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California Turtle & Tortoise Club

the Tortuga Gazette

Volume 55, Number 5 • September/October 2019

Dermochelys coriacea, the leatherback sea turtle, photographed by Claudia Lombard, USFWS, at the Sandy Point National Wildlife Refuge in the U.S. Virgin Islands. Public domain.

featured species

Leatherback Sea Turtle, *Dermochelys coriacea*

A Remarkable Ancient Mariner

by M. A. Cohen

The leatherback sea turtle, *Dermochelys coriacea*, is, by any measure, an extraordinary chelonian. Surpassed by only three saltwater crocodile species in size, the leatherback is the fourth largest reptile and the largest living turtle species in the world.

Some other amazing facts about the leatherback: the species "lays the largest eggs of all the turtles, produces the heaviest clutches of eggs, produces the largest hatchlings, migrates the greatest distances, grows faster than any other reptile, and is among the widest ranging vertebrates on the planet" (Spotila, 2004).

The only living member of the chelonian family Dermochelyidae, the leatherback has existed virtually unchanged since the Mesozoic Era, the "age of the dinosaurs." The Mesozoic era is divided into three periods: "the Triassic period (245–208 million years ago), the Jurassic period (208–145 million years ago), and the Cretaceous period (145–66 million years ago)" (dinodatabase.com, 2005).

The leatherback is the fastest marine turtle, swimming in the open ocean at a maximum speed of 21.92 miles per hour (35.28 kilometers per hour) with an average swimming speed of 1.1–6.3 miles per hour (0.5–2.8 meters per second), (Animals Time, n.d.).

D. coriacea can tolerate ocean temperatures that are much lower than other sea turtles can endure. Its front flippers are uniquely well-endowed with blood vessels, and this, coupled with insulating layers of fats and oils embedded in the thick, leathery skin (1.5 inches | 3.8 centimeters) on its carapace contribute to this low-temperature tolerance (Spotila, 2004).

The leatherback is the only reptile that ventures into frigid sub-Arctic waters of the North Atlantic during its annual migration to its foraging grounds. During these

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journeys, the leatherback maintains a comparatively warm body temperature as described in the previous paragraph.

Migrating from its nesting grounds on tropical and subtropical beaches to its favored foraging grounds in sub-Arctic seas, the leatherback may navigate as many as 10,000 miles (16,093 kilometers) of open ocean.

The deepest documented dive of *D. coriacea* is some 4,000 feet (1,219 meters), deeper than any other marine turtle and most marine mammals. The species is capable of remaining submerged for as long as 85 minutes before it must surface for air (NOAA Fisheries, n.d.).

Description

Unlike other marine turtles that have carapaces with keratinized scutes, a thickened "leathery" or "rubbery" skin covers the leatherback's carapace. The genus name *Dermochelys* comprises two Greek root words, *dermo-*, meaning skin, and *-chelys*, meaning turtle. Making reference to the hide on its carapace, the species name *coriacea* derives from a Latin root word *coria-*, meaning leather.

Weighing from 550 to 2,000 pounds (250 to 900 kilograms) and reaching a length of up to 8 feet (2.3 meters), the dappled, black carapace of the leatherback is teardrop-shaped and terminates in a blunt point. It features seven prominent, lengthwise ridges that enable the leatherback to aerodynamically navigate the vast expanses of the open ocean during its migrations. Colored white, cream or pale pink, the plastron of the species has five lengthwise ridges.

Underneath its leathery skin, the leatherback's carapace comprises many small, interlocking "dermal bones" positioned above the ribs and just beneath the skin. Another unique characteristic of the species' skeletal structure is that the ends of its bones feature thick cartilage with an abundance of blood vessels (Spotila, 2004).

While its rear flippers are paddle-shaped, the leatherback's front-flipper "wingspan", the distance from one tip to the other, can approach nine feet (2.7 meters). Proportionately larger than those of other marine turtles, its front flippers have an extraordinary arrangement of veins and arteries. These blood vessels are situated side-by-side, resulting in a "counter-current blood-flow heat exchanger" system that enables the leatherback to withstand frigid sub-Arctic water temperatures (Spotila, 2004).

