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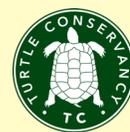
*Actinemys pallida* (Seeliger 1945) –  
Southwestern Pond Turtle, Tortuga de Poza

DAVID J. GERMANO, R. BRUCE BURY,  
AND JORGE H. VALDEZ-VILLAVICENCIO

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***Actinemys pallida* (Seeliger 1945) –  
Southwestern Pond Turtle, Tortuga de Poza**

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**SUMMARY.** – The Southwestern Pond Turtle, *Actinemys pallida* (family Emydidae) occurs in western North America from Baja California, Mexico, north through the Coast Range to the Monterey Bay area south of San Francisco, California, USA. A recent genetic study elevated this former subspecies of *A. marmorata* to species status. The species generally grows to 130–180 mm straight-line carapace length (SCL). It occurs in a variety of permanent and intermittent aquatic habitats, including rivers, streams, creeks, lakes, ponds, marshes, vernal pools, and human-constructed ponds associated with wastewater and cattle watering-tanks from sea level up to ca. 1,240 m (4,080 ft) in elevation. Hatchlings are 20–36 mm SCL and adult males grow to 179 mm SCL and females to 164 mm SCL. Females produce 2–11 eggs in a clutch and double clutching occurs. Much of the core area of the range of the species is in the highly populated Los Angeles Basin and in southern California, and many populations have as a result been lost, although populations are robust in the upper mountain reaches extending into the Los Padres National Forest in Ventura County. North of Santa Barbara, the species is more secure because of the less dense human population and more rural habitat extending to the northern edge of the range in the Monterey Bay region. The primary threats to the species are loss and alteration of both aquatic and terrestrial habitats as well as, potentially, climate change causing prolonged droughts. These losses fragment remaining populations and may magnify the effects of introduced species through predation, competition, and epidemic disease(s). The turtle is listed as a Species of Special Concern in California and is being considered for federal listing by the U.S. Fish and Wildlife Service. Research is ongoing on many aspects of its ecology and status, but many of the studies are unpublished. Greater effort is needed to protect and manage its aquatic habitats as well as nesting and overwintering sites in adjacent uplands.

**DISTRIBUTION.** – Mexico, USA. The species occurs from northern Baja California, Mexico, north through the Coast Range to Monterey Bay, California, south of San Francisco, USA. The northern and southeastern boundaries are uncertain because turtles in the San Francisco Bay Area and along the southern edge of the Transverse Range in Los Angeles County have an admixture of both *A. pallida* and *A. marmorata* genes. Pure *A. pallida* occurs from the southern end of Monterey Bay south into Baja California, with disjunct populations in the westernmost Mojave Desert.

**SYNONYMY.** – *Clemmys marmorata pallida* Seeliger 1945; *Actinemys marmorata pallida*; *Emys marmorata pallida*; *Emys pallida*, *Actinemys pallida*.

**SUBSPECIES.** – None recognized.

**STATUS.** – IUCN 2026 Red List (in press): Endangered (EN A2ce+4ce, E), assessed 2024; IUCN 2025 Red List: Vulnerable (VU A1cd [ver. 2.3]), assessed 1996 as part of *Actinemys marmorata*; CITES: Not Listed; California: Species of Special Concern; US ESA: Candidate Threatened Species (USFWS 2025).

**Taxonomy.** — The phylogenetic relationships of the Western Pond Turtle, *Actinemys marmorata* (*sensu lato*), have recently been in a state of flux. Recent evidence has suggested that the species is distinct from the other three species of the former broader group *Clemmys* in eastern

North America (Bickham et al. 1996; Feldman and Parham 2001; Holman and Fritz 2001). Feldman and Parham (2002) and Parham and Feldman (2002) proposed that the Western Pond Turtle should be placed in the genus *Emys*, along with the European Pond Turtle (*Emys orbicularis*) and the



**Figure 1.** Adult male Southwestern Pond Turtle, *Actinemys pallida*, from Arroyo San Rafael, Baja California, Mexico. Photo by Jorge H. Valdez-Villavicencio.

Blanding's Turtle (*Emys* [= *Emydoidea*] *blandingii*), and this assessment was adopted by some others (Spinks et al. 2003; Spinks and Shaffer 2005). In contrast, Holman and Fritz (2001) as well as Stephens and Wiens (2003) reported that the Western Pond Turtle is not closely related to any extant species and should be placed in its own genus, *Actinemys*.

The genus *Actinemys* is used in both of the standardized names of North American herpetofauna (Collins and Taggart 2002; Iverson et al. 2008, 2017; Taggart and Carr 2025) and globally (Fritz and Havaš 2006, 2007; TTWG 2021, 2025), which we follow here.

The first specimens of *A. marmorata* were collected in 1841 in the vicinity of Puget Sound (Washington) and described by Baird and Girard (1852) as *Emys marmorata*. *Emys nigra* was described by Hallowell (1854) from “Posa

(Poso) Creek, Lower California,” which is in Kern County in the Central Valley of California (Bury 1970), but this taxon is a junior synonym of *A. marmorata* and is not recognized. Seeliger (1945) described the Southwestern Pond Turtle as *Clemmys marmorata pallida* and suggested it was subspecifically distinct from the Northwestern Pond Turtle, *Clemmys marmorata marmorata*. The northwestern taxon has a relatively large inguinal scute compared to a smaller or absent inguinal scute in the southwestern taxon. In male Northwestern Pond Turtles, the throat is light and contrasts with the darker sides of the head and neck, whereas Southwestern Pond Turtles have a more uniform coloration of the throat and neck, often with dark flecking.

Gray (1995) reported low levels of genetic variation within and among several populations throughout the range of *A. marmorata* (*sensu lato*), although significant differences



**Figure 2.** Male Southwestern Pond Turtle, *Actinemys pallida*, dorsal view (*left*) and ventral view (*right*) from the Sweetwater River, San Diego County, California. Photos by David J. Germano.



**Figure 3.** Female Southwestern Pond Turtle, *Actinemys pallida*, dorsal view (left) and ventral view (right) from Ventura County, California. Photos by Nathanael Stanek and Turtle Conservancy.

were present between northern and southern populations. Spinks and Shaffer (2005) reported four genetic clades with different distributions from: 1) the Traverse Mountains of southern California south into Baja California; 2) the San Joaquin Valley and adjacent foothills; 3) Ventura and Santa Barbara counties in central coastal California; and 4) all remaining populations to the north. More recently, Spinks et al. (2014) presented evidence of specific genetic differentiation of the former subspecies, recognizing the northern form as *A. marmorata* and elevating the southern subspecies as *A. pallida*. The Turtle Taxonomy Working Group (TTWG 2021, 2025) has accepted these two species in the genus *Actinemys*: *A. marmorata* and *A. pallida*, as do we.

