

**ARIZONA GAME AND FISH DEPARTMENT
HERITAGE DATA MANAGEMENT SYSTEM**

Animal Abstract

Element Code: ARAAF01013

Data Sensitivity: Yes

CLASSIFICATION, NOMENCLATURE, DESCRIPTION, RANGE

NAME: *Gopherus morafkai*

COMMON NAME: Sonoran Desert Tortoise, Morafka's Desert Tortoise

SYNONYMS: *Gopherus agassizii*, *Xerobates agassizii*, *Scaptochelys agassizii*

FAMILY: Testudines: Testudinidae

AUTHOR, PLACE OF PUBLICATION: Brown. 1912. Proceedings of the Californian Academy of Natural Science. Identified by R.W. Murphy et al., 28 Jun 2011.

TYPE LOCALITY: From Tucson (approximate location 32°7'N, 110°56'W, elevation 948 m), Pima County, Arizona, U.S.A.

TYPE SPECIMEN: CAS (California Academy of Sciences) 33867; juvenile collected on 9 July 1912 by H. Brown and preserved in ethanol.

TAXONOMIC UNIQUENESS: The genus *Gopherus* contains six extant species in the southern US and Mexico (Crumly 1994).

The Sonoran Desert Tortoise and Mohave Desert Tortoise were previously considered populations of the same species, *Gopherus agassizii*. In 2011, genetic analysis supported elevating the Sonoran Desert Tortoise to the species level (Murphy et al. 2011). This taxonomy had been previously hypothesized by several authorities (Lamb et al. 1989, Lamb and McLuckie 2002, Van Devender 2002). In the southern portion of its range, Sonoran Desert Tortoise taxonomy was further distinguished with the description of *G. eygoodei*, the Goode's Thornscrub Tortoise (Edwards et al. 2016).

DESCRIPTION: Adults in Arizona range from 20 to 38 cm (8 to 15 in) in total carapace length (Brennan and Holycross 2006). The relatively high domed carapace is usually brownish or dark in color with a definite pattern and prominent growth lines (Stebbins 1985, Brennan and Holycross 2006, Murphy et al. 2011). The plastron is yellowish and is not hinged (Brennan and Holycross 2006). Limbs are very stocky; forelimbs are flattened for digging and covered with large conical scales (Brennan and Holycross 2006). Males have elongate gular (throat) shields, chin glands visible on each side of the lower jaw, and a concave plastron (USFWS 2021).

AIDS TO IDENTIFICATION: Two species in this genus occur in Arizona. Sonoran Desert Tortoise have a relatively narrower shell, shorter gular scutes, shorter projections of the anal scutes, and a flatter, pear-shaped carapace when compared to Mohave Desert Tortoise (Germano 1993).

ILLUSTRATIONS:

Black and white drawing (Stebbins 1966: plate 15)

Color photo (Behler and King 1979: plate 328)

Black and white photos (Bury and Germano 1994: pp. vi, 56, 72, 94, 108)

Color photos (USFWS 2021)

TOTAL RANGE: *Gopherus morafkai* occurs in western, central, and southern Arizona and in northwest Sonora, Mexico, in the Sonoran Desert (USFWS 2021). Traditionally the range of this tortoise has been defined as east and south of the Colorado River. However, recent studies have refined this range in the northwestern edge of the range to be east of the spine of the Black Mountains (Dolby et al. 2021, USFWS 2021), and north of the Rio Sonora in Sonora, Mexico (Edwards et al. 2016). However, hybridization occurs at both of these geographic areas, making range boundaries difficult to quantify (USFWS 2021).

RANGE WITHIN ARIZONA: *Gopherus morafkai* includes those tortoises south and east of the Colorado River, from locations near Pearce Ferry in Mojave County, to the south beyond the International Boundary, and at many scattered locations in between (Arizona Interagency Desert Tortoise Team [AIDTT] 2000). The northeastern-most tortoise records in Arizona occur along the Salt River near Roosevelt Lake in Gila County, although populations here have not been confirmed with recent observations. The middle San Pedro River drainage in Cochise County harbors the eastern-most substantial tortoise populations.

