# Contents

# 1 Crocodylia

## 1.1 Crocodylidae — Crocodiles

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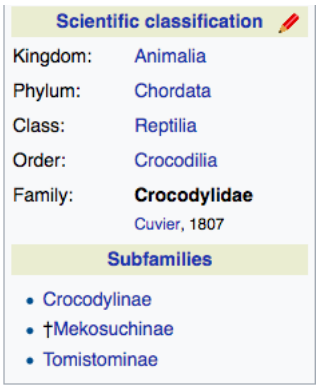
| Taxonomy/Ancestry | • subfamilies – crocodylinae, mekosuchinae (ex.), tomistominae<br>• **tomistominae** – false gharial; genetic evidence suggests they are closer to the gharials so they may be reclassified into the Gavialidae family<br>• 3 extant genera; 16-17 species<br>• Ancient Greek = "lizard of the Nile"<br>• separated from other crocodilians during Eocene epoch 55 million years ago<br>• closest living relatives are birds<br>  |
| Size | 5-20 ft (1.5-6.1 m)<br>weigh up to 2000 lb (900 kg)<br>juveniles 20 cm (7.9 in) |
| Color | |
| Anatomy | • diapsid skull<br>• dorsal scales backed by osteoderms from heavy armor plating on neck and back<br>• tail strongly muscled and flattened for swimming<br>• aquatic adaptations<br>– nostril/ear valves<br>– nictitating membrane to cover eye<br>– glottal valve in throat<br>– able to concentrate and excrete salt; salt glands on tongue filter salt to allow for survival in saltwater environments<br>• webbing on toes of the hind feet speeds swimming + gives advantage on dry land<br>• cerebral cortex w/ 4-chambered heart<br>• slit pupils w/ tapetum lucidum<br>• teeth are replaced throughout lifespan<br>• poikilothermic + ectothermic<br>• live 70-80 yrs<br>• distinguishing from alligators<br>– narrower + longer heads<br>– v-shaped snouts<br>– lower teeth protrude when mouth closed<br>– large 4th tooth visible<br>– salt glands = saltwater habitat<br>– sensory pits all over body<br>– jagged fringe on hind legs + feet<br>– more aggressive + dangerous |
| Dimorphism | males grow larger + faster |

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| Behavior | • nocturnal hunter-scavengers<br>• often bask on shoreline<br>• aestivate during drought or arid conditions<br>• adult males bellow, growl, or hiss for dominance<br>• hatchlings grunt, squawk, communicate thru ultrasound |
| Habitat | Hill streams, large rivers, marshes, ponds, lakes, canals, reservoirs, saline habitats (i.e. mangrove creeks/saltpans)<br>Deep water = safety + drought resistance but some species live in places where water regularly dries (Crocodylus suchus) by living in deep tunnels or caves; drought can also force species to move inland |
| Distribution | tropical + subtropical regions in Africa, Asia, Americas, Australia |
| Feeding Ecology | • opportunistic apex of the food chain<br>• young are agile + can jump to eat dragonflies, termites, spiders, other insects<br>• adolescents begin to feed on crabs, fish, frogs, reptiles, birds, + mammals<br>• scavenge for carrion<br>• teeth/jaws designed for seizing, tearing, + crushing rather than chewing<br>• some species have narrow jaws + sharp teeth to hunt fish<br>• Sensory pores in or around mouth to help detect prey<br>• Some species herd fish to shore w/ their bodies, often communally<br>• Control predators of commercially important fish + help maintain cleanliness as scavengers |
| Reproductive Biology | • males defend territories + compete for mates<br>• fixed breeding seasons where males mate w/ multiple females<br>• females lay eggs 40-70 days after mating; incubation period depends on nest temp (avg. 60-90 days)<br>  – higher temperatures = male, lower temperatures = female<br>  – **hole-diggers** – females dig in sand, earth, or gravel embankments above the hind-water line w/ clawed hind-limbs; eggs emerge lubricated + hatch with the wet season<br>  – **mound-nesters** – females gather vegetation, soil, or compost and digs a hole on top to lay eggs; eggs are laid at the start of the wet season and hatch when the water is highest<br>• females, sometimes males, guard nest during incubation<br>• young call w/ quacking grunts when ready to emerge so parents release young and carry to water<br>• young are cared for in creche formation w/ parents guarding young for 90 days<br>• adults are conditioned to respond to young distress calls<br>• mortality rate = 90% due to predators |
| Conservation Status | populations are reduced due to overhunting (for skin) and habitat loss due to human industrialization. sustainable-use programs responsible for recovery and continued survival of species like Nile, saltwater, and New Guinea crocodiles. 3 CR; 2 EN; 3 VU; 1 CD; 1 DD.<br>In Ancient Egypt (Sobek and Taweret), Hinduism (Varuna, Ganga, Yamuna, Goa), Aztec (Cipactli) |

## 1.2 Alligatoridae — Alligators

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| Taxonomy/Ancestry | subfamilies:<br>• **alligatorinae** – true alligators; only 1 of 10 genera currently extant; represented today by *A. mississippiensis* in US and *A. Sinesis* in China<br>• **caimaninae** – caimans in C. and S. America<br>  <br>**Scientific classification**<br>Kingdom: Animalia<br>Phylum: Chordata<br>Class: Reptilia<br>Order: Crocodilia<br>*Clade*: Globidonta<br>Family: **Alligatoridae** Gray, 1844<br>**Subfamilies**<br>• Alligatorinae<br>• Caimaninae |
| Size | alligator: 5-20 ft (1.5-6.1 m)<br>caiman: average maximum weight of 6 to 40 kg (13 to 88 lb) depending on species, with the exception of the black caiman (Melanosuchus niger), which can grow more than 5 m (16 ft) in length and weigh up to 1,100 kg (2,400 lb). The average length for most of the other caiman species is about 2 to 2.5 m (6.6 to 8.2 ft) long. largest species = black caiman, smallest = Cuvier's dwarf. |
| Color | |
| Anatomy | • diapsid skull<br>• armored w/ osteoderms and large scales that do not overlap<br>• forelimbs are smaller and weaker with 5 partially-webbed toes<br>• distinguishing from crocodiles:<br>– wider, shorter heads w/ more obtuse snouts<br>– 4th enlarged underjaw tooth fits into pit in upper jaw –¿ no teeth visible when mouth closed<br>– no jagged fringe on hind legs + feet<br>– sensory pits appear only on snout and face, not neck and body<br>– toes of hind feet webbed not more than halfway to tips<br>– intolerant to salinity<br>– generally less aggressive and dangerous<br>– partake in foliage and fruit in addition to fish and meat<br>• caiman characteristics:<br>– no bony septum b/w nostrils<br>– ventral armour composed of overlapping bony scutes formed from two parts united by a suture<br>– longer, more slender, teeth than those possessed by alligators. The calcium rivets on its scales make their hides stiffer, and thus less valuable, than those of alligators and crocodiles. |
| Dimorphism | males larger and grow faster. |