**Description.** — Information on many aspects of *Actinemys pallida*, including its description, distribution, biology,

and life history was included in the previous Conservation Biology account on *Actinemys marmorata* (Bury and Germano 2008), before *A. pallida* (Fig. 1) was split from *A. marmorata*. Overall, *A. pallida* is similar to its congener, *A. marmorata* (Bury and Germano 2008; Bury et al. 2012). Both are medium-sized turtles, with adults reaching 160–180 mm straight midline carapace length (SCL).

Both species mostly have drab brown shells; the carapace coloration ranges from light brown to dark brown or black, with or without darker streaks or flecking (Figs. 2–3). The plastron is yellowish-brown in color, sometimes with dark areas on parts of the scutes (Figs. 2–3). Male *A. pallida* can be distinguished from females reliably at a size of 120 mm SCL, when individuals are considered adults. In some populations males may develop



**Figure 4.** Captive hatchling Southwestern Pond Turtle, *Actinemys pallida*, showing yellow coloring that disappears with age. Photo by David J. Germano.



**Figure 5.** Wild yearling Southwestern Pond Turtle, *Actinemys pallida*, from Ventura County, California, showing one season of growth. Photo by Nathanael Stanek and Turtle Conservancy.



**Figure 6.** Female (*top*) and male (*bottom*) Southwestern Pond Turtles, *Actinemys pallida*, from the Chimineas Mountains, San Luis Obispo County, California. Photos by David J. Germano.

secondary sexual characteristics by 110 mm or smaller; however, because females retain juvenile characteristics even when reproductive, any turtle <120 mm SCL that lacks adult characteristics and does not have eggs should be considered a juvenile. Generally, adult turtles range in size from 130–180 mm SCL (Lovich and Meyer 2002; Germano and Rathbun 2008; Germano and Riedle 2015). Hatchlings (Fig. 4) are 20–36 mm SCL (Holland 1985a; Lovich and Meyer 2002; Valdez-Villavicencio et al. 2016a). Like many other turtle species, young *A. pallida* add concentric rings of scute material each year as juveniles grow (Fig. 5), which ceases around maturity.

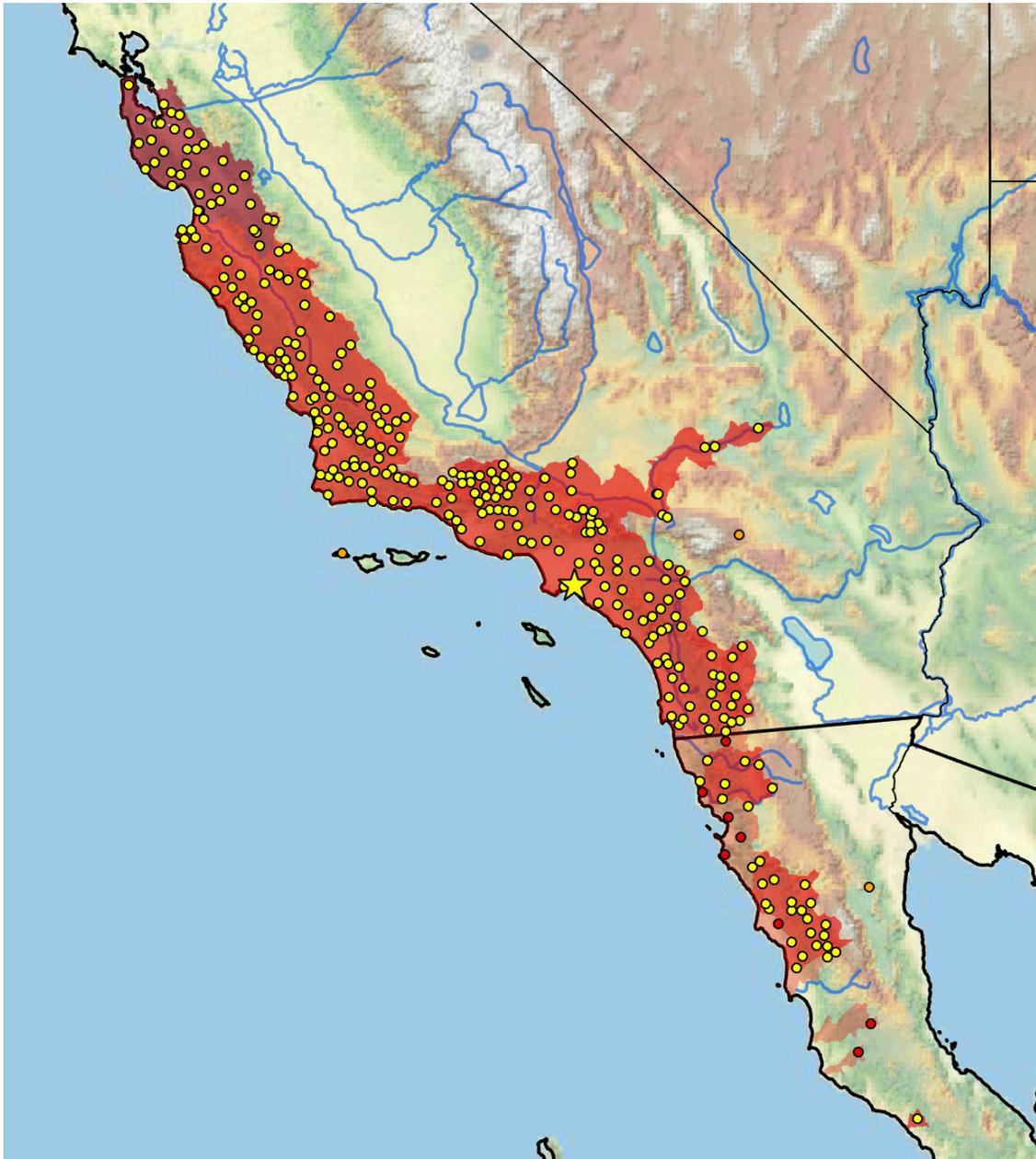
The shell is low and broad, generally widest posterior to the middle (across the 8th marginal). The carapace in adults is smooth and lacks a keel or serrations. Vertebral scutes are broader than long, and the first touches four marginals and the nuchal (Carr 1952; Ernst and Lovich 2009). Kyphosis has been seen in two turtles in a Baja California population (Valdez-Villavicencio et al. 2024). The hind foot is webbed to the base of the claws (Ernst and Lovich 2009).

