The commercial horticulture industry, through its extensive selection and propagation efforts, has produced an impressive array of hollyhock varieties. The oldest garden hollyhocks are very tall, single-flowering biennials or short-lived perennials. Today's gardener has access to a medley of hollyhock heights, flower colors, and flower forms.

Most hollyhocks have biennial life cycles. The term "biennial," by definition, is a plant growing vegetatively, i.e., produces its stems and leaves, during its first season of growth. During its second season, the biennial plant flowers, sets seed, and dies. Through selective breeding, horticulturists have developed a few hollyhock varieties with perennial life cycles, meaning that they live for three years or more.

Plant heights range from 2 to 9 feet (0.6 to 3 meters). Shorter varieties, in the 2- to 4-foot (0.6- to 1.2-meter) range, are excellent choices for container gardening, while the taller types are appropriate for general landscaping, and are especially well-suited for placement against walls and fences as a backdrop for planting beds. Vertical in its growth habit, the hollyhock reaches a maximum width of 3 feet (1 meter) in the taller varieties.

Hollyhock leaves are large, rounded, and rough-textured. Showy flowers that are 3 to 6 inches (8 to 15 centimeters) in diameter grow along the stem; colors range from pure white and pastels to bright red, purple, and maroon. Single, semi-double, and double flower forms are available.

A garden planting of hollyhocks. Photo © 2014 by Jolliro. Source: Creative Commons; license: CC-BY-SA-4.0.

Culture

A. rosea requires full sun in all but the hottest regions. Soil that is rich in amendments and has good drainage is important for optimum growth. Gardeners recommend deep, infrequent watering. Horticulturists recommend minimal

fertilizing twice per season in all but the most porous soils; hollyhocks in sandy soils require more frequent feeding.

The fungal disease known as rust plagues hollyhocks. Water early in the morning so the plants dry off before nightfall to help prevent the development of fungal diseases such as mildew and rust. Remove all diseased plant parts promptly, and dispose of infected material with the rubbish. ***Never*** put diseased material in the compost bin.

Planting hollyhocks from seeds in early spring is common, easy, and economical, and seedlings are another option. *A. rosea* will reseed freely, so selecting a planting site carefully is important. Hollyhocks grow best with about 2 feet (0.6 meter) of space between plants. To avoid over-crowding in small spaces, prune plants as soon as flowers fade before they set seed.

Less reliable than planting seeds, bareroot plantings of hollyhock roots can be a challenge. The advantage of this planting method is that bareroot hollyhocks are less likely than seedlings to develop rust disease.

Because of their large, nectar-filled flowers, hollyhocks attract a variety of wildlife to the garden, especially butterflies and hummingbirds.

Edible and Medicinal Uses

Bearing edible leaves and flowers, *A. rosea* also has medicinal properties. Flowers are typically eaten raw in salads, and leaves are eaten raw or cooked as greens.

Medicinally, hollyhock has anti-inflammatory healing properties, as well as various uses in home remedies, herbal infusions, and teas.

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Meetings and Programs

Click on your Chapter's website link for the latest program information. Programs may be scheduled after newsletter publication.

Cen-Val: 10 May; 14 June

Chino Valley: 18 May; 15 June

Foothill: 25 May; 22 June: Annual Health Clinic and Silent Auction

High Desert: 14 May; 11 June

Inland Empire: 4 May; 1 June

Kern County: 14 May; 11 June

Low Desert: 4 June

Orange County: 11 May; 8 June

Ridgecrest: 14 May; 11 June

Santa Barbara-Ventura: Contact the chapter for meeting details.

Santa Clarita: 19 May–Ed LaRue of Circle Mountain Biological Consultants on Desert Tortoises

TOOSLO (San Luis Obispo): 9 May; 13 June

TTCS (Long Beach): 18 May–Laura and Jay from Prehistoric Pets; 15 June–Plant Auction with Dr. Tom Greek

Valley: 18 May; 15 June

Executive Board: 14 July. Meetings take place at the Los Angeles County Arboretum, Arcadia, CA.

2018 CTTC Show Schedule

5 May: Turtle & Tortoise Care Society MiniShow at El Dorado Nature Center, 7550 E. Spring St., Long Beach, CA 90815; 10 AM–3 PM.

19 May: Valley Chapter Annual Show at Woodland Hills Christian Church, 5920 Shoup Ave., Woodland Hills, CA 91367; 11 AM–4 PM.

21 July: Inland Empire Annual Show at Redlands Senior Citizen Center, 111 W. Lugonia Ave., Redlands, CA; 10 AM–3 PM.

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Galápagos Islands Update

Galápagos: Pinzón Giant Tortoises Returning

7 April 2015 — Two years after conservationists successfully carried out an aerial rodenticide bait drop on the Galápagos Archipelago, the island is showing signs of recovery in the form of ten newly hatched Pinzón tortoises. These baby giant tortoises are the first known to have survived in the wild in over 150 years.

The recent finding is a hopeful step forward in the ongoing effort to help the critically endangered species that once teetered on the edge of extinction because of a rat infestation on the island.