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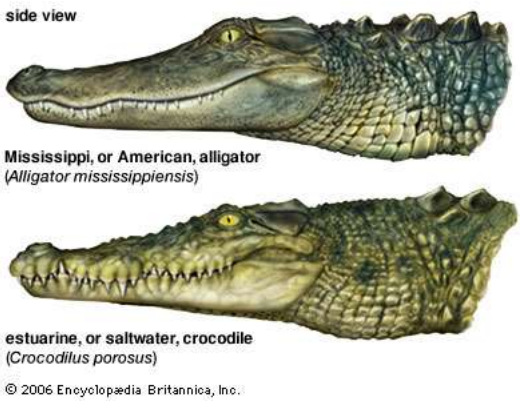
| Behavior | • ectotherms basking on shoreline<br>• float on surface of water<br>• become more subdued as temperatures drop but do not hibernate, making use of burrows in the winter months<br>• live in groups w/ dominance hierarchies. the highest-ranking individuals assert dominance through ritualized behaviors such as vocalizations and slapping the water with their heads.<br>• **high walk**: 4-limbed forward motion used for overland travel w/ belly up from the ground<br>• alligator holes in the wetlands increase plant diversity and provide habitats for other animals during droughts |
| Habitat | lakes, slow-moving streams/rivers, rivers, swamps, marshes, occasionally roadside ditches. freshwater sites w/ slow or still waters. often inhabit heavily-vegetated areas w/ muddy or murky water. |
| Distribution | a New World group w/ habitats in Central-Northern S. America; parts of southern and western Central America and Mexico; SE United States; eastern China. |
| Feeding Ecology | • opportunistic scavenger-hunters<br>• juveniles mainly eat snails and other invertebrates<br>• Typical adult diet = fish, small mammals, other reptiles (including smaller alligatorids), and birds, occasionally continuing to eat snails/invertebrates<br>• Predation typically occurs among eggs and hatchlings<br>• Racoons, coati, foxes, skunks, and other mammals, snakes, and various raptors, can raid nests or take hatchlings<br>• occasional cannibalism, but rare<br>• larger alligators help control coypu population |
| Reproductive Biology | • spring reproductive season<br>• courtship rituals thru loud bellowing choruses, vibrations of the male trunk<br>• use vegetables to construct nest mounds<br>• 12-60 eggs depending on species<br>• egg-laying once a year in midsummer, w/ eclosion 1-2 months afterward<br>• females respond to noises from eggs and assist offspring. offspring also use egg teeth for eclosion.<br>• females remain w/ offspring for up to 1 year.<br>• TSD is associated w/ several species, such as American alligator and common caimans. ¡88degF/31degC = female; ¿90degF/32degC = male. natural sex ratio of 5:1 female:male.<br>• Muja = oldest known in Serbia |
| Conservation Status | • raised commercially for their meat and skin<br>• ecotourism industry<br>• in Louisiana, heavy grazing by coypu and muskrat are damaging coastal wetlands<br>• Chinese alligator critically endangered; Louisiana and Florida zoos have some in captivity they are trying to preserve |


side view
Mississippi, or American, alligator
(Alligator mississippiensis)
estuarine, or saltwater, crocodile
(Crocodilus porosus)
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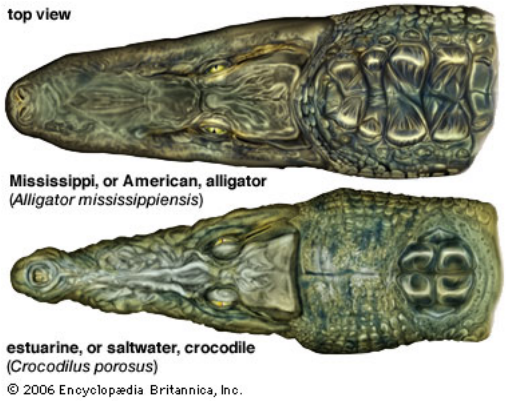
top view
Mississippi, or American, alligator
(Alligator mississippiensis)
estuarine, or saltwater, crocodile
(Crocodilus porosus)
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# 2 Testudines

## 2.1 Chelydridae — Snapping Turtle

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| Taxonomy/Ancestry | 7 extinct, 2 extant genera.<br>**chelydra** – 3 species native to the Americas<br>**macrochelys** – much larger alligator snapping turtle, 2 species exclusively N. American forming the largest freshwater turtles in N. America. A 3rd species has been proposed, the Apalachicola.<br>• Most closely related to Platysternidae (big-headed turtles)<br>• Sometimes considered as subfamilies within the same family, but genetic evidence supports recognition as separate families<br>• Fossil record dating from Paleocene of N. America and Oligocene of Eurasia<br>• *Chelydra* is known from as far back as the Pliocene in N. America<br>• *Macrochelys* is known from as far as early Miocene<br>**Scientific classification**<br>Kingdom: Animalia<br>Phylum: Chordata<br>Class: Reptilia<br>Order: Testudines<br>Suborder: Cryptodira<br>*Clade*: Americhelydia<br>Family: **Chelydridae** Gray, 1831[2]<br>**Genera**<br>• *Chelydra*<br>• *Macrochelys*<br>• †*Acherontemys*<br>• †*Chelydrops*<br>• †*Chelydropsis*<br>• †*Emarginachelys*<br>• †*Macrocephalochelys*<br>• †*Planiplastron*<br>• †*Protochelydra* |
| Size | 7.1-31.5 in (18-80 cm); up to 249 lb (113 kg) |
| Color | |
| Anatomy | • long tail<br>• 3 rows of tubercles*<br>• hooked beak<br>• kelled*, posteriorly separated carapace<br>• reduced, cruciform*, hingeless plastron<br>• heavy claws<br>• 11 marginal scutes on each side of the carapace<br>• abdominal scutes on plastron reduced; not in contact medially<br>• carapace and plastron connected by narrow bony bridge<br>• posterior skull roof deeply emancipated<br><br>The alligator snapping turtle is characterized by a large, heavy head, and a long, thick shell with three dorsal ridges of large scales (osteoderms), giving it a primitive appearance reminiscent of some of the plated dinosaurs, most notably the ankylosaurs. They can be immediately distinguished from the common snapping turtle by the three distinct rows of spikes and raised plates on the carapace, whereas the common snapping turtle has a smoother carapace. They are a solid gray, brown, black, or olive-green in color, and often covered with algae. They have radiating yellow patterns around their eyes, serving to break up the outline of the eyes to keep the turtle camouflaged. Their eyes are also surrounded by a star-shaped arrangement of fleshy, filamentous "eyelashes". |

