**Evolution and systematics**

The oldest fossils are known from the Upper Cretaceous and Paleocene of North America. These modern cryptodires are most closely related to the Geoemydidae of South America, Europe, Africa, and Asia and the Testudinidae, which are also found in North America.

Morphological and molecular evidence suggests a close relationship among western pond turtles (*Actinemys marmorata*), European pond turtles (*Emys orbicularis*), and Blanding’s turtles (*Emydoidea blandingii*). Some researchers consider them to be members of a single genus (*Emys*), while others recognize them individually as the sole representatives of monotypic genera. Two subfamilies are recognized: the Emydinae (palatine excluded from the triturating surface) and the Deirochelyinae (humeropectoral sulcus excluded from the entoplastron).

**Physical characteristics**

There are typically eight pleurals, five vertebrals, and 24 marginals on the carapace and 12 scutes on the plastron. The seam between the posterior marginal scutes and the last vertebral overlap the pygal bone. A double articulation is found between the fifth and sixth cervical vertebrae. Most species have at least some webbing between the toes, and some species have a hinged plastron.

Bog turtles (*Glyptemys muhlenbergii*) attain a maximum size of 5 in (12 cm), whereas adult Gray’s sliders (*Trachemys venusta grayi*) may reach 24 in (60 cm) or more. Males are generally smaller than females in the aquatic emydids; however, among semiaquatic and terrestrial species this may be reversed.

**Distribution**

These turtles are found in the lowland temperate regions of North America, North Africa, southern Turkey, the Middle East, and throughout Europe to southern Russia. They were formerly more widespread in Europe, but the Scandinavian populations were extirpated during the Pleistocene.

**Habitat**

This extremely diverse family is found in many habitats. They occur in abundance in most permanent freshwater rivers, streams, lakes, and ponds. One species is only found in estuaries and coastal waters, and a few species are semiaquatic to fully terrestrial.

**Behavior**

Whether fully aquatic or terrestrial, most emydids have a well-developed basking habit. Some species are active year-round; others are seasonally inactive (dry season or winter). Males of many species exhibit elaborate courtship displays.
Among the temperate northern species, hibernacula are generally located in well-oxygenated areas; however, painted turtles (*Chrysemys picta*) and Blanding’s turtles are tolerant of extremely hypoxic, or low oxygen, conditions. At least two aquatic species, the chicken turtle (*Deirochelys reticularia*) and the western pond turtle, are known to hibernate terrestrially. The eastern box turtle (*Terrapene carolina*) burrows beneath leaf litter and hibernates in shallow soil where it may experience subfreezing temperatures.

**Feeding ecology and diet**

This family includes species that are strictly herbivorous to those that are strictly carnivorous. Hatchlings of many species are highly carnivorous, but switch to a more omnivorous diet as they mature. Some species have diverse, generalized diets and others are highly specialized. In map turtles (genus *Graptemys*), the females may develop huge heads with broad palates that enable them to crush large mollusks. Chicken turtles and Blanding’s turtles have independently evolved a long neck with a well-developed hyoid apparatus, an elaborate bony structure that rapidly expands the throat to suck in prey items. This feeding adaptation is frequently found in piscivorous (fish-eating) turtle species.

**Reproductive biology**

In sexually dimorphic aquatic species, the female is larger than the male. The size difference is most extreme among species of the genus *Graptemys*. Mating generally occurs in the spring; however, some species may store sperm from an earlier mating for several years. The male is brightly colored and may possess long thin claws on the forelimbs that are vigorously waved before the female during courtship. A unique pattern of head bobs also may be exchanged before the female allows the male to mount. This elaborate courtship suggests that females choose their mate. The elongate eggs, which may be flexible or brittle shelled, are generally laid in nests dug in the soil away from the water (sometimes more than 0.6 mi [1 km] away). Most species that have been investigated exhibit temperature-related sex determination.

**Conservation status**

Seven species are listed as Vulnerable and six as Endangered on the IUCN Red List; 14 others are listed as Lower Risk/Near Threatened. Human activities (e.g., pollution, habitat destruction, road mortality, and collecting for the pet...
trade) are responsible for declines in most species. No species demonstrates the destructive effect that human exploitation may have on a turtle population better than the diamondback terrapin (*Malaclemys terrapin*), which once faced extinction throughout its range due to overcollection for human consumption. This turtle recovered as it fell out of favor with the wealthy.