Rat Eradication on Pinzón

Rodents are one of the most serious threats to the endemic species of the Galápagos Islands. Rats prey on the eggs and hatchlings of birds and reptiles, and threaten fauna and native flora.

Galápagos tortoise, *Chelonoidis nigra*. Photo © 2012 by Charlesjsharp. Source: Wikimedia Commons; license CC-BY-SA-3.0.

Over the past 40 years, small-scale control efforts targeted rodent populations in specific regions on the islands. In 2012, Bell Laboratories manufactured and donated pelleted bait for aerial baiting, designed to attract only rats. Bell's specialized island conservation rodenticide was designed to attract rats and to rid the island of these invaders, thus saving endangered species and helping to focus a global spotlight on threatened wildlife populations. This was the first step in a planned 20 to 25-year process designed to rid the Galápagos Islands of non-native rats and mice for good.

Called the largest rat eradication in South America, the project is supported by the Galápagos National Park, California-based Island Conservation, the Charles Darwin Foundation, Bell Laboratories, The Raptor Center of the University of Minnesota and private partners.

The Return of the Pinzón Tortoise

Rats have prevented Pinzón Giant Tortoises from successfully reproducing in the wild for nearly 150 years. In order to stave off extinction, conservationists intervened in the 1960s by collecting the few unhatched eggs that remained on the island. The eggs were incubated, hatched and raised until they reached a "rodent-proof" size. Once the tortoises reached an age that they could fend for themselves, conservationists released the young tortoises back on the Pinzón islands.

After decades of conservation efforts, the discovery of ten hatched tortoises in December brings a promise of a successful elimination effort of invasive rodents. In a post on the Galápagos Conservancy blog, James Gibbs, an environmental scientist at State University of New York, details an encounter with the tortoises on a recent trip to Pinzón.

In his account, Gibbs estimates roughly 500 saddleback tortoises are now living on the island, a tripling of the population from six decades ago. While his team only found ten hatchlings, Gibbs noted that the discovery might be just the tip of the iceberg of what is to come.

"This new bunch of "little guys" is one of the important results of the rat eradication campaign," notes Gibbs. "Tangible proof that with dedication, hard work, support, and heart, conservation efforts can effect positive change."

While Gibbs and others were primarily looking for tortoises, they also looked hard for signs of invasive species. "We looked very hard for signs of rodents," says Gibbs. "But we didn't find droppings or any other sign of rodent activity."

These results point to a common sentiment amongst conservationists. The growing tortoise population is showing an island in recovery, a reward and validation for the hard work of the Galápagos National Park Service and its collaborators - including Bell. ♾

— Bell Laboratories press release

Bell Laboratories, based in New Jersey, USA, is a leading manufacturer of rodent control products. Bell Laboratories has worked with conservation organizations worldwide to target and eradicate destructive, nonnative rodent populations that put indigenous wildlife at risk.

Upcoming CTTC newsletters will feature updates on the restoration of Floreana, the next Galápagos Island on which Galápagos National Park Directorate, Galápagos Conservancy, and Island Conservation are working to protect indigenous wildlife.

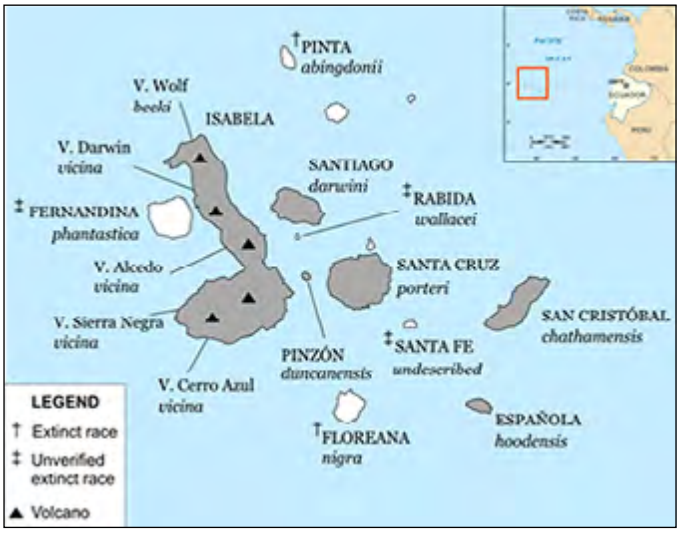
Continued recovery of Pinzón Island: The result of the eradication of black rats in 2012 — *Galápagos Conservancy press releases*

5 January 2018 — The restoration of Pinzón Island continues following the successful rat eradication campaign in December 2012, carried out by the Galápagos National Park Directorate (GNPD), in collaboration with Island Conservation and The Raptor Center. In addition to the exciting news of natural recruitment of juvenile tortoises into the population, a potentially new endemic snail species has recently been discovered.

During a tortoise monitoring trip in 2015, several hatchling tortoises were discovered, the first in well over 100 years. This was the first evidence of ecological recovery following the eradication.

More recently, Dr. Christine Parent of the University of Idaho and her technical team discovered a potentially new endemic species of land snail, which they are in the process of describing.