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| Dimorphism | males larger than females |
| Behavior | • vicious temperament; since they are on top of the food chain, they have little fear<br>• snapping jaws used against prey and predators<br>• highly aquatic but leave water to nest or travel over land to reach new habitats or lay eggs<br>• diurnal, but nocturnal activity rare in northern populations<br>• most hibernate, but many individuals are capable of going w/o hibernation and remaining active beneath ice. Hibernating snapping turtles do not breathe for, in the northern part of their range, more than six months since ice covers their hibernating site. These turtles can get oxygen by pushing their head out of the mud and allowing gas exchange to take place through the membranes of their mouth and throat. This is known as extrapulmonary respiration. If they cannot get enough oxygen through this method they start to utilize anaerobic pathways, burning sugars and fats without the use of oxygen. The metabolic by-products from this process are acidic and create very undesirable side effects by spring, which are known as oxygen debt.<br>• In shallow waters, common snapping turtles may lie beneath a muddy bottom with only their heads exposed, stretching their long necks to the surface for an occasional breath (their nostrils are positioned on the very tip of the snout, effectively functioning as snorkels).<br>• Common snapping turtles sometimes bask—though rarely observed—by floating on the surface with only their carapaces exposed, though in the northern parts of their range, they also readily bask on fallen logs in early spring. |
| Habitat | Common habitats are shallow ponds or streams. Some may inhabit brackish environments, such as estuaries. |
| Distribution | **common snapping turtle**: southeastern Canada, southwest to the edge of the Rocky Mountains, as far east as Nova Scotia and Florida.<br>**alligator snapping turtle**: southeastern United States waters. They are found from the Florida Panhandle west to East Texas, north to southeastern Kansas, Missouri, southeastern Iowa, western Illinois, southern Wisconsin, southern Indiana, western Kentucky, and western Tennessee. They are found on the Missouri River at least as far north as the Gavins Point Dam, the southernmost dam on the Missouri River at Yankton, South Dakota, and are featured in the Gavins Point Dam Aquarium.<br>Located from sea level to 2000 m elevation. |
| Feeding Ecology | Snapping turtles consume both plant and animal matter, and are important aquatic scavengers, but they are also active hunters that prey on anything they can swallow, including many invertebrates, fish, frogs, reptiles (including snakes and smaller turtles), unwary birds, and small mammals. In some areas, adult snapping turtles can be incidentally detrimental to breeding waterfowl, as they will occasionally take ducklings and goslings but their effect on such prey is frequently exaggerated.<br>Common snapping turtles have few predators when older, but eggs are subject to predation by crows, mink, skunks, foxes, and raccoons. As hatchlings and juveniles, most of the same predators will attack them as well as herons (mostly great blue herons), bitterns, hawks, owls, fishers, bullfrogs, large fish, and snakes. There are records during winter in Canada of hibernating adult common snapping turtles being ambushed and preyed on by northern river otters Other natural predators which have reportedly preyed on adults include coyotes, black bears, alligators and their larger cousins, alligator snapping turtles. Large, old male snapping turtles have very few natural threats due to their formidable size and defenses, and tend to have a very low annual mortality rate |

