CONSERVATION BIOLOGY OF FRESHWATER TURTLES AND TORTOISES

A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group

Edited by

Anders G.J. Rhodin, John B. Iverson, Peter Paul van Dijk,
Craig B. Stanford, Eric V. Goode, Kurt A. Buhlmann, and Russell A. Mittermeier

Kinosternon vogti **López-Luna, Cupul-Magaña, Escobedo-Galván, González-Hernández, Rangel-Mendoza, Ramírez-Ramírez, and Cazares-Hernández 2018 – Vallarta Mud Turtle, Casquito de Vallarta**

Nadin E. López-González, Torsten Blanck, Fabio G. Cupul-Magaña,
Jose Rafael Nolasco-Luna, Peter Praschag, Marco A. López-Luna,
Taggert G. Butterfield, Gabriel Barrios-Quiroz, and Shannon Diruzzo

Chelonian Research Monographs
Number 5 (Installment 19) 2025: Account 132

Published by
Chelonian Research Foundation and Turtle Conservancy

in association with
IUCN/SSC Tortoise and Freshwater Turtle Specialist Group, Re:wild,
Turtle Conservation Fund, and International Union for Conservation of Nature / Species Survival Commission

Chelonian Research Monographs
Contributions in Turtle and Tortoise Research

CHELONIAN RESEARCH MONOGRAPHS (CRM) (ISSN 1088-7105) is an international peer-reviewed scientific publication series for monograph-length manuscripts, collected proceedings of symposia, edited compilations, and other longer research documents focused on turtles and tortoises. The series accepts contributions dealing with any aspects of chelonian research, with a preference for conservation or biology of freshwater and terrestrial turtles and tortoises. Bibliographic and other reference materials are also of potential interest. Submit manuscripts directly to Anders Rhodin at the e-mail address above. The series is published on an occasional basis, from 1996–2016 by Chelonian Research Foundation, and from 2017 and on by Chelonian Research Foundation and Turtle Conservancy.

Published CRM Issues

CRM 1. The Galápagos Tortoises: Nomenclatural and Survival Status. 1996. By Peter C.H. Pritchard. 85 pp. Open-access pdf available here.

CRM 2. Asian Turtle Trade: Proceedings of a Workshop on Conservation and Trade of Freshwater Turtles and Tortoises in Asia. 2000. Edited by Peter Paul van Dijk, Bryan L. Stuart, and Anders G.J. Rhodin. 164 pp. Open-access pdf available here.

CRM 3. Biology and Conservation of Florida Turtles. 2006. Edited by Peter A. Meylan. 376 pp. Open-access pdf available here.

CRM 4. Defining Turtle Diversity: Proceedings of a Workshop on Genetics, Ethics, and Taxonomy of Freshwater Turtles and Tortoises. 2007. Edited by H. Bradley Shaffer, Nancy N. FitzSimmons, Arthur Georges, and Anders G.J. Rhodin. 200 pp. Open-access pdf available here.

CRM 5 (Installments 1–19, 132 species accounts to date). Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. 2008–2025. Edited variously by Anders G.J. Rhodin, John B. Iverson, Peter Paul van Dijk, Kurt A. Buhlmann, Peter C.H. Pritchard, Craig B. Stanford, Eric V. Goode, Raymond A. Saumure, and Russell A. Mittermeier. 1,433 pp. to date. All accounts available as open-access pdf downloads: follow links here.

CRM 6. Turtles on the Brink in Madagascar: Proceedings of Two Workshops on the Status, Conservation, and Biology of Malagasy Tortoises and Freshwater Turtles. 2013. Edited by Christina M. Castellano, Anders G.J. Rhodin, Michael Ogle, Russell A. Mittermeier, Herilala Randriamahazo, Rick Hudson, and Richard E. Lewis. 184 pp. Open-access pdf available here.

CRM 5 (Installment 8). Turtles and Tortoises of the World During the Rise and Global Spread of Humanity: First Checklist and Review of Extinct Pleistocene and Holocene Chelonians. 2015. TEWG [Turtle Extinctions Working Group: Anders G.J. Rhodin, Scott Thomson, Georgios L. Georgalis, Hans-Volker Karl, Igor G. Danilov, Akio Takahashi, Marcelo S. de la Fuente, Jason R. Bourque, Massimo Delfino, Roger Bour, John B. Iverson, H. Bradley Shaffer, and Peter Paul van Dijk]. 66 pp. Open-access pdf available here.