Males differ from females in size, shell, and soft-body characteristics. Males have a concave plastron in the femoral region, while the plastron in females tends to be flat (Figs. 2–3). When the tail is extended, the cloaca is usually posterior to the edge of the carapace in males, but usually at or anterior to the margin in females. In males, the tail is thicker, the head



**Figure 7.** Comparison of heads of male Southwestern Pond Turtles, *Actinemys pallida*, from (*top*) the Santa Rita Ranch, San Luis Obispo County, California, (*middle*) the Sweetwater River, San Diego County, California, and (*bottom*) Arroyo San Rafael, Baja California. Note that all retain reticulation patterning on side of the heads, similar to females. Top and middle photos by David J. Germano, bottom by Jorge H. Valdez-Villavicencio.

slightly larger, and the snout more angular than in females. Unlike the congener *A. marmorata*, in which males usually have light-colored throats, most male *A. pallida* have a brown or yellow-brown throat with moderate to extensive flecking, similar to females (Fig. 6). This is the same patterning and coloration seen in juveniles. There is variation in head coloration in male *A. pallida* (Fig. 7), but chin patterning is still similar to females. Whether this difference in male head coloration and patterning is consistently different between the species has not been quantified. Turtles in Alameda, Contra Costa, Santa Clara, and Santa Cruz counties at the northern edge of the range exhibit intermediate characteristics of male head coloration and patterning or show characteristics more typical of *A. marmorata*. At a coastal site (Germano and Rathbun 2008) and a mountain site (Germano and Riedle 2015), the average and upper decile carapace lengths did not differ significantly between males and females, but average



**Figure 8.** Estimated historical indigenous distribution of *Actinemys pallida* in California, USA, and Baja California, Mexico. Yellow dots = museum and current and historical occurrence records of presumed native populations based on literature and online records (TTWG 2025); orange dots = probable non-native introductions, translocations, or erroneous records; red dots = apparently extirpated populations; star = type locality. Colored shading = estimated historical indigenous range (dark red = extant; light red = apparently extirpated; purple = approximate area of partial hybridization with *A. marmorata*). Distribution is based on fine-scaled GIS-defined level 12 HUCs (hydrologic unit compartments) constructed around verified localities and then adding HUCs that connect known point localities in the same watershed or physiographic region, and similar habitats and elevations as verified HUCs, and further adjusted based on data from the literature and the authors. Map by Chelonian Research Foundation.

female SCL was significantly larger (144 mm) than that of males (137 mm) for a population from the Mojave Desert (Lovich and Meyer 2002). The largest size of males was 179 mm SCL at both the coastal and mountain site but 162 mm SCL (coastal) and 164 mm (mountain) for females. In the Mojave River region, maximal size was 155 mm SCL for males and 160 mm for females.

**Distribution.** — *Actinemys pallida* occurs from northern Baja California, Mexico, north through the

Coast Range to Monterey Bay, California, south of San Francisco, USA (Fig. 8) (Legler and Vogt 2013; Spinks et al. 2014; TTWG 2021, 2025). The northern and southeastern range boundaries are uncertain, because turtles in the San Francisco Bay Area and along the southern edge of the Transverse Range in Los Angeles County have both species and an admixture of both *pallida* and *marmorata* genes (Spinks et al. 2010; USFWS 2023). Pure *A. pallida* occur from the southern end of Monterey

Bay south into Baja California (Spinks et al. 2014). The species occurs in the Inner Coastal Range separating *A. pallida* from *A. marmorata* in the San Joaquin Valley and along the southern drainages of the mountains at the southern end of the valley. Baja California turtles are found in the northwestern region south to El Rosario (Smith and Smith 1979; Welsh 1988; Lovich et al. 2007; Valdez-Villavicencio et al. 2016b, 2025; Peralta-Garcia et al. 2023a). Isolated populations occur in the Mojave River in the western Mojave Desert, California (LaRivers 1942; Banta 1963; Lovich and Meyer 2002; Lovich et al. 2021) and the Central Desert of Baja California (Valdez-Villavicencio et al. 2016b, 2025).

**Habitat and Ecology.** — *Actinemys pallida* occurs in a variety of permanent and intermittent aquatic habitats, including rivers, streams, lakes, ponds, marshes, vernal pools, and human-constructed ponds associated with wastewater and cattle watering-tanks (Fig. 9) (Goodman 1997a; Pires 2001; Germano and Rathbun 2008; Bury and Germano 2008; Germano and Riedle 2015; Nerhus 2016; Tu and Trulio 2022). The species has been recorded from sea level up to ca. 1,240 m (4,080 ft) in elevation (in Ventura County, California).

Prior to human settlement, there were few natural ponds or lakes within the range of the species, although it occurs in back-dune ponds in coastal sand-dune complexes in central California. The species usually occurs in streams, rivers, and artificial small ponds. Because the range of *A. pallida* has a Mediterranean climate (mild, wet winters; dry, hot summers), many natural watercourses and ponds are intermittent or exhibit greatly reduced flows in late summer. Although considered an aquatic species, this turtle may spend considerable time on land every year. Based on radio-tracking studies along the central coast of California, some turtles remain on land up to 7 months out of each year (Rathbun et al. 2002; Pilliod et al. 2013). They may estivate in dry marshes, woodland, and scrub under leaves, logs, and dead grasses (Goodman 1997a; Nerhus 2016). Some travel up to 200 m from water (Nerhus 2016). Turtles may also travel across terrestrial habitats at distances >1 km from water (Bury et al. 2012). Habitats with abundant basking sites, underwater refugia, and standing or slow-moving waters are conditions preferred by this species (Bury et al. 2012). Turtles in streams often take refuge in plunge pools, perhaps because these pools provide deep water for escape and lack swift currents. Turtles aggregate in these microhabitats at densities often several times that observed in swifter moving sections of water.

**Diet.** — The species is omnivorous and a dietary generalist (Holland 1985a; Holland 1985b; Bury 1986; Goodman and Stewart 1998), feeding on the larvae of dragonflies, mayflies, stoneflies, caddisflies, midges, beetles, and other insects, as well as crayfish and other aquatic invertebrates. Native fishes and anurans also are

eaten, but these are minor items (<10%) in the diet and may represent animals scavenged when dead or weakened (Holland 1985a). Further, turtles may eat small to large amounts of vegetation, including filamentous green algae, tule and cattail roots, water lily pods, and alder catkins (Holland 1985a). *Actinemys pallida* can employ neustophagia (modified gape-and-suck feeding) to obtain small prey items (such as *Daphnia*) off the water surface or in the water column (Holland 1985b).

**Behavior.** — Basking sites of *A. pallida* can become crowded with turtles and, at these times, turtles may display aggressive interactions (pushing, open-mouth gestures, biting) among all size and sex classes (Bury and Wolfheim 1973; Holland 1985a). As with *A. marmorata* in the wild, *A. pallida* is usually wary and secretive. Most individuals rapidly depart basking sites when disturbed by either visual or auditory stimuli by people (e.g., waving an arm, shouting) at distances >100 m. When resting or hiding, turtles often seek refuge under rocks, boulders, and root masses, or below undercut banks, where they wedge themselves into the most inaccessible crevices available. Turtles disturbed in shallow water often remain motionless or attempt to hide in or under floating vegetation or occasionally dig into the substrate.