Range and Habitat

Distributed throughout the globe in tropical, temperate, and the margins of sub-Arctic waters, *D. coriacea* has the widest range of any marine turtles.

Leatherback turtles are found in the North Atlantic waters as far north as Newfoundland, Nova Scotia, and Labrador, and in South Atlantic waters as far south as Argentina and South Africa.

Populations of leatherbacks, while smaller than the Atlantic population, also range throughout North and South Pacific waters as well as in the Indian Ocean.

The term "pelagic" describes animals that inhabit the open seas. *D. coriacea* is primarily pelagic throughout its life following

A necropsy photo of the interior of a leatherback's esophagus. The keratinized spines lining the esophagus face backwards and help the turtle retain the gelatinous foods it favors. Public domain.

hatching, and only female leatherbacks return to land to nest.

Foods and Feeding

The leatherback's migration from its nesting grounds to its feeding grounds is the stuff of legend, hence its reputation as an ancient mariner. This migratory journey takes *D. coriacea* from its tropical nesting beaches to the glacial waters of the sub-Arctic North Atlantic and North Pacific Oceans.

Leatherback hatchlings emerge from their nest and head for the sea. Photo by USFWS Southeast Region. Public domain.

The annual migration of the leatherback turtle is a quest for its favorite foods, jellyfish and salps, a journey that may encompass 10,000 miles.

Jellyfish are planktonic, gelatinous marine invertebrates (animals lacking a backbone) with some 200 identified species. Like jellyfish, salps are gelatinous invertebrates composed of numerous individual organisms linked as a chain when mature.

The carnivorous leatherback also consumes cephalopods (cuttlefish, octopus, and squid), crustaceans, fish, sea urchins, snails, starfish, marine worms, and zooplankton, among other prey (Farmer, et al., 2007).

Lacking the hard, crushing jaws characteristic of other marine turtles, the leatherback has sharp-edged jaws that are ideal for biting soft-bodied prey. Lining its mouth, throat and esophagus are backward-facing spines that assist with the consumption of gelatinous prey, so the leatherback is well-suited to digest its prey. These keratinized, spiked linings in its digestive system equip the species to hold and direct its gelatinous prey into its lower digestive tract (Farmer, et al., 2007).

Reproduction

Mating in the water adjacent to nesting beaches in tropical and temperate regions, the female leatherback swims ashore at night when she is ready to dig a nest and lay her eggs. Estimates vary from 8 to 12 days as to the interval between nesting events during the nesting season.

When nesting each season, female leatherbacks produce one to ten clutches of 50 to 100 eggs per clutch. These eggs are the largest of any marine turtle eggs, weighing 2.7 ounces (77 grams) each (Spotila, 2004).

Like many other chelonian species, leatherback turtles are subject to temperature-dependent sex determination, with a ratio of 50–50 males to females produced at 85°F (29.5°C). Hatchlings tend to emerge from their nests at night which increases their chances of eluding the many predators that lurk on the beach awaiting their arrival (Spotila, 2004).

D. coriacea, being the fastest growing reptile, reaches reproductive maturity in 7 to 13 years (Spotila, 2004), although estimates of the age of maturity range from 6 to 29 years (NOAA, n.d.).

Threats and Conservation

With many serious threats challenging the survival of the leatherback, it is no wonder that their populations worldwide are diminishing dramatically. The greatest threat to the leatherback's survival is being trapped as bycatch in fishing gear such as gillnets, longlines, and trawls. Other threats include harvesting of their eggs, hunting by humans for their meat and their skin, strikes from the propellers and hulls of vessels, alteration and destruction of nesting beaches, ocean pollution, and plastic marine debris that may be mistaken for food (NOAA Fisheries, n.d.).

In 2012, the state of California designated the Pacific leatherback sea turtle as the official state marine reptile. as well as declaring the 13th of October Pacific Leatherback Sea Turtle Conservation Day.