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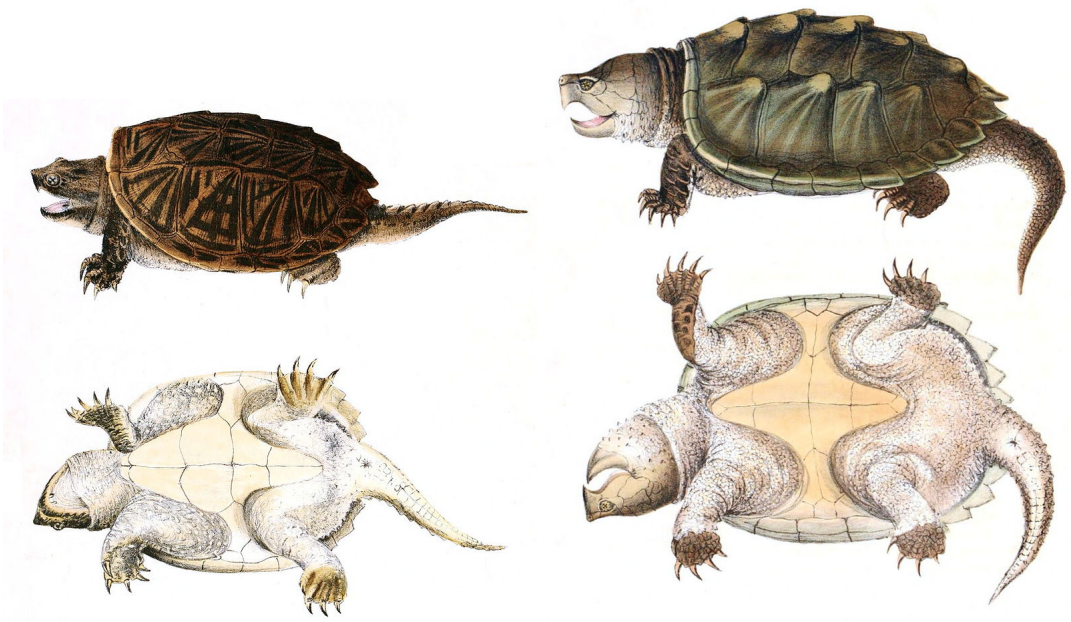
| Reproductive Biology | Courtship is variable and poorly developed and may include direct mounting, following of the female, face-offs/head-swaying, etc.<br>This species mates from April through November, with their peak laying season in June and July. The female can hold sperm for several seasons, using it as necessary. Females travel over land to find sandy soil in which to lay their eggs, often some distance from the water. After digging a hole, the female typically deposits 25 to 80 hard-shelled, but not brittle eggs each year, guiding them into the nest with her hind feet and covering them with sand for incubation and protection. Incubation time is temperature-dependent, ranging from 9 to 18 weeks. In cooler climates, hatchlings overwinter in the nest.<br>TSD: intermediate temperatures produce male offspring, while high and low extremes produce females. clutches are so large that different areas of the nest may produce different sex ratios.<br>Though their potential lifespans in the wild are unknown, alligator snapping turtles are believed to be capable of living to 200 years of age, but 80 to 120 is more likely. In captivity, they typically live between 20 and 70 years. |
| Ecological Role | have been seen as invasive species in Italy and Japan, as well as the Czech Republic and Germany for the alligator snapping turtle. |
| Conservation Status | **common snapping turtle**: used as food w/ turtle soup. The species is currently classified as Least Concern by the IUCN, but has declined sufficiently due to pressure from collection for the pet trade and habitat degradation that Canada and several U.S. states have enacted or are proposing stricter conservation measures. In Canada, it is listed as 'Special Concern' in the Species at Risk Act in 2011 and is a target species for projects that include surveys, identification of major habitats, investigation and mitigation of threats, and education of the public including landowners. Involved bodies include governmental departments, universities, museums, and citizen science projects.<br>**alligator snapping turtle**: Because of collection for the exotic pet trade, overharvesting for their meat, and habitat destruction, some states have imposed bans on collecting alligator snapping turtles from the wild. The IUCN lists it as a threatened species, and as of June 14, 2006, it was afforded some international protection by being listed as a CITES III species (which will put limits on exportation from the United States and all international trade in this species). The alligator snapping turtle is now endangered in several states, including Kentucky, Indiana, Illinois, and Missouri, where they are protected by state law. They are designated as "in need of conservation" in Kansas. |



## 2.2 Kinosternidae — Musk and Mud Turtles

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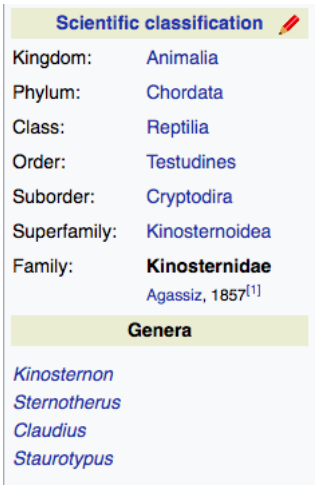
| Taxonomy/Ancestry | • 24 species within 4 genera, but taxonomic reclassification ongoing<br>• *kinosternon* — "mud turtles," small aquatic turtles from the Americas<br>• *sternotherus* — "musk turtles," endemic to N. America, closely related to *kinosternon*<br>• *claudius* — only extant species is narrow-bridged musk turtle found in Mexico, Guatemala, and Belize<br>• *staurotypus* — Mexican musk turtles; giant musk turtles; three-kelled musk turtles; 2 recognized species found in Mexico and Central America<br>  |
| Size | typically small, 10-15 cm (3.9-5.9 in) in length, but *staurotypus* can get much larger, up to 30 cm (12 in). |
| Color | may be black, green, or yellowish in color.<br>most species don?t have shell markings, but some have radiating black markings on each carapace scute. some species have distinctive yellow striping along head and neck. |
| Anatomy | • tall, highly domed upper carapace w/ distinct keel down center<br>• plastron differs by species<br>– some species have 1 or 2 hinges reaching from left to right side of shell; other species have none. the hinges allow plastron and carapace to pull tight against each other after the turtle pulls itself into the shell.<br>– some species have plastron covering only part of lower body; others have large plastron almost entirely concealing undersides<br>• barbles* hanging from chin<br>• glands/sacs along side produce characteristic musky substance (smells like skunk spray) |
| Dimorphism | Males usually have thicker and longer tails tipped w/ a spine; also have 2 rough, scaly patches on each leg. females are typically larger than males. |
| Behavior | • aquatic for majority of lifespan<br>• slow swimmers<br>• travel to land for nesting or to feed during rainy season<br>• some diurnal, others nocturnal<br>• hibernation/estivation:<br>– yellow mud turtle holds record for amt of time spent hibernating/estivating: inactive from winter to spring, summer to fall, only awakening when spring rains flood ground<br>– warm, wet climates –¿ active all year<br>– cold winters and deserts w/ long stretches of dry weather –¿ active only a few months a year and spend the rest underground waiting for better conditions |

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| Habitat | freshwater species living in still or slow-moving waters. prefer year-round bodies such as lakes or ponds. a few reside in shallow, seasonal ponds which have water only during a few months of the year, typically spring. |
| Distribution | native to Americas |
| Feeding Ecology | carnivorous turtles eating snails, clams, insects, worms, leeches, and sometimes freshly killed fishes they find. those w/ large heads typically prefer snails and clams which they can easily open w/ their jaws. in seasonal ponds, they may eat a large amount of seeds. |
| Reproductive Biology | • no courtship rituals; mating takes place in water<br>• females go onto land to nest. they may either bury eggs in a hole they dig or simply lay eggs on surface leaves.<br>• lay 3-6 hard-shelled eggs during late spring and early summer<br>• up to 6 clutches per year<br>• oblong eggs range from 0.9-1.7 in (2.3-4.3 cm) long and from 0.6-1.0 in (1.5-2.5 cm) wide<br>• hatch 75 days to a year after being laid<br>• TSD: medium temperatures produce male offspring; females are produced by extremes<br>• post-eclosion, some species winter in subterranean nest and truly emerge in spring<br>• the yellow musk turtle is the only turtle species known to exhibit parental care. suggested to sometimes stay w/ nest and urinate on eggs long after laying to keep them moist or protect them from predators. |
| Ecological Role | |
| Conservation Status | 4 VU; US Fish and Wildlife lists flatted musk turtle as Threatened. However, most species are quite common in their own habitats. |