*Actinemys pallida* occupies relatively small home ranges in stream habitats and moves over large areas in other habitats (Goodman and Stewart 2000). In a coastal stream in central California, some turtles moved 1–2 km up the stream between May and August (Rathbun et al. 1992). In a southern California site, Goodman and Stewart (2000) reported that turtles moved up and down a stream from 0.66 to 4.26 km (mean = 1.27 km) and at a river site from 32 to 966 m (mean = 335.2 m). Including the width of the water course, the home range size at the stream site varied from 0.66 to 4.56 ha (mean = 1.34 ha) and was 0.29 to 7.28 ha (mean = 3.06 ha) at the river site. In an upper tributary stream to the Rio Santa Domingo in Baja California, 33 *A. pallida* recaptured >1 yr apart had moved up to 1.6 km downstream and 2.3 km upstream, averaging a net upstream movement of 240 m (Jones et al. 2024).

*Actinemys pallida* overwinters either by remaining in water or moving to upland areas. Although some turtles may be active on a year-round basis, others may seek overwintering sites in October–November and re-emerge in March–April. Turtles have been found in the fall inside a rock crevice above a pool of water (Holland and Goodman 1996). In flowing-water habitats, they often leave the watercourse in late fall and move up to 480 m into upland habitats, where they burrow into leaf litter, usually under trees or shrubs (Rathbun et al. 1992; Goodman 1997a; Davis 1998; Pilliod et al. 2013) and some return to ponds (Davis 1998). Further, they may emerge from these sites to bask on warm days and may move among several overwintering sites over the course of several months (Rathbun et al. 1992; Davis 1998). Turtles will move to upland sites when



**Figure 9.** Habitats supporting Southwestern Pond Turtles, *Actinemys pallida*, in California, USA, and Baja California, Mexico. *Upper Left:* Cattle tank in Chimineas Mountains, San Luis Obispo County, California. *Upper Right:* Pond in Tehachapi Mountains near Gorman, Los Angeles County, California. *Middle Left:* Pond in coastal dunes on the Vandenberg Air (Space) Force Base, Santa Barbara County, California. *Middle Right:* Stream in San Diego County, California. *Lower Left:* Marsh habitat at the San Joaquin Freshwater Marsh Reserve, Orange County, California. *Lower Right:* Stream at San Antonio Murillos, Baja California. All photos by David J. Germano, except lower right by Jorge H. Valdez-Villavicencio.

water disappears in streams (G. Rathbun, pers. comm.) or ephemeral ponds and may stay out of water up to half the year (Pilliod et al. 2013).

*Growth and Sexual Maturity.* — In a coastal stream site in central California, hatchlings increased 100–150% in SCL up to a mean of 49.5 mm in their first year and some turtles reached 115–120 mm SCL in their 5th or 6th year (Holland 1985a). In coastal ponds in central California, adult turtles grew quickly (Germano and Rathbun 2008).

Males grew faster than females, with males reaching 120 mm SCL in 3.6 yrs on average versus 4.1 yrs for females, and males reached 150 mm SCL in 8.3 yrs and females took 11.1 yrs on average to reach that size (Germano and Rathbun 2008). Females were found with eggs at 4–7 yrs of age and the smallest female with eggs was 139 mm SCL (Germano and Rathbun 2008). At a mountain pond, both males and females took 4.4 yrs on average to reach 120 mm SCL, but males reached 150 mm SCL in about 8 yrs

and females required about 10 yrs on average to reach that size (Germano and Riedle 2015). Most females >8 yrs old were gravid and the smallest female with eggs was 134 mm SCL (Germano and Riedle 2015). The smallest female with eggs was 133 mm SCL at the Mojave River (Lovich and Meyer 2002).

**Population Structure.** — Like most turtle species, ages of young *A. pallida* can be determined by counting scute annuli (Germano and Bury 1998). Annuli are countable for 6–12 yrs in *A. pallida* (Bury and Germano 1998; Germano and Rathbun 2008; Germano and Riedle 2015). Mark-recapture is the only current way to determine the age of older individuals. Adult *A. marmorata* may reach an age of more than 50 yrs in the wild, but these old adults are rare (Bury et al. 2019). No data on longevity exist for *A. pallida*, but some adults are likely to live as long as *A. marmorata*. At a site studied by Brock (2009), mean annual survival estimates for males was 66.7% (range of values, 54.5–77.1%), for females 83.0% (74.4–89.1%), and for juveniles 87.5% (76.3–93.9%). These values were much higher at another site studied by Germano and Riedle (2015): 87.6% (80.4–93.0%) for males, 93.0% (85.5–96.5%) females, and 99.4% (98.8–100%) juveniles. The relative proportion of old turtles in most populations appears low (Germano and Bury 2001) with 47–60% of turtles <14 yrs old in one population (Germano and Riedle 2015) and 74% <12 yrs and 41% <5 yrs old at another site (Germano and Rathbun 2008). Sex ratios of *A. pallida* populations vary from 1:1 (Lovich and Meyer 2002; Goodman 1997a; Nerhus 2016) to significantly male-biased (Holland 1985a; Germano and Rathbun 2008) or significantly female-biased (Goodman 1997a; Germano and Riedle 2015), depending on the location.

Shell size distributions of *A. pallida* vary among sites, and small turtles (<120 mm SCL) occur at almost all sites in California: Pico Pond in San Luis Obispo County, SCL varied from 32.1–165.7 mm (Holland 1985a); along the Mojave River in San Bernadino County, SCL ranged from 117–160 mm (Lovich and Meyer 2002); Vandenberg Air (Space) Force Base in Santa Barbara County, 86–179 mm (Germano and Rathbun 2008); Gorman Pond in Los Angeles County, 55–179 mm (Germano and Riedle 2015); and at the San Joaquin Freshwater Marsh Reserve in Orange County, 32–166 mm (Nerhus 2016). Except for the Mojave River site, the percentage of juvenile turtles (<120 mm SCL) varied from 16.2–63.3% (Goodman 1997a; Germano and Rathbun 2008; Brock 2009; Germano and Riedle 2015; Nerhus 2016). At the Mojave site, none of the 37 *A. pallida* caught were <117 mm SCL (Lovich and Meyer 2002). The age of turtles shows that some turtles >120 mm SCL are not old. At the Vandenberg site, where only 16.2% of turtles caught were <120 mm SCL, 40.8% were ≤5 yrs old (Germano and Rathbun 2008) with 2 and 3 yr-old turtles captured. At Gorman Pond, the percentage of young turtles (0–5 yrs old) was 22.2% in 2007 and 35.0% in 2010 (Germano and Riedle 2015).

