



Regional Records and Reproductive Potential of the Non-Indigenous Central Asian Tortoise, *Testudo horsfieldii* Gray 1844 (Testudinidae), in Southwestern Florida

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Southern Florida is a known epicenter of exotic species introduction, especially for herpetofauna (Meshaka 2011), with more than 60 known established species as of 2015 (Krysko et al. 2016). At least four chelonian species are known to be established (Krysko et al. 2016), with several others documented but without confirmation of reproductive success (Stemle and Levine 2020; Stemle 2022; Weber et al. 2022). Most of these are predominantly aquatic species; however, observations of a number of species of tortoises (Testudinidae) have been verified or vouchered; these include African Spurred Tortoises (*Centrocheleys sulcata*), Red-footed Tortoises (*Chelonoidis carbonaria*), Yellow-footed Tortoises (*C. denticulatus*), Aldabra Tortoises (*Aldabrachelys gigantea*), Asian Forest Tortoises (*Manouria emys*), Home’s Hinge-backed Tortoises (*Kinixys homeana*), Leopard Tortoises (*Stigmochelys pardalis*), Indian Star Tortoises (*Geochelone elegans*), and Central Asian Tortoises (*Testudo horsfieldii*) (Squires et al. 2018; Krysko et al. 2019; EDDMapS 2022).

The Central Asian Tortoise (*Testudo horsfieldii*), commonly referred to as the Russian Tortoise or Steppe Tortoise, is native to the desert steppes and hillsides of central Asia from southeastern Russia and China west to Iran (Bonin et al. 2006). The exploitation and export of this species has cemented its status as a common pet-trade species, with farmed and wild-caught adults commonly offered as the preferred pet tortoise species for wholesalers and chain stores alike (Lee and Smith 2010).

This prominence in the pet trade has led to numerous reports of released or escaped *T. horsfieldii* across the United States, including vouchers in Florida (Krysko et al. 2015). Krysko et al. (2010) directly encountered one individual in Bill Bags Cape Florida State Park during herpetofaunal surveys, indicating the potential for survival in southern Florida environments. Herein I describe additional records of *T. hors-*

fieldii observed in Lee and Collier Counties in southwestern Florida and discuss the reproductive potential of this non-indigenous species in the region.

From 2011 to 2022, seven *T. horsfieldii* (two females and five males) were found in several different locations and habitat types that included urban neighborhoods and protected wildlife areas. I was asked to identify or collect tortoises and also opportunistically encountered one myself. Following are accounts of each vouchered individual.

In August 2011, I was contacted by personnel at Viscaya Animal Clinic (Cape Coral, Lee County) regarding an adult male Russian Tortoise (UF 193783) that had been found in a local park (-26.65930, -81.94332). The male measured 144 mm straight carapace length (SCL), and suffered from an overgrown rhamphotheca and front claws, indicating an escaped or intentionally released pet. I collected and homed the animal on 3 August 2011.

On 6 February 2013, I was contacted about an adult female tortoise (UF 193784) found in an upland in the Rookery Bay Estuarine Preserve of Naples (Collier County) (26.02395, -81.71202). The tortoise might have been purposely released here as a misguided attempt to accommodate the individual due to the presence of Gopher Tortoises (*Gopherus polyphemus*) in the region. The female (134 mm SCL) showed signs of damage from past predator interactions on both the carapace and plastron but was otherwise in good health. This animal was transferred to me approximately one week later.

On 13 March 2017, I was contacted about another adult male (UF 193786), (SCL unknown) found in an urban neighborhood (26.26800, -81.81100) in North Naples (Collier County). I confirmed the individual as *T. horsfieldii* upon receipt of images the same day. I helped direct the finder to place the animal in the collection of a private keeper/outreach group.

On 10 June 2018, another adult female tortoise (UF 193785) was observed and collected by me in 10 Mile Linear Park, Fort Myers (Lee County) (26.53858, -81.854960) while conducting visual herpetofauna surveys. This female (154 mm SCL) was found less than 20 m from an active *G. polyphemus* burrow and could also have been the result of a purposeful release. Other exotic tortoises, including a South American Red-footed Tortoise (*Chelonoidis carbonaria*) have been observed and collected in this same area (Donini, pers. obs.).

On 13 November 2018, a subadult male (UF 193789) was found near a neighborhood in Bonita Springs (Lee County) (26.33502, -81.823130) and admitted to the Clinic for the Rehabilitation of Wildlife (CROW). The animal was healthy (119 mm SCL) with no obvious injuries or defects other than a slightly overgrown rhamphotheca and was transferred to me the following week.

On 26 February 2020, another subadult male (UF 193787) was admitted to CROW after being found near a school in Cape Coral (Lee County) (26.71819, -81.93849). The individual (116 mm SCL) exhibited a healed 40 mm diagonal carapacial fracture, likely from vehicle impact, and the finder assumed it was an injured native tortoise and brought it to the clinic for examination. This animal was transferred to me on 3 March 2020.