## 2.3 Emydidae — Box, Pond, and Marsh Turtles

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| Taxonomy/Ancestry | the largest and most diverse turtle family, w/ about 50 species in 10 genera. previously, several species of Asian box turtles were classified as Emydidae but now they have been moved to another family. it contains 2 subfamilies: Emydinae and Deirochelyinae.<br>the oldest fossils are known from Upper Cretaceous and Paleocene of N. America. in modern times, closest relatives = Geoemydidae and Testudinidae (tortoises). as recognized today, Emydidae family includes primarily New World species.<br><br>**Scientific classification**<br>Kingdom: Animalia<br>Phylum: Chordata<br>Class: Reptilia<br>Order: Testudines<br>Suborder: Cryptodira<br>Superfamily: Testudinoidea<br>Family: **Emydidae**<br>(Rafinesque, 1815)[2] |
| Size | 10-24 in (25-60 cm) |
| Color | |
| Anatomy | • most diverse turtles in appearance<br>• the carapace typically takes the form of a low arch, but is domed in some<br>• some have keels* in the form of 1-2 ridges running from the front to the back<br>• a prominent bridge often connects the carapace to the plastron<br>• typically 8 pleugrals, 5 vertebrals, and 24 marginals on carapace<br>• 12 scutes on the plastron<br>• seam b/w posterior marginal scutes and last vertebral overlap pygal bone<br>• some members have moveable hinge separating pectoral and abdominal segments<br>• small skulls<br>• toe webbing<br>• karyotype most commonly has 50 chromosomes |
| Dimorphism | Males generally smaller than females in aquatic emydids, but this may be reversed among semiaquatic and terrestrial species. |
| Behavior | • well-developed basking habit<br>• some active year-round; others seasonally inactive<br>– in temperate northern species, hibernacula are generally located in well-oxygenated areas of water, but painted and Blanding's turtles are tolerant of hypoxic conditions<br>– at least 2 aquatic species, chicken turtle (Deirochelys reticularia) and western pond turtle known to hibernate terrestrially<br>– eastern box turtle (Terrapene carolina) burrows beneath leaf litter and hibernates in shallow soil to survive subfreezing temps<br>• elaborate courtship |
| Habitat | • Found in diverse range of habitats<br>• Occur abundantly in most permanent freshwater rivers, streams, lakes, and ponds<br>• One species found only in estuaries/coastal waters<br>• May be semi-aquatic to fully terrestrial |

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| Distribution | • Found in lowland temperate regions of N. America, S. Africa, southern Turkey, Middle East, and throughout Europe to southern Russia<br>• Formerly more widespread in Europe but Scandinavian populations extirpated during Pleistocene |
| Feeding Ecology | • Includes diets from strictly herbivorous to strictly carnivorous<br>• Hatchlings of many species highly carnivorous, but become omnivorous as they mature<br>• Some have diverse, generalized diets; others have highly specialized diets<br>• Map turtle (genus Graptemys) females may be develop huge heads w/ broad palates to crush large mollusks<br>• Chicken turtles and Blanding?s turtles independently evolved long neck w/ well-developed hyoid apparatus (elaborate bony structure that rapidly expands throat to suck in prey items)<br>• Hyoid apparatus commonly found in piscivorous turtle species |
| Reproductive Biology | • mating generally occurs in the spring, but some species may store sperm from earlier matings for many years<br>• many species display elaborate courtship utilizing thin forelimb claws which are vigorously waved at females; a unique pattern of head bobs may be exchanged<br>• the female allows the male to mate, suggesting the females choose whom to mate with<br>• elongated eggs may be flexible or brittle-shelled<br>• most exhibit TSD |
| Ecological Role | |
| Conservation Status | • 7 VU; 6 EN; 14 NT<br>• Human activities (eg pollution, habitat destruction, road mortality, and collection for pet trade) responsible for most species? decline<br>• Ex — Diamondback terrapin (Malaclemys terrapin) once faced extinction due to overcollection for human consumption, but recovered as it fell out of favor w/ wealthy ppl |

### 2.3.1 Terrapene — Box Turtles

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|---|---|
| Taxonomy/Ancestry | a member of the subfamily emydinae. 12 taxa over 4 species. Terrapene originally coined as genus separate from Emys for species w/ sternun separated into 2-3 divisions which can move independently.<br>they appear abruptly in the fossil record in modern form, implying they are a generalist species able to survive under a wide variety of conditions. older fossils have been found in Nebraska dating back to the Miocene (15 Mya). only recognized extinct subspecies dates from Pliocene and was much larger than other species.<br>  |
| Size | 10-22cm (4-9 in) |
| Color | females usually have yellowish-brown eyes, while males typically have red or orange eyes. |
| Anatomy | • distinguished by domed shell which is hinged at the bottom<br>– allows animal to close shell tightly to escape predators<br>• item avg. lifespan of 50 yrs, but many can live past 100. once maturity is reached, the chances of death do not seem to increase w/ age.<br>• age can be roughly estimated by counting growth rings on scutes, but estimates may be inaccurate b/c the plastron is worn smooth over time. |
| Dimorphism | Males have concave area on plastron centered beneath hinge. |
| Behavior | • defend selves from predation by hiding, closing shell, and biting, but are vulnerable to surprise attacks and persistent gnawing/pecking<br>• tend to move further into woods prior to hibernation |
| Habitat | • no standard habitat, but generally found in mesic woodlands<br>• *T. ornata* can be found in grasslands<br>• desert box turtle can also be found in semidesert w/ rainfall predominantly in summer<br>• Coahuilan box turtles found only in region characterized by marshes, permanent presence of water, and cacti |
| Distribution | native to N. America, where the species w/ the widest range, the common box turtle, is found in the US and Mexico. the ornate box turtle is endemic to south-central and south-western US/adjacent Mexico, the spotted box turtle is endemic to northwestern Mexico, and the Coahuilan box turtle found only in Cuatro Cienegas Basin in Coahuila, Mexico. |
| Feeding Ecology | an omnivore w/ a varied diet, it eats anything it can catch. invertebrates/insects = principal component but diet also consists of vegetation. the diet can be amended w/ fruits. at times, it eats poisonous mushrooms, making its meat dangerous for humans. |