In Baja California, Jones et al. (2024) only found one site (San Faustino) with turtles reaching 160 mm SCL (67–160 mm CL,  $n = 48$ ). Shell size distributions of other Baja California sites were small (Valdez-Villavicencio, unpubl. data): in an upper tributary stream to the Rio Santo Domingo, SCL varied from 45–135 mm ( $n = 486$ ; Jones et al. 2024); at Arroyo Santo Tomas, SCL varied from 51–131 mm ( $n = 72$ ); Arroyo San Vicente, 45.3–144 mm ( $n = 44$ ); Arroyo San Rafael, 23.5–149 mm ( $n = 206$ ); Arroyo San Antonio Murillos, 43–139 mm ( $n = 230$ ); and in Oasis San José, 94–134 mm ( $n = 36$ ).

**Parasites and Predators.** — In Baja California, leeches (*Helobdella* sp.) occur on turtles at different localities, attached to legs, groins, neck, and carapace (Valdez-Villavicencio, unpubl. data). External leeches and internal nematodes have been found in the congener *A. marmorata* (Ingles 1930; Thatcher 1954; Bury 1986; Reilly et al. 2023), although external parasites are rare. Hundreds of nematodes may occur in the intestine of a single individual *A. marmorata* (Bury 1986).

Potential mammalian predators of either *Actinemys* species include Northern Raccoons (*Procyon lotor*), Gray Foxes (*Urocyon cinereoargenteus*), Coyotes (*Canis latrans*), and Black Bears (*Ursus americanus*). The Great Egret (*Ardea alba*) is a known predator of *A. pallida* (Germano and Buchroeder 2018), and other avian predators may include Bald Eagles (*Haliaeetus leucocephalus*), Ospreys (*Pandion haliaetus*), and Great Blue Herons (*Ardea herodias*; Holland 1985a).

Introduced American Bullfrogs (*Lithobates catesbeianus*) are predators on young turtles (Moyle 1973; Nussbaum et al. 1983), but their effect on populations is not well understood (see also Nicholson et al. 2020). Many of these frogs and turtles often co-exist (Germano and Bury, pers. obs.). Largemouth Bass (*Micropterus salmoides*) also are often implicated as a threat to recruitment of young *A. pallida* (e.g., Manzo et al. 2021; USFWS 2023); however, no studies have shown that *M. salmoides* eat young *A. pallida*.

A Population Viability Analysis (PVA) indicated that *L. catesbeianus* and *M. salmoides* are a high-ranking threat to *A. pallida* (Manzo et al. 2021), but the analysis relied on anecdotal predation only by *L. catesbeianus* on hatchling turtles and did not have experimental evidence that this predation affects population stability. In Yosemite National Park in California, however, eradicating bullfrogs led to an increase in smaller sized *A. marmorata*, including hatchlings (Woodruff et al. 2025), and at a creek in San Diego County, removal of *L. catesbeianus* led to increased numbers of hatchling *A. pallida* in the population (R. Fisher, pers. comm.). Also, no small turtles were caught during trapping from 2022 to 2025 at a small reservoir in San Luis Obispo County with large *M. salmoides*, although 17 of 51 (33%) turtles captured were 4–9 yrs old (Germano, unpubl. data), indicating some recruitment was occurring. Whatever the

effect of these predators, it will be important to determine ages of turtles to correctly assess the survivorship curve for a population.

**Thermoregulation.** — Like most temperate aquatic turtle species, *A. pallida* will bask on logs, vegetation, rocks, and mud banks to raise its body temperature (Holland 1985a; Goodman 1997a; Germano, pers. obs.). The activity cycle of *A. pallida* is largely determined by temperature (Rathbun et al. 2002). The species becomes most active when water temperatures are  $>15^{\circ}\text{C}$ . Turtles may be active year-round in warmer areas, but on a reduced level in late fall and winter. During atmospheric basking, adult turtles elevate and maintain body temperatures near  $32^{\circ}\text{C}$  through a repertoire of thermoregulatory behaviors (Bury 1979; Holland 1985a). In *A. marmorata*, turtles expose the shell to direct sun (heating) and then may dunk the head, limbs, or entire body in water for cooling as well as rotate the body axis, extend or retract the head and/or limbs, and change time of emergence (Bury 1972). *Actinemys pallida* may also raise its body temperature by floating in the warm upper layer of water (Holland 1985a), by burying themselves in warm sand (Rathbun et al. 2002), and under algal mats that are much warmer than the surrounding water (G. Rathbun, pers. comm.). In regions such as the San Joaquin Valley of California, *A. marmorata* appears to remain in water and not bask once summer arrives (Bury et al. 2012), although this has not been recorded for *A. pallida*.

The temperature of egg development affects sex determination in many species of chelonians (Vogt and Bull 1982), and eggs of *A. marmorata* exposed to high temperatures ( $>27^{\circ}\text{C}$ ) result in female hatchlings (Ewert et al. 1994; Geist et al. 2015; Christie and Geist 2017). Presumably, eggs of *A. pallida* have a similar response. Some female *A. pallida* display nesting-area fidelity (Goodman 1997a). Females are noted for long overland treks to deposit eggs, moving as much as 457 m away from water and up to 90 m in elevation above it (Rathbun et al. 1992; Nerhus 2016; Alvarez and Del Vecchio 2024); however, most nests are within 50 m of water (Holland 1986a; Goodman 1997a; Bury et al. 2012).

**Reproductive Biology.** — Courtship and mating behavior generally extend from March to September (Holland 1988), although Goodman (1997a) found a pair in courtship rituals in early November. Mating occurs in water; two pairs of *A. pallida* were found mating in streams in Baja California in March (Valdez-Villavicencio et al. 2016a). Females have been found with eggs from late April to late July (Lovich and Meyer 2002; Scott et al. 2008; Germano and Riedle 2015). Clutch size varies from 2–11 eggs, and mean clutch size is from 4.5 to 6.3 eggs, depending on location and female size (Rathbun et al. 1992; Goodman 1997a; Pires 2001; Lovich and Meyer 2002; Germano and Rathbun 2008; Germano and Riedle 2015). Females can produce two clutches in one season (Goodman 1997b; Pires

2001; Lovich and Meyer 2002; Germano and Rathbun 2008), and some may produce three clutches (Germano and Riedle 2015). At Gorman Pond where females were caught in traps, 18% of females in 2007 and 2010 double-clutched (Germano and Riedle 2015), whereas at coastal creeks in San Luis Obispo County, 41% of females followed by radio telemetry over 3 yrs produced two clutches in a year (Scott et al. 2008). The percentage of double clutching at this site could be as high as 61% if incomplete clutch records are included (Scott et al. 2008).