Conservation measures enacted nationally and internationally to protect the declining populations of *D. coriacea* include listing on Convention on International Trade in Endangered Species as Appendix 1, the International Union for the Conservation of Nature's Red List designation of Critically Endangered, and the U.S. Endangered Species Act listing of Endangered.

☯

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Care Society's 2019 Annual Luau and Potluck

Photography by Anita De Leon and text by John Wong

▲ Helen Cain and Rusty Rustwen

Care Society's Annual Luau was held on July 19th 2019. The luau featured Hawaiian food and food brought in by club members. The entertainment was performed by Tausala Polynesia. It was, as in past years, a night to remember.

Aloha!

▲ Anita De Leon (center) with the Tausala Polynesia Dancers

▲ Marcie Thompson

▲ Robbie Rustwen and Greg Curtis

▲ James Hong

▲ Charlie and Debbie Fagan

▲Left to right: Helen Cain, Paul and Marci Thompson, Naomi Higuchi, Tammy Wayne and Jeanne Klauk

▲John Kim and Kurt Kraton

▲Ralph Hoekstra

▲Hula Time!

▲Becky Rustwen

▲Gerald and Lucy Roach

▲Virginia and Mike Scully

◀ Left to right: Marci, Gerald, Alex Guerrero, Catie Chumley and Helen Cain

▲Left to right: a guest, Jerry Weir, Yolanda Keh, John and Joanie Wong, Marlene and Stan Landis

▲ Becky, Rusty and Robbie Rustwen

▲Left to right: Michelle and John Kim, Mr. Gregory, Nicole Perlman, George Alcatraz, Kim Ayres, Ginny Doepping

▲ Richard Roosman, Angela and Kurt Kraton

▶Having a great time at the luau!

▲ Goodies!

▲ Luau time!

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Some turtle embryos can influence their own sex, study finds

by Shreya Dasgupta; posted on **Mongabay.com** on 2 August 2019

☉ The sex of some turtle species is influenced not by genes but by the temperatures they experience in the nests. Embryos of the Chinese pond turtle, however, can move inside the eggs toward cooler or hotter spots and influence their own sex, at least to some extent, a new study has found.

☉ This is good news because it means that, at least in theory, the turtles might be able to buffer some of the predicted shifts in the sex ratio because of climate change.

☉ But while the embryos seem to be influencing their sex under ideal conditions, researchers say that it may not be enough to counter the rapidly changing climate brought about by human activities.

Chinese pond turtle, *Mauremys reevesii*. Image by 64. Source: Wikimedia Commons; license CC-BY-3.0.

The sex of some turtle species is influenced not by genes but by the temperatures they experience in the nest. Eggs incubated at cooler temperatures develop into males, while those that face warmer temperatures turn out to be females. When temperatures fluctuate between cool and warm, the eggs produce a mix of male and female babies.

The Chinese three-keeled pond turtle (also called the Chinese pond turtle) is one such species. But its embryos seem to have some control over their own sexual fate, according to a new study.

The embryos can move inside the eggs toward cooler or hotter spots, researchers have found, influencing their own sex to some extent. This is good news because it means that, at least in theory, the turtles might be able to buffer some of the predicted shifts in sex ratio because of climate change. Since hotter temperatures produce only female babies, rising temperatures due to climate change could end up creating populations of mostly female turtles, scientists say, leading to population declines.

"Our research shows that a reptile embryo is not just a passive victim of global warming, but may control their own sex fate to some degree," Du Wei-Guo, a professor at the Chinese Academy of Sciences and corresponding author of the study, told Mongabay.

In previous research, Du and his colleagues had shown that embryos of the freshwater Chinese pond turtle (*Mauremys reevesii*), an endangered species, move inside eggs in response to temperatures. The significance of this behavior, though, remained unclear.

To find out more, the researchers conducted experiments on Chinese pond turtle eggs both in the laboratory — using eggs collected from a private commercial turtle farm in China's Zhejiang province — and in an outdoor pond where farm turtles had laid some eggs.