On 29 January 2022, I received emailed photos of another adult male tortoise (UF 193788) found in the Fort Myers (Lee County) neighborhood (26.55288, -81.85719), harassing the homeowners' captive Red-footed Tortoises. The animal was not measured for carapace length, but did weigh 483 g. The individual was placed in the collection of a responsible private keeper.

The five individuals I personally collected joined a group of an additional three *T. horsfieldii* in a naturalistic outdoor enclosure with sand and gravel substrate, and

native Florida grasses planted for cover (Fig. 1). Multiple observations of courting, breeding, nesting, and the production of fertile eggs were documented from 2016–2020 (Fig. 2). Due to the high humidity in southwestern Florida, fertile eggs were able to develop to full term only in the highly regulated temperature and humidity of a custom-made reptile incubator for the aforementioned period. However, on 10 June 2021, I found a freshly hatched *T. horsfieldii* in the enclosure.

This single instance of ground hatching I observed was likely an isolated event, but does indicate that, if specific environmental conditions are met, reproduction in *T. horsfieldii* may be possible in southern Florida. In captive tortoises, successful egg incubation has typically been recorded

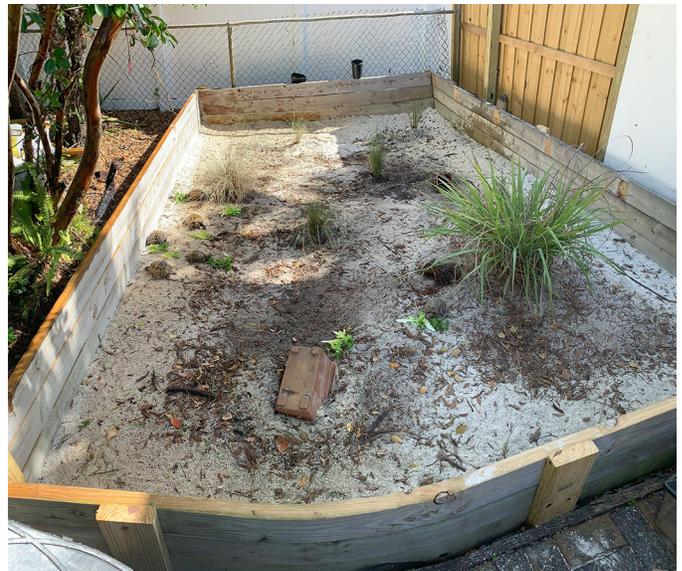


Figure 1. An outdoor enclosure housing acquired Central Asian Tortoises (*Testudo horsfieldii*) found in southwestern Florida. Photograph by Jordan Donini.



Figure 2. Breeding attempt by a male Central Asian Tortoise (*Testudo horsfieldii*) (left) and excavation of a nest cavity by a female *T. horsfieldii* (right) in an outdoor enclosure. Photographs by Jordan Donini.

at relative humidities (RH) of 60–80% (Henning 2020). Some instances of success at higher RH were documented, although the extent of time at these higher levels were not always specified. The humidity of a nest laid in the ground in southern Florida would of course vary depending on habitat and soil type, but the intensity of peak wet seasons would likely see increases in humidity or even water logging that probably would prevent eggs from reaching full-term development in most years. However, a particularly intense dry season occurred during the summer of 2021 (28% less total precipitation in April 2021 and 67% less total precipitation in May 2021 compared to average data from 1991–2020) (National Weather Service 2023). The captive incubation period in this species ranges from 60–100 days (Henning 2020), and this intense dry period likely occurred during the peak of the development and might have contributed to the successful ground incubation.

All documented observations were of solitary individuals with no other conspecifics documented in the immediate vicinity, suggesting that unchecked reproduction is unlikely. Seven other documented observations of *T. horsfieldii* have been reported in five additional Florida counties (EDDMapS 2022). These reports also are indicative of solitary individuals that had either escaped or were released by pet owners. The low density of animals in recorded locations and the specific conditions needed for survival and reproductive success make it unlikely that *T. horsfieldii* is a threat to become an established invasive/non-indigenous species in southern Florida (Fujisaki et al. 2010). Additionally, a proper winter brumation is likely a driver of reproductive success along with general health in this species (Pellett et al. 2020). Overwintering is a known cue for reproductive cycles in other temperate turtle species (Kuchling 1999), and some species may even see disruption of reproductive cycles if temperatures are higher than normal (Mendonça 1987). Thus, the lack of prolonged cooling periods in southwestern Florida will also likely inhibit wild reproduction. However, given the sheer number of animals that are imported into the United States, continued monitoring of the presence of this non-native species, especially in climates that may be more suited to their temperate reproductive cycles (Lee and Smith 2010), is advised.

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