Eggs of *A. pallida* are off-white in color, elliptical-oval in shape, and range from 18–24 mm in diameter (Goodman 1997a, Pires 2001), but egg lengths were not recorded in these studies. Mean lengths and widths of *A. pallida* eggs ( $n = 6$ ; referred to as *A. marmorata*) from San Luis Obispo, California, were 37.3 and 19.1 mm, respectively (Congdon and Gibbons 1985). The eggshell is hard and has a bone-china texture. The time from ovulation of eggs to deposition in a nest is unknown. Incubation of eggs in the nest varies from 94–122+ days in the wild (Goodman 1997a). Hatchlings may overwinter in the nest (Ultsch 2006; Rathbun et al. 2002; Janzen et al. 2018); however, it is unclear if the eggs hatch in the fall and young do not emerge (e.g., due to dry conditions) or whether hatching and emergence happens the following spring. A nest along the Mojave River was flask-shaped and about 7 cm deep (Lovich and Meyer 2002).

**Population Status.** — Although *A. pallida* has benefited from increased aquatic habitats due to construction of stock tanks and other standing waters created by people over the last century, populations of turtles in southern California from the Mexican border up to Ventura occur now only in isolated clusters of aquatic habitats (Brattstrom 1988). Predictably, humans are drawn to such aquatic habitats, especially in the summer. Further, these populations are now separated by inhospitable, developed areas of cities and roads (Nicholson et al. 2020). Although there were 80 known localities of *A. pallida* in southern California (Ventura County to the Mexican border) in 1960, there remained only 53 sites in 1987, 25 of which were in Ventura County (Brattstrom 1988). A resurvey in 2000 of 18 of the 20 sites that Brattstrom thought were reproductively viable found that only 8 still supported *A. pallida* (Fisher 2003), although several new populations have been found elsewhere. The number of occupied sites north of Ventura County to Monterey is unknown, but the human population density is much lower there than in southern California until reaching the San Francisco Bay Area (Santa Clara and San Mateo counties). There is, however, agricultural development in river valleys in this region. Much of this northern part of the range of *A. pallida* is open rolling hills or oak woodland, used for cattle grazing and not open to public use.

In Baja California, there were 18 known localities of *A. pallida* in 2007. In 2016, a new population was reported

(Valdez-Villavicencio et al. 2016b), and by 2019 there were up to 23 locations of turtles (Valdez-Villavicencio et al. 2025, unpubl. data). The last surveys completed in 2023 included 27 known locations on 10 watersheds, including seven historical sites that still support turtle populations (Valdez-Villavicencio et al. 2025). Although extirpated from some historical localities, the detection of new records suggests that turtles still occur in most rivers in foothills and mountains in Baja California away from human habitation.

Populations of *A. pallida* can reach high densities, but these are few. Goodman (1997a) caught 82 individuals in creeks and ponds at Chico Hills State Park and 239 in the west fork of the San Gabriel River in the early 1990s, Germano and Rathbun (2008) caught 179 individuals in two years in the mid-1990s at several coastal ponds at Vandenberg Air (Space) Force Base, and Lovich and Meyer (2002) found 37 in the Mojave River in 1998 and 1999. Holland (1985a) marked 315 turtles over 4 yrs in a coastal stream and pond in central California covering 8 ha. At a marsh site in Orange County, Nerhus (2016) caught 236 individuals from 2008–2012 and estimated the population size as 284–320 turtles. In 2007 and 2010, Germano and Riedle (2015) caught 321 individual *A. pallida* in a 1.3 ha pond in the Tehachapi Mountains. In two days in 2014, Valdez-Villavicencio et al. (2016b) caught 10 individuals in a pond in Baja California and saw another 7 in a creek upstream from the pond. Other localities still reach high densities, such as an upper tributary stream to the Rio Santo Domingo with densities of 134.5 turtles in 2016 and 174.7 turtles/river-km in 2017 (Jones et al. 2024).

Based on turtles caught in a coastal central California site (Holland 1985a), the density of *A. pallida* was about 39 turtles/ha. At a 1.3 ha mountain pond, Germano and Riedle (2015) estimated density of 247 turtles/ha. Although somewhat anomalous because of its extremely small size (about 0.2 ha when full), 57 individual turtles were caught in two years at a spring-fed cattle tank in the Chimineas Mountains, San Luis Obispo County, giving a density of 285 turtles/ha (Germano, unpubl. data). No other larger water bodies occur within 1 km of this site. In some cases, turtle densities can be overestimated if turtles are caught when waters were drying up (concentrating turtles into remaining small pools or ponds), especially late in the activity season or in drought years. Populations of turtles, in these cases, were likely more dispersed when more water area was present earlier in the year. The largest populations of *A. pallida* occur in Mediterranean-climate areas that have warm to hot summers, but the same conditions often result in scarce surface water due to increased evaporation rates and lack of precipitation in a relatively long dry season. In most areas, the species occurs in disjunct populations over large areas (e.g., aggregations of turtles along long segments of rivers and streams or in isolated ponds or lakes).

A recent range-wide Population Viability Analysis (PVA) model of *A. pallida* by Gregory et al. (2024) predicted a 57.8% mean range-wide probability of its extinction by the end of the century. This and another PVA (Manzo et al. 2021) made many assumptions that may not be totally accurate, especially about survivorship estimates. We recommend further research to evaluate outcomes estimated by these PVAs.

**Threats to Survival.** — Unlike *A. marmorata* (see Bettelheim and Wong 2022), there are no reports of commercial harvesting of *A. pallida* for food. Some may be collected illegally for food but in limited areas. Mostly in the past, many *A. pallida* were likely to have been taken from the wild for pets, especially in southern California. In the early 1960s, one of us (Bury) was asked by a reptile dealer in southern California to help collect this species. When asked for an approximate number to collect, the dealer replied that they had just exported 500 individuals of this species to Europe and they needed that many additional turtles to fill orders. Collecting is now greatly reduced due to protective regulations. Removal of turtles from the wild may still occur in streams at lower mountain elevations where people recreate, although there are no estimates of its impact on populations.

As with many turtle species in the world, habitat destruction and alteration are the primary threats to the continued survival of *A. pallida*. The use of mowing equipment next to aquatic habitat can kill or injure hatchlings and adults (Alvarez et al. 2017), and removal of algae in ponds using mechanical harvesters can entrap turtles (Alvarez et al. 2021). Water development projects have changed the location, flow, and use of water across much of the range of *A. pallida*, especially in southern California. The human population in 2023 was 12.5 million people in the Los Angeles Metro region. This includes 9.8 million in Los Angeles County, the highest density for a county in the U.S. The immense increase in the human population since the 1950s has left almost no habitat in southern California outside of water bodies in hills and mountains. Populations of turtles have fared better from Santa Barbara north because of fewer people.