When incubation temperatures are cooler than 26 degrees Celsius (79 degrees Fahrenheit), the turtle's eggs all hatch male babies. When the temperature rises above 30 degrees Celsius (86 degrees Fahrenheit), every embryo is a female. At 29 degrees Celsius (84 degrees Fahrenheit), or the pivotal temperature, the eggs are known to produce a 50:50 sex ratio.

The researchers used capsazepine, a chemical that blocks the eggs from sensing temperature, on half of both the laboratory and outdoor eggs, and monitored the embryos throughout their development. When the eggs hatched, the team found that the embryos inside the eggs treated with capsazepine did not move as much compared to those in eggs that hadn't been treated. The treated eggs also produced all male babies when the incubation temperature was low, and all females when the temperature was high. Embryos in the untreated eggs, meanwhile, had moved around inside the eggs and hatched into a 50:50 mix of male and female turtles.

"Until a few years ago, we thought that even given the choice, turtles would not be able to choose among temperatures in the egg," Rory Telemeco, an assistant professor at California State University, Fresno, who was not involved in the study, told Mongabay in an email. "Then, thanks to earlier work by this laboratory, as well as myself and other colleagues, we thought that [embryos] could choose among temperatures, but may never be given the opportunity in nature. This study confirms

that, at least in this species of turtle, both the choice of thermal environment and ability to choose among them can be available for embryos. Moreover, when available, embryos appear able to make the 'good' choice and choose the environment that will result in a more 50:50 sex ratio."

But a turtle embryo likely has very limited control over its own sex in the wild, researchers say. "The sexes of the baby turtles are most sensitive to conditions available in the environment and the mother's nesting choices," Telemeco said.

The extent to which the embryos can counteract the effects of climate change also remains unclear.

Telemeco said that while the embryos seem to be influencing their sex under ideal conditions, those conditions "might not be available much of the time, especially given climate change predictions." "For embryos to meaningfully alter their temperatures within the egg, eggs must be large, near the surface, and average temperature during a 1–month window must be very close to the pivotal temperature for sex determination," Telemeco said. "This study confirmed that this behavior only works under those conditions.

"Most reptiles produce eggs that are too small, or buried too deep, or exposed to too extreme of average conditions for this behavioral response to have any effect. Therefore, we cannot consider embryo behavioral thermoregulation to be a panacea allowing this species or others to respond to climate change," he added.

Ideal conditions aside, Du agreed that the embryos' power over their own sex may not be enough to counter the rapidly changing climate brought about by human activities.

"However, the discovery of this surprising level of control in such a tiny organism suggests that in at least some cases, evolution has conferred an ability to deal with such challenges," Du said. ☯

Citation:
Ye, Y., Ma, L., Sun, B., Li, T., Wang, Y., Shine, R., and Du, W. (2019) The embryos of turtles can influence their own sexual destinies. Current Biology. doi:10.1016/j.cub.2019.06.038

Trump Finalizes Disastrous Weakening of Endangered Species Act

Rollback Threatens Wildlife Across Country, Will Face Legal Challenge—Center for Biological Diversity press release

Washington DC—12 August 2019—In a massive attack on imperiled wildlife, the Trump administration today finalized rollbacks to regulations implementing key provisions of the Endangered Species Act. The changes, which could lead to extinction for hundreds of animals and plants, are illegal and will be challenged in court.

The three rules finalized today were developed under the supervision of David Bernhardt, the secretary of the U.S. Department of the Interior and a former fossil fuel industry lobbyist. They severely weaken protections for threatened and endangered species across the country.

"These changes crash a bulldozer through the Endangered Species Act's lifesaving protections for America's most vulnerable wildlife," said Noah Greenwald, the Center for Biological Diversity's endangered species director. "For animals like wolverines and monarch butterflies, this could be the beginning of the end. We'll fight the Trump administration in court to block this rewrite, which only serves the oil industry and other polluters who see endangered species as pesky inconveniences."