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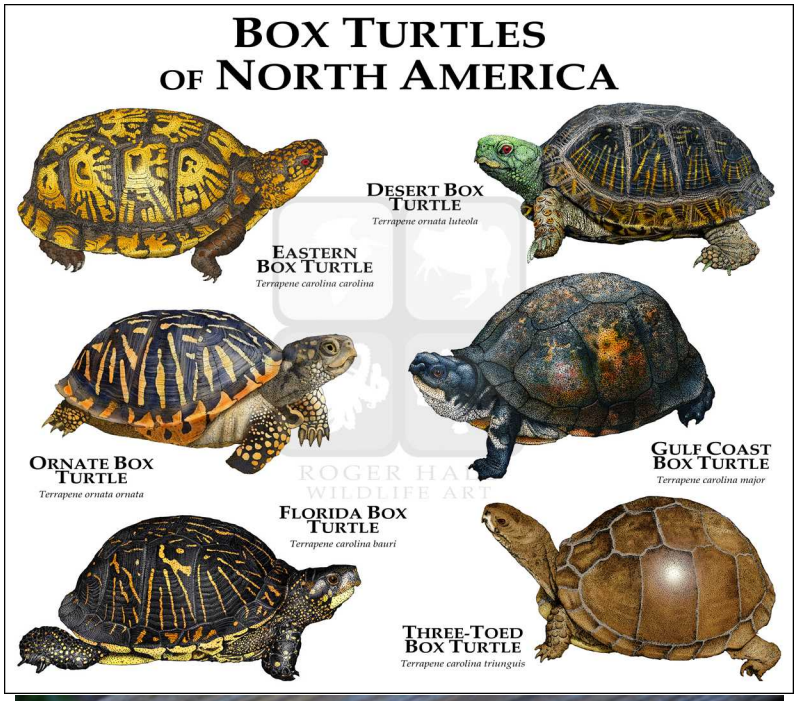
| Reproductive Biology | relatively slow reproducers, they reach sexual maturity only after 4-5 yrs. females can store viable sperm in the oviducts for up to 4 yrs. they mate from may-october and lay elliptical, leathery eggs in flask-shaped holes 3-4 in deep in warm, sunny soil. they may have more than 1 clutch a yr, w/ avg. clutch size being larger in northern populations and ranging from 1-7 eggs. incubation takes 2-3 months. infant mortality is high, since the shell is weaker. infants may overwinter in the nest. |
| Ecological Role | |
| Conservation Status | • 1 EN; 1 V; 1 NT; 1 DD<br>• Often taken as or bred as pets<br>– Easily stressed and require more care than is generally thought<br>– Require outdoor enclosure and constant exposure to sun<br>– Recommended to buy captive bred to reduce pressure on wild populations<br>• Some states prohibit collecting wild turtles or require permits to keep them<br>• State reptile of N. Carolina, Tennessee, Missouri, and Kansas |




### 2.3.2 Actinemys — Western Pond Turtles

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| Taxonomy/Ancestry | emydinae subfamily. originally, its single species was considered to be part of *Clemmys*.<br><br>**Scientific classification**<br>Kingdom: Animalia<br>Phylum: Chordata<br>Class: Reptilia<br>Order: Testudines<br>Family: Emydidae<br>Genus: *Actinemys* or *Emys*[1]<br>Species: ***A. marmorata***<br>**Binomial name**<br>***Actinemys marmorata* or *Emys marmorata***[1]<br>(Baird and Girard, 1852)<br>**Subspecies**<br>*Actinemys marmorata marmorata*<br>*Actinemys marmorata pallida* |
| Size | up to 20 cm (8 in) in carapace length. |
| Color | dorsal color — dark brown, dull olive.<br>yellow plastron w/ dark blotches in acute center. |
| Anatomy | • low, broad carapace which is widest behind the middle. in adults, it is smooth, containing no keels* or serrations.<br>• grow slowly in wild — age at 1st reproduction may be 10-12 yrs<br>• may survive >50 yrs in wild |
| Dimorphism | males have light/pale-yellow throat. |
| Behavior | frequently bask, and can be encouraged to bask on artificial surfaces for easier study. |
| Habitat | • occur in both permanent and intermittent waters — marshes, streams, rivers, ponds, lakes<br>• favor habitats w/ many emergent logs/boulders to bask<br>• bask on top of aquatic vegetation, and are consequently often overlooked in the environment<br>• terrestrial habitat also important b/c they can spend up to 200 days outside of water when aquatic habitat dries (intermittent ponds), and many overwinter outside the water |
| Distribution | originally, the western pond turtle ranged from northern Baja California, Mexico, north to Puget Sound, Washington. however, as of 2007, they are rare/absent in Puget Sound. they have a disjunct distribution in most of Northwest, isolated populations in southern Washington, and may be locally common in some streams, rivers, and ponds in southern Oregon. they also occur in Uvas Canyon area, Santa Cruz Mts, California, in Northbay, lakes such as Fountaingrove lake. they range up to 305 m (1,001 ft) in Washington, up to 915 m (3,002 ft) in Oregon.<br><br>  <br>The range of the Western pond turtle. |

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| Feeding Ecology | omnivorous, they often eat:<br>• insects, crayfish, aquatic vertebrates<br>• fish, tadpoles, frogs, carrion rarely<br>• filamentous algae, lily pads, tule, cattail roots<br>generally, they are well protected due to their shells, but are threatened by predators such as raccoons, otters, ospreys, coyotes. hatchlings may be preyed on by weasels, bullfrogs, large fish. |
| Reproductive Biology | • 5-13 eggs per clutch in annual or biannual egg-layings<br>• may travel some distance from water for egg-laying, as much as 0.8 km (1/2 mi) away from and up to 90 m (300 ft) above nearest source of water. however, most nests are within 90 m (300 ft) of water<br>• the female leaves water in evening, selects nest site in open area of sand or hardpan facing southwards<br>• flask-shaped nest w/ abt 5 cm (2 in) opening; the female covers nest w/ soil/adjacent low vegetation<br>• the vast majority of hatchlings overwinter in the nest<br>• winter rains may be necessary to loosen hardpan soil where nest is<br>• young first appear in spring following egg deposition |
| Ecological Role | |
| Conservation Status | listed as VU due to human threat, they face extinction due to the removal of ponds, wetlands, and the contamination of water sources. |