**European pond turtle (*Emys orbicularis*)** is native to Spain, France, northern Italy, southern Germany, Poland, Turkey, Iran, Russia, Morocco, and Algeria. (Photo by Henri Janssen. Reproduced by permission.)

**River cooter hatchling (*Pseudemys concinna*).** (Photo by Animals Animals ©Mella Panzella. Reproduced by permission.)

**Significance to humans**

Many species are prominent in the international pet trade; the red-eared slider (*Trachemys scripta elegans*) has been the world’s pet turtle for several decades. The hatchlings are exported by the tens of thousands from ranching operations in Louisiana. This turtle has established breeding populations throughout the world and is considered an invasive pest because it may harm native species. A few species are consumed by humans locally.
Painted turtle

*Chrysemys picta*

**SUBFAMILY**
Deirochelyinae

**TAXONOMY**
*Testudo picta* Schneider, 1783, location unknown, although said to be England (in error). Four subspecies are recognized.

**OTHER COMMON NAMES**
French: Chrysémydes peint; German: Zierschildkröte; Spanish: Tortuga pinta.

**PHYSICAL CHARACTERISTICS**
A small- to medium-sized (maximum carapace length 10 in [25 cm]) turtle with a dark olive to black carapace. The upper and lower surfaces of the marginals are adorned with a pattern of red markings. The plastron may be plain yellow, yellow with a central pattern, or with complex designs of red and yellow. The dark head has a pattern of thin yellow lines and a distinctive yellow spot behind the eye in most subspecies. The males are smaller than the females and have long claws on the forelimbs.

**DISTRIBUTION**
This widespread species is found from southwestern British Columbia to Nova Scotia and throughout the central and southern regions of temperate North America. Disjunct populations occur in the U.S. Southwest.

**HABITAT**
Ponds, streams, slow-flowing portions of rivers and estuaries.

**BEHAVIOR**
By absorbing solar radiation with their dark carapaces, painted turtles thermoregulate by basking on almost any exposed surface. They bask early in the morning to elevate their body temperature, forage for food, and then return to basking sites to facilitate digestion. In the northern populations, the juveniles and adults spend a majority of the winter trapped below thick ice. This species does not readily absorb oxygen from the water; therefore, it must tolerate long periods of hypoxia or anoxia. The mineralized shell buffers the accumulation of lactic acid formed under anaerobic conditions to maintain a stable blood pH through the winter. The hatchlings remain within the shallow nest chamber over the winter and may be exposed to temperatures of 10°F (−12°C) or lower. Although they tolerate freezing at high subzero temperatures (e.g., to 25°F [−4°C]), they must remain supercooled (i.e., without the tissues freezing) in order to survive colder temperatures.

**FEEDING ECOLOGY AND DIET**
Omnivorous, feeding upon aquatic vegetation, insects, tadpoles, small fish, and carrion.

**REPRODUCTIVE BIOLOGY**
Although individual females may not reproduce every year, nesting is annual and seasonal. Courtship and mating occur in the autumn and spring, but nesting usually occurs in the spring and early summer. Females can store sperm in their oviducts for years and may not need to mate annually. The size of the elongate, flexible eggs (1.1–1.4 in [28–35 mm] long and 0.6–0.9 in [16–23 mm] wide) decreases with increasing latitude and clutch size. As many as five, but typically one or two, clutches of one to 20 eggs are deposited in nests constructed in sand or loamy soil. The eggs hatch after 72 to 80 days of incubation. This species has temperature-related sex determination, where males are produced below 82°F (28°C) and mostly females are produced at higher temperatures. Paternity analysis using DNA has shown that eggs within the same clutch are sometimes fertilized by more than one male.

**CONSERVATION STATUS**
Not threatened. This species remains common, in part because it tolerates disturbance due to human activity and its reproductive output is exceptional.

**SIGNIFICANCE TO HUMANS**
The colorful painted turtle hatchlings and adults are often available in the international pet trade. As a result of their small size and their considerable overlap with the larger and presumably more palatable common snapping turtle (*Chelydra serpentina*), they are rarely eaten by humans.