One set of regulatory changes weaken the consultation process designed to prevent harm to endangered animals and their habitats from federal agency activities. A second set curtails the designation of critical habitat and weakens the listing process for imperiled species. A third regulation would eliminate all protections for wildlife newly designated as "threatened" under the Act.

The changes are part of a broader effort by the Trump administration to undercut protections for the nation's air, land, wildlife and water.

"These regulations are totally out of touch with the American public, which broadly supports endangered species protections," Greenwald said. "We'll do everything in our power to get these dangerous regulations rescinded, including going to court."

Under a change relating to federal consultations, impacts to critical habitat will be ignored unless they impact the entirety of an animal's habitat. This disregards the cumulative "death-by-a-thousand-cuts" process that is the most common way wildlife declines toward extinction.

The new rules will also prohibit designation of critical habitat for species threatened by climate change, even though, in many cases, these species are also threatened by habitat destruction and other factors. The rollbacks will also preclude designation of critical habitat for areas where species need to move to avoid climate impacts.

The new rules will sharply limit wildlife agencies' ability to designate critical habitat in unoccupied areas needed for recovery. That ignores the fact that many threatened and endangered species have lost substantial range and need their historic habitats preserved to provide living space for recovering populations. ☯

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**

How Turtles Got Their Shells
Brief overview of what we know about turtle shell evolution from the Smithsonian.

How Sea Turtles Find Their Way Home
Scientific review of natal homing by magnetic navigation in sea turtles (and salmon).

Home's Hinge-back Tortoises
The National Zoo is now home to 3 young Home's hinge-backs, *Kinixys homeana*.

Pancake Tortoise Hatchling
Who needs cat videos when you can watch a hatchling pancake tortoise playing with a pencil?

Impacts of Feral Sliders on Western Pond Turtles
New study finds introduced red-eared sliders compete for food with western pond turtles but the negative impacts on basking in natural contexts are more limited.

Bighead Turtle Behavior
Study of a captive population finds evidence of multiple paternity and male hierarchy in Chinese bighead turtles, *Platysternon megacephalum*.

Perth Zoo Releases 73 Western Swamp Tortoises
Seventy three western swamp tortoises hatched at Perth Zoo were released to the wild in the single biggest wild release of this very rare Australian turtle.

Keeping Turtle Nesting Beaches Clean
Sarasota, Florida teenager invents 'Turtle Safe Toy Box' to save turtle hatchlings by reducing plastic waste.

Loggerhead Sea Turtle Nests Up
In 2019, North Carolina has seen the largest number of sea turtle nests ever recorded for the state.

Feds Sued to Protect Green Sea Turtle Habitat
Conservationists are suing the federal government for failing to designate critical habitat for the 11 listed populations of threatened green sea turtles.

Turtle Embryos May Be Able to Influence Their Sex by Moving Around Inside the Egg
Incubation temperature can determine sex in many species of turtle. A controversial new study suggests that the temperature gradient across a turtle egg may be large enough such that an embryo can move within it and thus influence its own sex!

Dog Days of Summer
Injured turtles are being helped with old-fashioned "bra hooks" that are being reused to anchor shell fragments as they knit back together.

African Sea Turtle Newsletter
Latest issue now available.

Marine Turtle Newsletter
Latest issue now available..

Indian Ocean Turtle Newsletter
Latest issue now available

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Lawsuit Launched to Protect Green Sea Turtle Habitat Threatened by Sea-level Rise, Plastic Pollution, Warming — Turtle Island Restoration Network press release

St. Petersburg, Florida—13 August 2019—The Center for Biological Diversity, Sea Turtle Oversight Protection and Turtle Island Restoration Network today filed a notice of intent to sue the federal government for failing to protect green sea turtle habitat, which faces threats from sea-level rise, plastic pollution and warming.

In response to green sea turtle population recovery, the National Marine Fisheries Service and Fish and Wildlife Service in 2016 found that growing climate change and sea-level-rise threats mean the turtles remain threatened and still need Endangered Species Act protections. Despite those threats — particularly to low-lying nesting beaches — the agencies failed to protect the turtle's critical habitat under the Act.