In Baja California, the overuse of water is one of the main threats. Water irrigation in agricultural areas across the range of *A. pallida* is decreasing water levels in streams and leading to the loss of ponds. In most watersheds, there is no running water near the coast, and in some cases up to 20 km inland, due to the presence of a large number of ground water pumps and surface pipes to deliver water across the agricultural landscape (Valdez-Villavicencio et al. 2025). Some historical sites no longer have surface water, so appropriate habitat is unavailable, and turtles are no longer present.

Climate change may have a significantly detrimental effect on *A. pallida* if small, ephemeral water bodies dry sooner in the year or stay dry over several years compared

to what occurred previously. A population of *A. pallida* at the edge of the Mojave Desert suffered severe losses and may have gone extinct because of prolonged drought from 2012–2015 and a fire in 2013 surrounding a lake (Lovich et al. 2017). At a pond about 40 km to the northwest, however, the same drought lowered the population size considerably, but adult and new juvenile turtles were still found, and reproduction was evident when trapping occurred in 2017, 2019, 2020, and 2023 (Germano, in press). A Population Viability Analysis indicated that a drying climate in the range of *A. pallida* could severely affect the species (Manzo et al. 2021). Rainfall was above average throughout the range of *A. pallida* in winter 2022–2023 and 2023–2024, and sites with *A. pallida* need to be revisited to determine if populations have responded to these wetter conditions.

Based mostly on correlations of measured body sizes, Nicholson et al. (2020) suggested that female-biased road mortality and predation on small turtles by non-native bullfrogs, *L. catesbeianus*, may be occurring and causing shifts in sex ratios and body sizes of turtles in affected populations. Roads and vehicle mortality negatively impact turtle populations in many regions (Steen et al. 2006; Boyle et al. 2021), and female *A. pallida* spend time on land when nesting and in many populations turtles overwinter on land (Bury et al. 2012).

The effect of roads on turtle populations may depend on road configuration and orientation relative to occupied habitats. A population of *A. marmorata* at 5-Mile Slough in the San Joaquin Valley, however, is directly adjacent to a two-lane state highway, yet there is a large turtle population there with abundant young (Germano 2021). Another site adjacent to a two-lane paved road in the Tehachapi Mountains in southern California has a population of *Actinemys* with many young turtles and females significantly outnumbering males (Germano and Riedle 2015). Additional evidence of the potential detriment of roads near *Actinemys* populations is needed. Further, although small *Actinemys* have been found in the stomachs of *L. catesbeianus* at some sites (Moyle 1973; Nussbaum et al. 1983; Nicholson et al. 2020), that does not necessarily mean that there is a significant deleterious population effect on *A. pallida* at sites with bullfrogs.

Other impacts can have local effects on *A. pallida*. Fire can cause mortality in turtles overwintering in terrestrial habitats, but this may be rare as overwintering mostly occurs during the rainy season. If turtles exit water bodies before rains arrive in the fall, many could die if a fire occurs during these typically dry times, even though most turtles bury themselves under duff or other detritus. Turtles are sometimes deliberately shot by people while basking or are inadvertently caught while fishing. They are also threatened by predators and competitors in some situations, especially urban waters. Raccoons can be a particular problem to adult turtles in situations where turtle habitat occurs in or close to urban environments

because of artificially high Raccoon populations associated with supplemental food from human habitations and the reduction of Coyote populations, which feed on adult Raccoons (G. Rathbun, pers. comm.).

Cummings et al. (2022) reported that 74% of turtles in the *A. pallida* population along the Mojave River had shell injuries; however, it is unknown if this results in reduced survival. The introduction and spread of the Red-eared Slider (*Trachemys scripta elegans*), a potential competitor, is occurring in California (Spinks et al. 2003; Patterson 2006; Lambert et al. 2019) and Baja California (Peralta-García et al. 2023b) but impacts to *A. pallida* populations are unknown. We have seen Red-eared Sliders only in waters associated with humans. Sliders (and other introduced eastern North American species) are not adapted to arid environments, and they probably cannot disperse away from human-associated sites because they likely cannot survive in the intermittent seasonal streams and ponds that *Actinemys* use.

Recently, Lambert et al. (2021) found Pond Turtle Shell Disease (caused by *Emydomyces testavorans*) in a Pond Turtle population near San Francisco, as did Green et al. (2025) and White et al. (2025) at six sites in the San Francisco Bay Area. This is an emerging infectious fungal disease that causes what is described as shell-devouring destruction in *Actinemys*. In recent years, many *A. marmorata* (up to 60%) had the disease in Washington State, and almost all were head-started (Haman et al. 2019). The extent of this condition is unknown in other populations of *A. pallida*, and needs assessment.

**Conservation Measures Taken.** — The U.S. Forest Service and the U.S. Bureau of Land Management list *A. pallida* as Sensitive. Both *A. marmorata* and *A. pallida* are Species of Special Concern in California (Thomson et al. 2016) and are under review for listing as Threatened under the U.S. Endangered Species Act (US ESA) at the Federal level (USFWS 2015). The U.S. Fish and Wildlife Service, after consulting with experts of both species, has conducted a Species Status Assessment (USFWS 2023).

*Actinemys pallida* has recently (2024) been assessed as Endangered (EN A2ce+4ce, E) on the IUCN Red List of Threatened Species, but this has not yet been officially published (Germano et al., in press). It was previously assessed as Vulnerable in 1996 as part of *A. marmorata* (TFTSG 1996), and provisionally assessed as Vulnerable by the IUCN SSC Tortoise and Freshwater Turtle Specialist Group in 2011 (Rhodin et al. 2018).

Surveys of distribution have covered many aquatic habitats in Baja California (Lovich et al. 2009; Hollingsworth et al. 2015), which aids locating areas for potential protection. Because of an extensive wildfire in 2020 in the San Gabriel Mountains north of Los Angeles, biologists from federal and state agencies, and from academic and private groups, temporarily removed many *A. pallida* from a river system to protect the turtles from expected mud flows (San Diego Zoo 2020).