SPECIES BIOLOGY AND POPULATION TRENDS

BIOLOGY: From hatching until their shells ossify at approximately 5 years of age, Sonoran Desert Tortoises are considered young juveniles. This age class is highly susceptible to predation, due to their small size and softened shells, which provide little protection until they ossify at approximately 11 cm (4.3) in midline carapace length. The behavior and ecology of this age class is not well known, as their small size makes them difficult to detect (USFWS 2021). Possible predators of tortoises in this age class are coachwhips (*Coluber flagellum*), gophersnakes (*Pituophis catenifer*), Red-tailed hawks (*Buteo jamaicensis*), and American badgers (*Taxidea taxus*) (Amarello et al. 2004, Emblidge et al. 2015, Anderson and Berry 2019). Gila monsters (*Heloderma suspectum*) may be a primary predator on tortoise eggs (Barrett and Humphrey 1986).

Once their shells are completely ossified, but before they are sexually mature, Sonoran Desert Tortoises are considered to be older juveniles. Depending on age and environmental conditions, tortoises remain in this size class from approximately 6 to 15-18 years of age (Owens et al. 2019). Survival rates at this size class have been estimated at 70-89%, and survival is believed to be higher at this age class than for young juveniles (Campbell et al. 2018, Zylstra and Steidl 2021).

Tortoises typically reach sexual maturity when carapace length reaches approximately 22 cm (8.7 in), at approximately age 16 for females and 18-19 for males (Averill-Murray and Klug 2000, Averill-Murray et al. 2002, Bury et al. 2002, Germano et al. 2002, Owens et al. 2019). In

the wild, longevity is estimated to be 42-54 years (Curtin et al. 2009), though many are presumed to live longer (USFWS 2021). Annual survival is estimated at 85-95% throughout the range, and 95-96% in Arizona (Heppell 1998, Zylstra and Steidl 2021). Adult tortoises are relatively protected from natural predation due to their size and hard shells (USFWS 2021).

Adequate shelter sites are one of the most important habitat features for Sonoran Desert Tortoises, as tortoises spend most of their time in below-ground shelter sites with emergence timed to resource availability such as foliage or precipitation (USFWS 2022). These burrows allow escape from extreme temperatures, for nesting, and protection from predators (USFWS 2021).

Behavior varies greatly among seasons and elevations of tortoise populations. Tortoises at moderate to high elevations exhibit surface activity during the early-mid spring, and again during the summer monsoon, with the remainder of the year largely spent dormant in shelter sites, though surfacing in response to precipitation is observed (Sullivan et al. 2014). At lower elevations, Sonoran Desert Tortoises may emerge to bask in response to thermoregulatory needs any month of the year (Sullivan and Sullivan 2015, Sullivan et al. 2021). Periods of dormancy vary greatly but appear to correlate with seasonal temperatures (Bailey et al. 1995, Averill-Murray et al. 2002). Gravid females are typically the first to emerge and become active every year, as they must forage on spring plants to gain energy for egg development (Averill-Murray et al. 2018). The primary active season for both sexes and all age classes coincides with the summer monsoon (July through September) (Averill-Murray et al. 2002).

REPRODUCTION: The Sonoran Desert Tortoise's breeding season generally occurs from July through October, and reproductive success is strongly influenced by environmental conditions (Averill-Murray et al. 2018). Yolk deposition is typically initiated during the period of cold-season dormancy and continues during the spring (Averill-Murray and Klug 2000, Averill-Murray et al. 2018). Mating occurs during the summer monsoon season, and females are capable of storing sperm for up to two years (Palmer et al. 1998, Averill-Murray et al. 2018). Approximately half of the adult females in a population produce in any given year, laying one clutch of 1-12 eggs, typically at the onset of the summer rainy season (monsoon) (Campbell et al. 2014, Averill-Murray et al. 2018). Average clutch size is 5.15 with a 61% hatch rate, and clutch size appears to be directly influenced by body condition (Campbell et al. 2014, Averill-Murray et al. 2018). Drought can reduce or eliminate ovarian follicle development in the subsequent reproductive season (Averill-Murray et al. 2018). Females usually lay their eggs inside burrows with adequate soil development, and nest defense behavior has been observed in females (Barrett and Humphrey 1986).

FOOD HABITS: Sonoran Desert Tortoises are herbivorous, and have been documented to eat 199 species of plants, including herbs (55.3%), woody plants (22.1%), grasses (17.6%), and succulents (5%) (Ogden 1993, Van Devender et al. 2002, Brennan and Holycross 2006, Oftedal 2007, Ernst and Lovich 2009, Meyer et al. 2010). The most common food items in microhistological analyses included the woody vine *Janusia gracilis* and various mallows (Malvaceae) (Van Devender and Schwalbe 1999).