"The recovery of most green sea turtle populations is a beacon of hope in our changing oceans, but we've got to protect the places they live," said Jaclyn Lopez, Florida director at the Center for Biological Diversity. "Protecting sea turtle habitat will keep them crossing oceans and loyally coming ashore to dig nests on our beaches."

Green turtle, *Chelonia mydas*, photographed at John Pennekamp Coral Reef State Park, Key Largo, Florida. Photo © 2008 by Daniel Schwen; source: Wikimedia Commons; license: CC-BY-SA-4.0.

"The Trump administration's moral and legal attacks on our country's greatest achievements extend all

the way to the gentle and defenseless sea turtles that are guaranteed protection under the Endangered Species Act," said Todd Steiner, biologist and executive director of Turtle Island Restoration Network. "It is unconscionable."

A 2019 peer-reviewed study by Center scientists found most marine species listed under the Endangered Species Act are recovering. Listed species with critical habitat protections and those listed for more than 20 years are most likely to be rebounding.

"Coastal nesting beaches are losing suitable nesting habitat due to sea level rise, as well as increased temperatures, which further jeopardizes the survival of green sea turtle," said Richard Whitecloud, founding director of STOP. "It is the government's responsibility to protect this essential habitat to ensure these marine turtles survive."

Federal experts have found that green sea turtles should be considered 11 distinct populations, or "distinct population segments." Although some sea turtle populations are improving significantly due to the protections of the Endangered Species Act, like those in Florida, several populations continue to struggle. The Mediterranean, Central South Pacific and Central West Pacific populations remain in danger of extinction and remain listed as "endangered."

The Endangered Species Act prohibits federal agencies from authorizing activities that will destroy or harm a listed species' critical habitat. Animals with federally protected critical habitat are more than twice as likely to be recovering as species without it. ☯

Erratum: an inadvertent conversion error occurred on page 5 of the July/August 2019 *Tortuga Gazette*. The photo caption should read as follows: "The desert tortoise can live where ground temperatures may top 140 degrees F [**60** degrees C] because it digs burrows to escape the heat."

Meetings and Programs

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

Chino Valley: 20 September; 18 October

Foothill: 27 September– Dr. Marlene Anschultz on Tortoise Brumation; 25 October–Dr. Michael Tuma on Pancake Tortoises

High Desert: 9 September; 14 October

Inland Empire: 6 September; 4 October

Kern County: 9 September; 14 October

Low Desert: 7 October

Orange County: 13 September; 11 October

Ridgecrest: 9 September; 14 October

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

Santa Clarita: 21 September

TOOSLO (San Luis Obispo): 17 September; 15 October

TTCS (Long Beach): 20 September; 18 October

Valley: 20 September; 18 October

Executive Board: 12 October. Meetings take place at the Los Angeles County Arboretum in Arcadia, CA.

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

Grapevines: *Vitis* species

Ripe clusters of *Vitis californica*, the California wild grape. Photo by Dr. G. Dallas and Margaret Hanna © California Academy of Sciences. Reprinted with permission.

A member of the Vitaceae family of vining plants, the grapevine genus *Vitis* includes some 60 different species worldwide. The grapevine is an excellent choice for edible landscaping, providing wholesome, natural food, dramatic seasonal color changes, and versatility in the garden.

While many areas worldwide have native grape species, according to Rutuja Jathar, the "motherlands of grapes" are Western Asia and Central Europe. The grape is likely the oldest domesticated fruit. It was cultivated by European residents beginning 6,000 to 8,000 years ago during the Neolithic Era.

Grapevines made their way to Greece from Asia with Phoenician traders around 1000 BCE [ed. note: Before Common/Current Era], and from Greece grapes spread to Spain and Portugal. The Mediterranean region proved to be a favorable climate for the cultivation of grapes.