Public and agency interest remains high for Pond Turtles. In the early 1990s, there were efforts to foster communication and coordinate research on the species, including several meetings held across its range (Bury, pers. comm.). Activities fell off until a resurrection in the 2010s, when a Turtle Working Group on *A. marmorata* was started in Oregon and now has three regional chapters plus a new one in northern California. Also, a regional working group has been initiated for *A. pallida*. The primary goal of these working groups has been to develop a strategic plan for the conservation of Pond Turtles. Members of these groups published a protocol for surveying of *A. pallida* (USGS 2006a, 2006b), a handbook on both species including sampling protocol, summary of ecology, and management considerations (Bury et al. 2012), a field guide for management (ODFW 2015), and a system to record visual surveys of *A. marmorata* in Oregon (ODFW 2020). Workshops with 110+ attendees on the biology and status of Pond Turtles sponsored by the San Francisco Bay Area Chapter of The Wildlife Society was held in 2005 and 2015 at California State University Sonoma and in 2025 at the Oakland Convention Center in northern California. The Association of Zoos and Aquariums (AZA) is coordinating efforts for Western Pond Turtles through their S.A.F.E. (Saving Animals From Extinction) program. Earlier, they held organizational meetings and developed an action plan (AZA 2019).

**Conservation Measures Proposed.** — Both *A. marmorata* and *A. pallida* remain under consideration for listing as Threatened at the Federal level under the U.S. Endangered Species Act (US ESA). This is part of a special review for “Long-Term Actions.” Decisions on their status are possibly expected sometime in the next year (USFWS 2025).

We believe that conservation efforts need to focus primarily on protection of turtles in their native habitats. A program is needed to locate and protect the few remaining large populations in southern California and Baja California. Then, habitats need to be enhanced by adding basking logs and protecting nesting areas that are usually nearby these concentrations of turtles. Also, invasive wild Pigs (*Sus scrofa*) may pose an increasing threat to *Actinemys* populations because their numbers are increasing in the range of the turtle and they tear up the ground searching for items to eat. We have seen them crossing through habitat for turtles and they likely destroy turtle nests. Their numbers need to be lessened severely within areas that include turtle populations. The California Department of Fish and Wildlife provides information about managing this invasive species (<https://wildlife.ca.gov/Conservation/Mammals/Wild-Pig>). Similarly, although a native species, Raccoons destroy turtle nests and can eat adult turtles; reducing their numbers likely will benefit *Actinemys* populations.

There have been attempts to translocate the species away from construction projects, but none of the results of these

mitigation efforts have been published. This practice needs scrutiny because freshwater turtles that are translocated often attempt to home back to their natal areas (Ernst and Lovich 2009). Translocated turtles are known to return to the original site (L. Hunt, unpubl. data), which subjects them to increased stress and the likelihood of mortality as they cross roads and landscapes. Also, this practice may mix stocks of genetically differentiated forms. Many attempts to translocate amphibians and reptiles have proven ineffective as conservation strategies (Dodd and Seigel 1991). It is imperative to rigorously monitor the results of these efforts to evaluate the potential effectiveness or ineffectiveness of this mitigation strategy.

We suggest that evidence is relatively weak implicating bullfrogs, *L. catesbeianus*, and bass, *M. salmoides*, as posing a significant or major threat to populations of *Actinemys*. Although small *Actinemys* have been found in the stomachs of *L. catesbeianus* at some sites, that does not necessarily mean that there is a significant deleterious population effect on *A. pallida* at such a site (but see Nicholson et al. 2020). We note that in many areas of California, *Actinemys* occurs together with native Red-legged Frogs (*Rana draytonii*), such as at Vandenberg Space Force Base, where Pond Turtles in large numbers occur in ponds with these frogs. *Rana draytonii* is not as large as *L. catesbeianus*, but is large enough to eat small *A. pallida*. Further, some recent studies investigating the diet of bullfrogs in southern California have found no turtles in their stomachs (Smith 2023; Smith et al. 2024; van Neer 2025). Also, there are no publications that have found *Actinemys* in the stomachs of *M. salmoides*.

To demonstrate population effects of frogs and large fish on populations of *Actinemys*, rigorous studies need to be conducted to determine the extent of harm to populations of turtles. We suggest one study of bullfrogs and another for fish. For either one, sites with turtles, and with and without bullfrogs or bass should be chosen, and these sites need to be replicated. Estimates of abundance of the non-native predators need to be made. Turtles would need to be trapped multiple times from May to July to determine size and age structures, and level of reproduction and age at maturity of females. Turtle population parameters need to be compared with and without predators. Woodruff et al. (2025) conducted a study partially fulfilling these parameters (two sites with and without bullfrogs) and found a positive effect on the turtle population of removing frogs. More studies need to be conducted, however, because removing bullfrogs from sites will take tremendous effort and resources. It may be that bullfrog eradication may only be required in certain habitats or isolated wetlands, but not everywhere.

Similarly, although roads have been implicated in turtle population harm in some eastern North American turtle populations, the impact to *Actinemys* is relatively unknown. Studies should be undertaken to determine the effect of

roads on adjacent and nearby *Actinemys* populations. We suggest surveys along roads near known turtle sites three times a week from May to August when female turtles go out to nest. The study should include varying road traffic levels (low, medium, high traffic), and these sites need to be replicated.

Publication of prior and ongoing research is needed. Effective management requires basic information about the life history of the species. The status of populations located in southern California needs updating, and the comprehensive distribution and abundance of turtles in Baja California awaits publication.

**Captive Husbandry.** — Efforts have been underway since the 1990s to head-start *A. marmorata* in Washington and >2,200 turtles have been released (Hallock et al. 2016). In recent years, however, many of these head-started turtles later developed shell disease (Haman et al. 2019). Head-starting has also occurred in coastal central California (Geist et al. 2015). For *A. pallida*, there is a head-starting program underway at the San Diego Zoo (Lopez 2019). A small group of rescued *A. pallida* were released into ponds on the campus of the University of California, Los Angeles, as part of a class project (Whitaker et al., unpubl. data).

Except in rare instances, we question the need for captive breeding or head-starting of this species. Prior to considering implementing head-starting, we suggest more thorough field surveys to document the occurrence of turtles and then first implementing efforts to improve habitats (Bury 2015). There are potential adverse effects that need to be carefully considered before initiating head-starting (e.g., mixing of gene pools, disease introduction). The long-term threats to the species must be considered in that these actions, if applied incorrectly, may dilute or impede efforts to effectively protect and manage wild populations and their habitats.

**Current Research.** — A comparison of key population features is underway at a few sites for *A. pallida* and range-wide for *A. marmorata* (Germano and Bury, in prep.). Surveys and abundance estimates are being determined at military bases in California (Department of Defense 2020; Robert Lovich, pers. comm.). Robert Fisher and his team at the U.S. Geological Survey in San Diego are conducting studies of distribution, ecology, and status of *A. pallida* at several populations in southern California. The Turtle Conservancy is conducting surveys and life-history studies of *A. pallida* at several sites in Ventura County, southern California (Nathanael Stanek, Kylie Rude, and Eric V. Goode, pers. comm.). In Baja California, Valdez-Villavicencio and Anny Peralta-García and others are determining the occurrence and ecology of the species.

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