### 2.3.3 Malaclemys — Diamondback Terrapins

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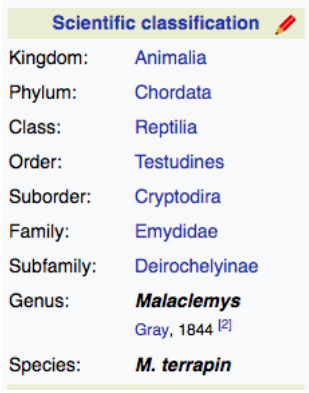
| Taxonomy/Ancestry | a member of the Deirochelyinae subfamily. a monotypic genus containing only the *M. terrapin* species, w/ 7 subspecies recognized.<br>  <br>**Scientific classification**<br>Kingdom: Animalia<br>Phylum: Chordata<br>Class: Reptilia<br>Order: Testudines<br>Suborder: Cryptodira<br>Family: Emydidae<br>Subfamily: Deirochelyinae<br>Genus: ***Malaclemys*** Gray, 1844 [2]<br>Species: ***M. terrapin*** |
| Size | males — 13 cm (5.1) in; 300 g (11 oz). sexually mature at 2-3 yrs and 4-5 in of length<br>females — 19 cm (7.5 in); 300 g (11 oz). sexually mature at 6-7 yrs and 6.75 in of length |
| Color | named for the diamond patterned growth rings on carapace. unique patterns of wiggly black markings/spots on the body and head. |
| Anatomy | • wedge-shaped shell wider from back than front<br>• large webbed feet<br>• species from warmer regions are larger<br>• adapted to marine environment near the shore<br>– impermeable skin can stay in salt water for extended periods of time<br>– lachrymal salt glands<br>– can distinguish b/w drinking water of different salinities<br>– behavior to obtain freshwater — drink freshwater surface layer on top of salt water during rainfall; raising head to catch rain drops |
| Dimorphism | females larger than males. |
| Behavior | the behavior of *Malaclemys* is mostly unknown due to their aquatic nature. it is suggested that nesting is the only activity that they perform on land. they most likely hibernate during colder months. |
| Habitat | • coastal habitats — estuaries, tidal creeks, salt marshes<br>• typically cordgrass marshes that flood at high tide, but also live in mangrove swamps in Florida<br>• survive in both freshwater and ocean water but prefer intermediate salinities<br>• no long-distance migrations |
| Distribution | narrow strip of coastal habitats on Atlantic and Gulf coasts of US — Cape Cod to southern tip of Florida and around Gulf Coast to Texas |
| Feeding Ecology | shrimps, clams, mussels, and other marine invertebrates, especially periwinkle snails. |
| Reproductive Biology | see Emydidae entry for courtship and mating.<br>• females wander considerable distances before nesting<br>• nest in sand dunes or scrub vegetation near ocean in June or July<br>• clutch sizes vary latitudinally ? 5.8 in S. Florida to 10.9 in NY<br>• after covering nest, female returns to ocean and does not come back to nest<br>• usually hatch in 60-85 days in August/September. the hatchlings, which are freeze-tolerant but have a lower salt tolerance, may overwinter in the nest.<br>• exhibit TSD — warmer temperatures produce females, cooler temperatures produce males |
| Ecological Role | at high densities, may eat enough invertebrates to significantly impact ecosystem, especially b/c periwinkles can overgraze important marsh plants |

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| Conservation Status | • Classified NT due to decreasing pop. #s within range<br>• Limited protection on state-by-state level<br>• 1900s — considered delicacy to eat, almost hunted to extinction<br>• Severely depleted by land development along Atlantic coast<br>• Receive wounds from propellors on motorboats<br>• Get trapped in crabbing/lobster nets |

### 2.3.4 Graptemys — Map Turtles

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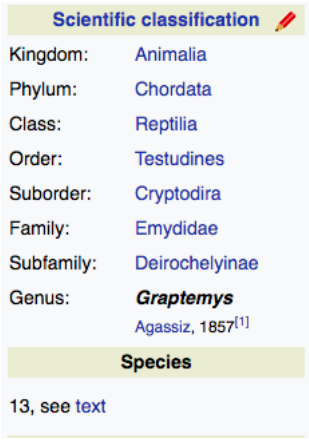
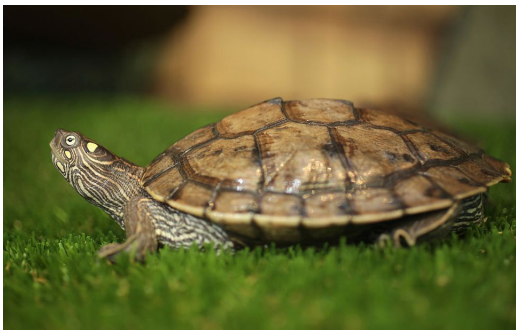
| Taxonomy/Ancestry | 13 species. also known as "sawback turtles." Member of subfamily Deirochelyinae.<br>  <br>**Scientific classification**<br>Kingdom: Animalia<br>Phylum: Chordata<br>Class: Reptilia<br>Order: Testudines<br>Suborder: Cryptodira<br>Family: Emydidae<br>Subfamily: Deirochelyinae<br>Genus: ***Graptemys***<br>Agassiz, 1857[1]<br>**Species**<br>13, see text |
| Size | Males: 3-7 in<br>Females: 7-10 in |
| Color | the lines on the shell resemble waterways on maps. it has thicker, yellow lines on the limbs and face. |
| Anatomy | resemble many other aquatic turtles, but distinguished by keel running length of center of carapace. some have spike-like juts along the keel. live 15-100 years. |
| Dimorphism | females larger than males.<br>males have much longer claws on the front legs.<br>Females can be partitioned into 3 groups based on head width/amt of mollusks eaten — Microcephalic (narrow, consume few mollusks); Mesocephalic (wider, mostly mollusks w/ softer-bodied prey); Megacephalic (widest, almost entirely mollusks) |
| Behavior | spend many hours basking. they are communal w/ other turtles — share space and use each other for predator-watching. |
| Habitat | • mostly aquatic, but spend some time on land<br>• live only in freshwater, like ponds/rivers, and prefer flowing water<br>• ideal environment = underwater plant matter to eat; rocks and logs to bask on |
| Distribution | found throughout eastern half of US and northwards into southern Canada |
| Feeding Ecology | • more carnivorous than most Emydids<br>• females have wider heads — eat mollusks, insects, crayfish<br>• males w/ smaller heads — smaller mollusks and insects<br>• feeding is always in the water |
| Reproductive Biology | • breed in spring/fall<br>• mating takes place in deep waters<br>• nesting period in May-July<br>• prefer unshaded sites of sandy soil<br>• usually lay 2 or more clutches of 6-20 eggs<br>• hatch after 50-70 days in August-September<br>• may overwinter in nest<br>• TSD<br>  – 25°C = male<br>  – 30-35°C = female |
| Ecological Role | control invasive mollusks like zebra mussels and Asian clams |
| Conservation Status | 5 LC; 3 EN; 2 VU; 2 NT<br>3 species bred heavily for pet trade in 1970s but slowly decreased in popularity |