Spanish and Portuguese settlers introduced European wine grapes, *V. vinifera*, to America. Many parts of America have harsh winters that kill off grapevines, but California and a few other temperate areas proved beneficial for viticulture, the specialized term for grape cultivation. Today 90% of grapes produced in America are grown in California.

Nutritionally speaking, grapes provide carbohydrates, protein, natural sugar, dietary fiber, antioxidants, minerals including calcium, phosphorus, magnesium, copper, and iron, and vitamins including vitamin A, vitamin C, and vitamin K.

This column will profile two *Vitis* species, the California wild grape and the wine grape.

California Wild Grape, *Vitis californica*

A California native plant that is also endemic to southwestern Oregon, the California wild grape is also known as the Northern California grape and the Pacific grape.

While in nature the species often grows in riparian habitats (those adjacent to streams or rivers), being a California native plant, it is also capable of withstanding periods of drought. *V. californica* prefers moderate garden watering in the landscape, but is drought-tolerant once it is established.

A winter-deciduous climbing vine, *V. californica* climbs by way of tendrils[1] that wrap around nearly any available support.

Vines produce comparatively large, somewhat round leaves, 2 to 4 inches (5 to 10 centimeters) in size at maturity. Gray-green when they appear in spring, the leaves turn medium green as they mature. Following the season of growth and fruit production, a spectacular autumn display of red, orange, and yellow occurs prior to the shedding of the leaves.

California wild grape will grow in full sun as well as partial shade. Fast-growing and easy to raise, this rambunctious vine can grow 10 to 40 feet (3 to 12 meters). It is important to give this species ample room to grow and a strong support system on which to climb.

An adaptable species, *V. californica* will thrive in soil types ranging from clay to sandy loam providing the soil has good drainage.

In botanical terminology, the grape is a berry, a fleshy fruit that contains one or more seeds but no stone. The grape berry is produced by a single flower with one ovary. Other common berries include currants, bananas, and tomatoes. Curiously, the fruits commonly called strawberries and raspberries are *not* berries in the botanical sense.

Given its tendency to overtake an area, *V. californica* typically requires pruning to manage its size in the garden. During winter dormancy, prune grapevines to control their unruly tendencies. Prune as needed any time of year if the tendrils attempt to wrap

[1] **tendril:** a threadlike structure that is a specialized leaf, petiole or stem which twines around any suitable support. A **petiole** is a stalk that attaches a leaf blade to the stem of the plant.

around neighboring shrubs or trees or any other unsuitable object.

In the wild, many species of wildlife utilize *V. californica* for food as well as for shelter, and bees are attracted to its flowers.

Here are a couple of tips to keep in mind when considering placement of a grapevine. California wild grape loses its leaves in late fall, so nearby planting beds will require somewhat tedious leaf clean-up.

Grape clusters will eventually dry and drop off the vines. The result is many "volunteer" seedlings as the grape seeds in the fruit germinate. Remove grape clusters before they dry out and begin to drop to avoid a deluge of grape seedlings.

Because it is extremely disease resistant, the California wild grape is often used as the rootstock onto which more disease-prone European varieties are grafted.

European or Wine Grape, *Vitis vinifera*

Native to Central Europe, the Mediterranean region, and southwestern Asia, *V. vinifera* is not only the source of wine but also table grapes. Worldwide there are thousands of varieties of *V. vinifera,* but only about 50 of these are commercially important for the production of wine, table grapes, fruit juice, and raisins (dried grapes).

Prior to cultivation, foragers and farmers harvested wild grapes. Domestication of the grape by people began thousands of years ago. The earliest records of the fermentation of grape juice for wine making are from Egypt. Wine played a part in the ceremonial life of the ancient Egyptians but was not imbibed socially.

Introduced into North America in the 17th century, the wine grape was brought to the area now known as California in the 18th century by the Spanish. Other major areas in which wine grapes are cultivated include parts of Arizona, parts of Oregon, and parts of Washington state. To some extent, grapes are grown in all 50 states in the United States in areas that offer microclimates conducive to grape cultivation.