The various field teams from the GNPD and collaborating institutions have also documented increases in the populations of lava lizards, Galápagos snakes, landbirds such as the endemic Galápagos dove, and others.



Map of the larger islands in the Galápagos archipelago with details on the living, extinct, and unverified populations of Galápagos tortoise. Map © 2011 by Fallschirmjäger. Source: Wikimedia Commons; license: CC-BY-SA-4.0,3.0,2.5,2.0,1.0.

Before the eradication campaign, all eggs and/or hatchlings of the Pinzón tortoise, *Chelonoidis duncanensis*, were preyed on by black rats introduced to the island in the late 1800s. The result was no natural recruitment of juvenile tortoises into the population for more than 100 years. The status of the Pinzón tortoise population resulted in the start of the Santa Cruz Tortoise Center in 1965, when the first eggs of Pinzón tortoises were transported there to complete their incubation. They were then reared in captivity for later release on Pinzón once they reached a rat-proof size.

This program, initiated by the Charles Darwin Research Station and now run by the Galápagos National Park Directorate, has returned 1,007 young tortoises to the island — with many of them now of sufficient age to be reproducing adults.

"This is one of the most important efforts that has taken place in Galápagos. After decades of ,work, today we see the results. We have an island undergoing a rapid recovery process," stated Walter Bustos, director of the Galápagos National Park.

Galápagos Conservancy celebrates these results with the GNPD, GC's main collaborator in the Giant Tortoise Restoration Initiative. We continue to work with them to rebuild the Pinzón tortoise population, which includes continuing the captive rearing program to help increase the population more rapidly than will occur naturally. GC has also supported various aspects of the recovery and monitoring through short-term grants to both Island Conservation and The Raptor Center.

163 Tortoises Repatriated to Cinco Cerros, Isabela Island, Galápagos

26 January 2018 — Park rangers from the Galápagos National Park Directorate (GNPD) returned 163 tortoises of the species *Chelonoidis guntheri* to their home in Cinco Cerros, in the southwest portion of Isabela Island — about 30 miles from Puerto Villamil. On the beach at the site, each park ranger placed nine tortoises on his shoulders to start the 14-kilometer hike over lava fields, and then ascended through a forest of manzanillo, hawthorns, and cat's claw (a native plant), which separated them from the repatriation site more than 300 feet above sea level.

Prior to being repatriated, the tortoises were given health exams, had their shells marked with special ink, and were given a microchip with data recorded in the breeding program of the Arnaldo Tupiza Chamaidan Breeding Center on Isabela Island. The 163 tortoises are part of a population of 1,000 individuals reproduced at the Breeding Center to date, which are repatriated to their place of origin once they reach eight years of age as part of the Giant Tortoise Restoration Initiative (GTRI) — a long-term collaborative effort between the GNPD and Galápagos Conservancy.

The hard work of the rangers during the repatriation will contribute to the protection of this species, as tortoise hatchlings in this area are negatively impacted by introduced species.

"These activities always encourage our work and are the reason for every park ranger's effort to take care of this heritage. Each year, we return hundreds of tortoises of the different species that are bred in captivity to their natural home," said Walter Bustos, GNPD Director.

Shoring up Seemore the sea turtle's shell

— Engineering students develop 3D-printed exoshell to help injured sea turtle

27 February 2018 — In February 2011, Seemore the green sea turtle came to the SEA LIFE Minnesota Aquarium from a turtle hospital in Florida. A 2009 collision with a boat had damaged her shell and trapped air beneath it, giving her "bubble butt syndrome."

This condition forces Seemore to swim with her rear end sticking up and keeps her from diving normally. Her care team at SEA LIFE attaches weights to the shell to correct her buoyancy, but must continually replace them when she sheds scutes (plates on the shell).

Because replacing the weights causes Seemore stress, she needed a better method for readjusting her buoyancy. Since last summer, a team of mostly undergraduate University of Minnesota students has been designing one for her.

Printing a prosthesis

"The whole process has been really exciting," says design team lead Alex Barrette, a mechanical engineering student. "It's something a mechanical engineer doesn't typically see, and it's been challenging."

After a June 2017 CT scan at the U's Veterinary Hospital, the students, led by mechanical engineering graduate student Davis Fay, took the data and started designing a shell prosthesis — called an exoshell — for the 100-pound turtle. Using equipment from the U's Institute for Engineering in Medicine 3-D Printing Core, the team printed a 3-D prototype exoshell.

"I'd had some experience with 3D printing in high school and college," says team member Tom Skahen, an aerospace engineering major. "I could use the software, run the printers, and explore the options we could use. I was really self-driven."

In January 2018 Fay and Barrette performed a fitting of the prototype on Seemore at SEA LIFE. The team hopes to have a permanent exoshell this summer. Then Seemore will be able to swim and dive more normally, and, says Fay, "if she gets hung up, she'll be able to break it off." ♧

—University of Minnesota press release

One, remember to look up at the stars and not down at your feet. Two, never give up work. Work gives you meaning and purpose and life is empty without it. Three, if you are lucky enough to find love, remember it is there and don't throw it away.

—Stephen Hawking (1942-2018), British theoretical physicist

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