### 2.3.5 Chrysemys — Painted Turtles

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| Taxonomy/Ancestry | 1 species, *C. picta*, w/ 3 subspecies. Member of subfamily Deirochelyinae.<br>it is commonly found in the fossil record. the oldest samples are from Nebraska 15 mya. most recent fossils are widely distributed; fossils < 300,000 years old are found throughout the US and southern Canada.<br><br>**Scientific classification**<br>Kingdom: Animalia<br>Phylum: Chordata<br>Class: Reptilia<br>Order: Testudines<br>Suborder: Cryptodira<br>Family: Emydidae<br>Subfamily: Deirochelyinae<br>Genus: ***Chrysemys*** Gray, 1844<br>Species: ***C. picta*** |
| Size | female: 10-25 cm (4-10 in); 500 g (18 oz)<br>male: 7-15 cm (3-6 in); 300 g (11 oz) |
| Color | red/yellow stripes on neck, legs, and tail. |
| Anatomy | upper jaw = philtrum (shaped like inverted V) w/ downward, tooth-like projection on either side. Distinguish from red-eared slider: *Chrysemys* is flatter; slider has red "ear" marking and spotted bottom shell |
| Dimorphism | females larger than males. the female has a higher, more rounded carapace, and the male has longer foreclaws; longer, thicker tail; cloaca located farther out on tail |
| Behavior | • emerges at sunrise to bask, then goes to water to forage; repeats cycle until night when it sinks to the bottom to sleep<br>• must maintain $17 - 25°C$ internal body temperature to be active<br>• spring — forages at water temp $15 - 18°C$ but not if temp exceeds $30°C$<br>• fall — stops foraging when temperature is below$15 - 18\circ C$<br>• winter — hibernation<br>– in the north, they can hibernate as long as October-March<br>– in the south, they may not hibernate at all<br>– body temperature falls to $6°C$<br>– periods of warm weather bring them out of hibernation temporarily<br>– buries self on bottom of water body, near water in shore-bank or muskrat burrow, or in woods or pastures<br>– does not breathe — adaptations of blood chemistry, brain, heart, and shell allow it to survive extreme lactic acid build-up<br>• may migrate several km searching for water, food, mates w/ group of 100s of turtles<br>– may vacate shallow water during summer to look for more permanent bodies<br>– frequently cross lakes or travel down creeks<br>– have homing capabilities thru visual recognition; can return to collection points if released elsewhere |
| Habitat | need fresh waters w/ soft bottoms, basking sites, and aquatic vegetation. it therefore favors shallow waters w/ slow currents such as creeks, marshes, ponds, and lakeshores.<br>Eastern painted turtle — Very aquatic, only leaves water body when forced by drought, have appeared in brackish waters<br>Midland/southern painted turtles — Seek v quiet waters: shores and coves; tolerate pollution<br>Western painted turtle — Streams and lakes, but also pasture ponds and roadside pools; found as high as 1,800 m (5,900 ft) |

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| Distribution | the most widespread N. American turtle, its range extends from the Atlantic to the Pacific. on the E. Coast, it ranges from the Canadian Maritimes to Georgia. on the W. Coast, it ranges from British Columbia to Washington to Oregon to Vancouver Island. in the north, it extends into much of southern Canada; to the south, it reaches the US Gulf Coast in Louisiana/Alabama. it also has dispersed populations in the southwestern US and is found in 1 river in northern Mexico. |
| Feeding Ecology | omnivorous, it hunts along water bottoms, chasing victims from vegetation to open water. it consumes plants and skims the surface of the water to catch small particles. they commonly eat crayfish, dragonfly larvae, water lilies, and duckweed. they are vulnerable to predators when young: red fox, garter snake, crows, snapping turtle, water bugs, raccoon. |
| Reproductive Biology | • mate in the spring and fall if the water temp is $10 - 25°C$.<br>• courtship — male follows female and strokes face w/ elongated claws until female swims to bottom to copulate<br>• female stores sperm for up to 3 years in oviduct — may have 3 clutches, w/ multiple fathers<br>• nesting in late May to mid-July<br>– Dug in sandy soil, often near water; older females nest further inland<br>– Dig nests w/ body temp $29 - 30°C$; may delay if not<br>– Presses throat against ground of diff potential sites to sense moisture, warmth, etc.<br>– Takes 4 hrs to build nest using hind legs, lubricating w/ bladder water<br>– Eggs = white, elliptical, porous, flexible<br>– Bigger female = bigger eggs and clutch<br>• 72-80 day incubation<br>• young hatch w/ egg tooth<br>• may overwinter. since they can survive winter in the nest, they range further north than most US turtles. they survive subfreezing temperatures w/ blood that can be supercooled and skin resisting penetration from ice crystals.<br>• Dependent on egg yolk at first, begin feeding to support growth after 1-1.5 weeks of leaving nest |
| Ecological Role | |
| Conservation Status | LC. widespread, but human settlement still has noticeable effects on population density. able to maintain range better than some other turtles b/c it can tolerate polluted environments. range eroding heavily in Pacific Northwest; considered S2 (imperiled) in Oregon and British Columbia. habitat loss by drying of wetlands; even if water remains, basking logs/rocks often cleared away; urbanization takes away soil for nesting. often killed on road. threatened by introduction of invasive non-native species (eg red-eared slider). |