Either by horticulturists or by chance, European grapes hybridized with native American grapes, and today these are known as 'American hybrids.' These hybrid varieties are generally disease-resistant, a highly desirable quality. Each variety of *V. vinifera* has its own growth requirements. Some need more or less heat and more or less humidity, and some have more cold tolerance or disease resistance than others. Consult knowledgeable resources to learn about the requirements of the grape varieties you are thinking about growing. Contact your local Cooperative Extension Office for information on the best grape varieties for your particular area.

A cluster of California wine grapes in the process of **veraison**, the onset of ripening when grapes grow in size, change color, and develop sweetness. Red grapes change from green to red; "white" grapes change from opaque to translucent. Photo © 2006 by Thomas Oldcastle. Source: Creative Commons; license CC-BY-SA-2.5.

Regardless of the variety, all grapes need full sun on their leaves in order to thrive and produce an abundance of fruit. If necessary, plant the grape's roots in shade as long as the leaves are in sun. Viticulturists recommend moderate watering and regular pruning of either the spurs or the canes, depending on variety. It is beyond the scope of this article to discuss these specialized pruning techniques.

Training the vines on a sturdy trellis, arbor, fence, or the like is important, because the grapevines grow rampantly as they mature. Such training and support promotes good fruit production.

To reduce the possibility of fungal diseases such as powdery mildew, place your grapevine in an area with plenty of sunshine, plenty of room to grow, and abundant air circulation. Stagnant air increases the chance of disease development.

Before grapes are fully ripe, they taste sour because of their malic acid content. As they ripen, the malic acid content of the grapes decreases and the natural sugar content increases. Grapes should be harvested when they are fully ripened in late summer or early autumn. Timing is critical, as ripening stops at the time of harvest. ☯

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Herpetology 2019 — Abstracts prepared by the Chicago Herpetological Society staff

Rainfall and Predation of Terrapin Nests

R. A Czaja et al. [2018, Journal of Herpetology 52(4):402–405] note that many turtle species, including diamond-backed terrapins (*Malaclemys terrapin*), often nest shortly before and during rainstorms. The authors test the hypothesis that rain can decrease the likelihood that nests will be depredated, presumably by reducing the chemical, tactile, or visual clues that predators use to locate turtle nests. They analyzed the impact of rainfall on predation rates of diamond-backed terrapin nests in Jamaica Bay Wildlife Refuge, New York, June-July 2016. Natural and artificial nests built on days with no rain or varying amounts of rain were monitored for 5 days after oviposition/construction. Predation rates were similar for both artificial and natural nests and decreased when nests were laid on rainy days. For artificial nests that decrease was significant, and for natural nests the decrease was nearly significant. Predation rates on natural and artificial nests were inversely correlated with the amount of rain on the day the nests were laid or constructed. These results indicate that selection may favor turtles that nest soon before or during rainfall.

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Detecting Alligator Snapping Turtles

S. M. Feist et al. [2018, Chelonian Conservation and Biology 17(2)271–279] note that the alligator snapping turtle (*Macrochelys temminckii*) is under consideration for listing as a federally endangered species. Distributional data and estimates of population sizes are needed to make a sound decision regarding listing, but this information is largely unavailable due to the immense effort required for *M. temminckii* trapping surveys. To alleviate difficulty in detection and to help inform the subsequent field-intensive survey efforts, the authors developed an environmental DNA (eDNA) method capable of providing presence data even in systems with high turbidity and suspended organic material. The assay utilizes probe-based quantitative polymerase chain reaction and reliably amplifies *M. temmickii* eDNA in both lentic [slow-moving freshwater] and lotic [rapidly-moving freshwater] systems, with no amplification observed in other nontarget, sympatric turtle species. The novel eDNA method developed, optimized, and field-tested in this study provides a promising tool for detection of alligator snapping turtles, with resultant presence data likely to provide beneficial for the management and conservation of this species.

Originally published in the Bulletin of the Chicago Herpetological Society, 54(4): 98–99, 2019. Reprinted with permission.

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