These tortoises are also geophagous, consuming bones, stones, soil, and mineral deposits for additional nutrient and mineral supplements, for mechanical assistants in grinding plant matter in the stomach, or to expel parasites in the intestinal tract (Sokol 1971, Marlow and Tollestrup 1982, Esque and Peters 1994, Stitt and Davis 2003, Walde et al. 2007, Sullivan and Cahill 2019).

The tortoise's large, bi-lobed bladder allows for storage of a high volume of water, dilution of salts and metabolic wastes, and re-absorption of water into the bloodstream, which allows for forage on dried vegetation while reducing effects of dehydration (Averill-Murray et al. 2002, Ernst and Lovich 2009). When free-standing water is available, tortoises drink to flush salts and reset the electrolytic balance to prepare for the next dry period (Averill-Murray et al. 2002).

HABITAT: *Gopherus morafkai* occurs primarily on rocky, steep slopes, incised washes, and bajadas of Mojave Desertscrub and the Arizona Upland and Lower Colorado subdivisions of Sonoran Desertscrub (USFWS 2021). Intermountain valleys and desert washes may be important for dispersal of juveniles (Averill-Murray et al. 2020). Home range estimates have varied from 0.04-0.10 sq mi (23-64 ac) for males, and 0.1-0.09 sq mi (6-58 ac) for females (Averill-Murray et al. 2020). High fidelity to home range is exhibited (Zylstra and Swann 2009).

Adequate shelter is one of the most important habitat features for tortoises, and tortoises appear to show strong shelter site fidelity (Rubke and O'Donnell 2020). Sonoran desert tortoises require loose soil in which to excavate shelters below rocks and boulders, beneath vegetation, on semi-open slopes, and within caliche caves of washes (Averill-Murray et al. 2002). Tortoises may also use existing structures for shelter, such as caliche caves, crevices between rocks and boulders, and under woodrat middens (Sullivan et al. 2016, USFWS 2021).

ELEVATION: The majority (>95%) of all Sonoran Desert Tortoise records in Arizona occur between 0 to 1,524 m (0-5,000 ft) (USFWS 2021).

PLANT COMMUNITY: Most often occur in Palo Verde-Mixed Cacti associations (Vaughan 1984), but records have been documented in Madrean Evergreen Woodland (Babb et al. 2013), Montane Conifer Forest (Aslan et al. 2003), Semidesert Grassland, Interior Chaparral, Plains of Sonora, and Sinaloan Thornscrub habitats (Molina-Padilla and Van Devender 2019). Telemetry research from one of the best studied locations suggests that Sonoran desert tortoises may select for vegetation type over any other habitat attribute including specific soil types, slope, or wash habitat in some areas (Leavitt et al. 2017).

POPULATION TRENDS: *Gopherus morafkai* currently occurs across much of its presumed historical range in Arizona and Sonora (USFWS 2021). Although there has likely been reduction in distribution within the species' range due to past habitat conversion, the U.S. Fish and Wildlife Service is unaware of any changes in the overall species' range or population status within Arizona (USFWS 2021). Range wide the population is estimated at 865,335 (USFWS 2021).

SPECIES PROTECTION AND CONSERVATION

ENDANGERED SPECIES ACT STATUS:	CCA (USDI, FWS, 2015) [Not Warranted for Listing (USDI, FWS, 2022)] [Candidate for Listing (USDI, FWS, 2020)]
Status Listings as subspecies:	[Mohave Desert pop. LT (USDI, FWS 1990)] [Sonoran Desert pop. C (USDI, FWS 2010)] [Sonoran Desert pop. C (USDI, FWS 2011)] [Sonoran Desert pop. None (USDI, FWS 1996)] [Sonoran Desert pop. C2 USDI, FWS 1991, 1994] [Both populations C2 USDI, FWS 1985, 1989]
STATE LIST STATUS:	1 (AZGFD, AWCS 2022) [1A (AGFD SWAP 2012)] [WSC (AGFD, WSCA 1996 in prep)] [Candidate (AGFD, TNW 1988)]
OTHER STATUS:	Bureau of Land Management Sensitive (USDI, BLM AZ 2017, 2008) [Not Bureau of Land Management Sensitive (USDI, BLM AZ 2010)] Forest Service Sensitive (USDA, FS Region 3, 2013, 2007) A, Determined Threatened (Secretaria de Medio Ambiente 2018, 2000) [Determined Threatened, Secretaria de Desarrollo Social 1994]