Diamondback terrapin

*Malaclemys terrapin*

**SUBFAMILY**
Deirochelyinae

**TAXONOMY**
*Testudo terrapin* Schoepff, 1793, Philadelphia, Pennsylvania, and Long Island, New York, later restricted by Schmidt (1953, 95) to the coastal waters of Long Island. Seven subspecies are recognized.

**OTHER COMMON NAMES**
French: Malaclémyde terrapin; German: Diamantschildkröte.

**PHYSICAL CHARACTERISTICS**
A small- to medium-sized turtle (maximum carapace length 9 in [24 cm]) with a rough, slightly keeled carapace and smooth speckled skin. The light brown, gray, or black carapace has raised concentric rings because the scutes are not shed each year, and new larger scutes form below. The rigid plastron varies in color from yellow to black and may have a distinctive pattern of blotches. The color of the soft skin is also quite variable, ranging from black to a light gray with black flecks. The females are much larger than the males and have larger heads with broad crushing plates. There are specialized salt glands near the eyes that excrete excess salt.

**DISTRIBUTION**
East Coast of temperate North America from southern Texas along the Gulf of Mexico and around Florida to Cape Cod, Massachusetts.

**HABITAT**
Salt marshes in brackish coastal waters and estuaries.
BEHAVIOR
Normally active during the day, this species may haul out on rocks or the banks of tidal creeks to bask. Terrapins range widely while foraging for food; however, they are often found in the same small area over consecutive years. Adults hibernate communally on the muddy bottom of creek beds. In southern climates the terrapins may become active on warm winter days, but in northern populations they remain in dormancy.

FEEDING ECOLOGY AND DIET
This species is highly specialized to feed upon mollusks. The females develop especially large heads with broad jaws for crushing the shells of marine gastropods. The diet of the smaller males differs from that of the female in that they consume different size classes of gastropods and they may supplement with a variety of aquatic insects.

REPRODUCTIVE BIOLOGY
The female is considerably larger than the male and may therefore choose her mate. In temperate regions, nesting occurs from mid-May to late July, but southern populations may nest as late as September. The females can store sperm in their oviducts for at least four years; however, fertility rates drop precipitously after the second year. The elongate eggs (1.0–1.7 in [26–42 mm] long and 0.6–1.1 in [16–27 mm] wide) have flexible shells. Two or more clutches of up to 20 eggs are deposited annually in the sandy dunes above the winter high tide mark. The eggs hatch after 61 to 104 days of incubation. Sex is dependent upon the incubation temperature; mostly males are produced from 77 to 84°F (25 to 29°C), however at 86°F (30°C) the hatchlings are all female. Most hatchlings emerge in the autumn and are presumed to hibernate aquatically, but some hatchlings may overwinter in the nest.

CONSERVATION STATUS
This species is listed as Lower Risk/Near Threatened on the IUCN Red List. Once considered a delicacy among aristocrats, it was decimated during the early twentieth century by overcollection for human consumption. The terrapin has largely recovered; however, populations continue to be threatened by the destruction and degradation of the tidal marshes they inhabit, and many thousands are needlessly drowned in crab traps that could be made safe by a simple modification.

SIGNIFICANCE TO HUMANS
This species was once prized for its delicate flesh; however, it fortunately fell out of favor with the wealthy. It is still consumed locally and is often sold in the Asian markets of large North American cities.

Pond slider
Trachemys scripta

SUBFAMILY
Deirochelyinae

TAXONOMY
Testudo scripta Schoepff, 1792, location unknown, later designated as Charleston, South Carolina, by Schmidt (1953, 102). Three subspecies are recognized.

OTHER COMMON NAMES
English: Red-eared slider, yellow-bellied slider.

PHYSICAL CHARACTERISTICS
This is a medium-sized (maximum carapace length 12 in [30 cm]) turtle with a green carapace, usually marked with yellow. The upper and lower surfaces of the marginals are adorned with a pattern of yellow lines. The plastron may be plain yellow or yellow with a dark pattern, or black in melanistic males. The green head has a pattern of thin yellow lines. There is a distinctive red stripe behind the eye in one subspecies (Trachemys scripta elegans),