CRM 7. Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (8th Ed.). 2017. TTWG [Turtle Taxonomy Working Group: Anders G.J. Rhodin, John B. Iverson, Roger Bour, Uwe Fritz, Arthur Georges, H. Bradley Shaffer, and Peter Paul van Dijk]. 292 pp. Open-access pdf available here.

CRM 8. Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (9th Ed.). 2021. TTWG [Turtle Taxonomy Working Group: Anders G.J. Rhodin, John B. Iverson, Roger Bour, Uwe Fritz, Arthur Georges, H. Bradley Shaffer, and Peter Paul van Dijk]. 472 pp. Open-access pdf available here.

CRM 9. Range-Wide Demographic Collapse and Extinction Dynamics of the Endemic Burmese Roofed Turtle, *Batagur trivittata*, in Myanmar. 2024. Steven G. Platt, Win Ko Ko, Kalyar Platt, Tint Lwin, Swann Htet Naing Aung, Khin Myo Myo, Me Me Soe, Myo Min Win, Kyaw Thu Zaw Wint, Htun Thu, Shine Hsu Hsu Naing, Brian D. Horne, and Thomas R. Rainwater. 26 pp. Open-access pdf available here.

CRM 10. Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (10th Ed.). 2025. TTWG [Turtle Taxonomy Working Group: Anders G.J. Rhodin, John B. Iverson, Uwe Fritz, Natalia Gallego-García, Arthur Georges, H. Bradley Shaffer, and Peter Paul van Dijk]. 575 pp. Open-access pdf available here.

Other Chelonian Research Foundation & Turtle Conservancy Publications

Turtles in Trouble: The World's Most Endangered Tortoises and Freshwater Turtles – 2025. TCC [Turtle Conservation Coalition: Craig B. Stanford, Anders G.J. Rhodin, Peter Paul van Dijk, Torsten Blanck, Eric V. Goode, Rick Hudson, Andrew D. Walde, Jordan Gray, Russell A. Mittermeier, and Vivian P. Páez. (Eds.)]. 2025. 77 pp. Open-access pdf available here.

Tortoises in the Mist: Turtle Poetry for Conservationists. Anders G.J. Rhodin and Eric V. Goode (Eds.)]. 2021. 106 pp. Open-access pdf available here.

CHELONIAN RESEARCH MONOGRAPHS (CRM) issues are variously available for purchase from Chelonian Research Foundation and Turtle Conservancy. Contact either Turtle Conservancy (www.turtleconservancy.org) or Chelonian Research Foundation (www.chelonian.org/crm; 564 Chittenden Dr., Arlington, VT 05250 USA; 978-807-2902; RhodinCRF@aol.com) for prices, titles, and to place orders for available print copies. Chelonian Research Foundation (founded in 1992) and Turtle Conservancy (founded in 2005 as Chelonian Conservation Center, renamed in 2010) are nonprofit tax-exempt organizations under section 501(c)(3) of the Internal Revenue Code.

Conservation Biology of Freshwater Turtles and Tortoises:
A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group
Rhodin, Iverson, van Dijk, Stanford, Goode, Buhlmann, and Mittermeier (Eds.)
Chelonian Research Monographs (ISSN 1088-7105) No. 5 (Installment 19), doi:10.3854/crm.5.132.vogti.v1.2025

Kinosternon vogti López-Luna, Cupul-Magaña, Escobedo-Galván, González-Hernández, Rangel-Mendoza, Ramírez-Ramírez, and Cazares-Hernández 2018 – Vallarta Mud Turtle, Casquito de Vallarta

Nadin E. López-González[1,2], Torsten Blanck[2], Fabio G. Cupul-Magaña[1], Jose Rafael Nolasco-Luna[1,3,4], Peter Praschag[2], Marco A. López-Luna[5], Taggert G. Butterfield[6], Gabriel Barrios-Quiroz[7], and Shannon Diruzzo[2]

[1]*Centro Universitario de la Costa, Universidad de Guadalajara, Av. Universidad 203, Puerto Vallarta, Jalisco 48280, Mexico [nadin.lgonzalez@alumnos.udg.mx; fabiocupul@gmail.com];*
[2]*Turtle Island, Graz, Austria [office@turtle-island.org];*
[3]*Universidad Autónoma de Nayarit, Tepic, Nayarit, Mexico;*
[4]*Centro Nayarita de Innovación y Transferencia de Tecnología A.C., Tepic, Nayarit, Mexico [failo.bio@gmail.com];*
[5]*División Académica de Ciencias Biológicas, Universidad Juárez Autónoma de Tabasco, Carr. Villahermosa-Cárdenas km 0.5, Villahermosa, Tabasco 86039, Mexico [marco.lopez.luna@gmail.com];*
[6]*Estudiantes Conservando la Naturaleza A.C., Plateros 5, Álamos, 85760 Sonora, Mexico [taggertbutterfield3@gmail.com];*
[7]*Ecologia y Conservación Dharma A.C., Carr. Yahutepec-Tepoztlán km 7.5, Barrio de Santiago Tepetlapa 62520, Tepoztlán, Morelos, Mexico [barriosg910@gmail.com]*