MANAGEMENT FACTORS: Threats to the Sonoran Desert Tortoise include; altered plant communities (nonnative vegetation), altered fire regime, habitat conversion (urban development, agriculture, mining), habitat fragmentation, climate change and drought, and human-tortoise interactions (USFWS 2021).

PROTECTIVE MEASURES TAKEN: Much of suitable habitat in Arizona occurs on public land, which affords some protection (Carter et al. 2020). A candidate conservation agreement exists with AGFD, BLM, Department of Defense, National Park Service, U.S. Fish and Wildlife Service, Bureau of Reclamation, Customs and Border Protection, U.S. Forest Service, Natural Resources Conservation Service, and Arizona Department of Transportation, in which participants commit to implement specific actions designed to remove or reduce threats across approximately 13,000 sq mi (8.3 million acres) of Sonoran Desert Tortoise Habitat in Arizona (USFWS 2021). Desert tortoises may not be collected from the wild in Arizona (Arizona Game and Fish Commission Order 43). Desert tortoises possessed without a special license prior to April 28, 1989, may be possessed, transported, and given away (Arizona Game and Fish

Commission Rule R12-4-407.A.1). Desert tortoises possessed pursuant to R12-4-407.A.1 may be propagated, progeny may be held in captivity for 24 months from the date of hatching, when they shall be disposed of by gift or as directed by the Arizona Game and Fish Department. The person receiving a desert tortoise given away pursuant to this rule is also exempt from special license requirements. As of August 2020, the USFWS is placing the Sonoran Desert Tortoise back on the candidate list for ESA protection.

SUGGESTED PROJECTS: A continuing state-wide monitoring program is of primary importance in collecting the data necessary for effective desert tortoise management in Arizona (AIDTT 1996). Additional research is also necessary to develop a more complete understanding of tortoise populations and how they respond to different land management actions, including research on population dynamics (reproductive ecology, life tables, population viability, population genetics), habitat (effects of exotic vegetation, fire, and grazing), disease (URTD, cutaneous dyskeratosis), and effectiveness of mitigation measures (AIDTT 1996). The extent of desert tortoise distribution in extreme northwest, southwest, southeast Arizona needs extensive survey efforts and monitoring.

LAND MANAGEMENT/OWNERSHIP: Bureau of Indian Affairs: Fort McDowell Reservation, Gila River Reservation, Salt River Pima Reservation, San Carlos Apache Reservation, San Xavier Reservation, Tohono O'Odham Nation. Bureau of Land Management: Kingman Field Office, Lake Havasu Field Office, Phoenix Field Office, Tucson Field Office, Safford Field Office, Tucson Field Office, Yuma Field Office. Department of Defense: Barry M. Goldwater Range, Yuma Proving Ground. US Forest Service: Coronado National Forest, Prescott National Forest, Tonto National Forest. US Fish and Wildlife Service: Buenos Aires National Wildlife Refuge, Cabeza Prieta National Wildlife Refuge, Cibola National Wildlife Refuge, Havasu National Wildlife Refuge, Imperial National Wildlife Refuge, Kofa National Wildlife Refuge. National Park Service: Organ Pipe Cactus National Monument, Saguaro National Park, Lake Mead National Recreation Area. State Land Department. Arizona Game and Fish Department: Powers Butte Wildlife Area. Arizona State Parks Department: Picacho Peak State Park. Private land. Other lands: McDowell Mountain Regional Park, Phoenix South Mountain Park, White Tank Regional Park.

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ADDITIONAL INFORMATION:

The genus *Gopherus* is said to derive from gaufre (French)-a honeycomb-due to the many holes made by members of the genus (Gotch, A.F. 1995. *Latin Names Explained: A Guide to the Scientific Classification of Reptiles, Birds, and Mammals*. Facts on File, New York. p. 56.). The specific name *agassizii* is in honor of the Swiss zoologist J.L.R. Agassiz (1807-1873).

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