Summary. – The Vallarta Mud Turtle, *Kinosternon vogti* (family Kinosternidae), is one of the most recently described turtle species and unfortunately also one of the most critically endangered. It is restricted to the Bahía de Banderas Valley in western Mexico, an area of only approximately 263 sq. km. It is the smallest turtle species known, with males reaching an average straight-line carapace length (SCL) of 76.4 mm, rarely exceeding 90 mm SCL and females reaching an average SCL of 78.4 mm, rarely exceeding 100 mm SCL. The species occurs in freshwater habitats and currently has a severely reduced estimated Area of Occupancy (AOO) of less than 0.3 sq. km. Courtship and oviposition occur during the rainy season (June to October). One to five eggs per clutch are laid, with up to three clutches per season. Hatchlings emerge after 100–263 days of incubation following a diapause, and measure 19–23 mm in SCL. While some conservation actions have been implemented by organizations and academic institutions, no protected habitat exists. The species has successfully reproduced in captivity since 2023, and although an in-situ Conservation Center was built in 2024 to provide an assurance colony for the species, ongoing poaching and theft of captive breeding animals have hampered conservation efforts.

Distribution. —Mexico. Endemic to Bahía de Banderas Valley, Jalisco and Nayarit.

Synonymy. — *Kinosternon vogti* López-Luna, Cupul-Magaña, Escobedo-Galván, González-Hernández, Rangel-Mendoza, Ramírez-Ramírez, and Cazares-Hernández 2018.

Subspecies. — None.

Status. — IUCN 2025 Red List: Critically Endangered (CR A1d+2d) (assessed 2022; Cupul-Magaña et al. 2022). CITES Appendix I (since 2022). EUCR: Annex A (since 2023). Norma Oficial Mexicana NOM-059-SEMARNAT-2019: Endangered species list (since 2019).

Taxonomy. — Despite intensive surveying of kinosternid species along the Mexican Pacific coast from the 1960s to 1990s, *Kinosternon vogti* evaded discovery until the second decade of the 21st century (Berry et al. 1997; López-Luna et al. 2018; Loc-Barragán et al. 2020). The species was first photographed and documented in 2002, but Cupul-Magaña and Rubio-Delgado (2003) identified it at that time as a probable juvenile *Kinosternon chimalhuaca*.

In 2009, photos of a male *Kinosternon* specimen with a bright yellow patch on the rostrum appeared on the internet, with a hobbyist asking for species identification. More photos of specimens were posted online between 2011 and 2016 (present authors, pers. obs.). Some observers initially hypothesized that someone had intentionally painted the rostrum of the specimen yellow to yield a higher price in the pet trade, while others considered it an aberrant color variant of *K. chimalhuaca*. However, López-Luna et al. (2018) formally and definitively described it as a new species, *K. vogti*, based on an adult male (IBH-31568, holotype, collected in 2005; two living male paratypes collected in 2012 and deposited in the UMA

Figure 1. Adult male *Kinosternon vogti* from Puerto Vallarta, Jalisco, Mexico. Photo by Carolina Sánchez Arias.

Reptilario Cipactli of the Universidad de Guadalajara in Puerto Vallarta City; two preserved males (IBH-31550 and 31569, collected in 2005 and 2015); and a dried carcass of unknown sex, hereby identified as a female based on the size and plastral scute shape, collected in 2005. All specimens were collected within the city limits of Puerto Vallarta, Jalisco, Mexico. The species was named in honor of the late Prof. Richard Carl "Dick" Vogt, a renowned turtle researcher and enthusiastic conservationist.

Based on morphological and molecular analyses (see Loc-Barragán et al. 2020; López-Luna et al. 2021), *K. vogti* is most closely related to *K. cora, K. chimalhuaca*, and *K. hirtipes*, and is a member of the subgenus *Kinosternon* (*Kinosternon*) (Hurtado-Gómez et al. 2024). The sister species of the Vallarta Mud Turtle, *K. cora*, occurs in northern Nayarit and the adjacent state of Sinaloa, geographically separated from *K. vogti* by the Sierra de Vallejo of the Sierra Madre Mountain range (TTWG 2021, 2025). *Kinosternon chimalhuaca* occurs from the Cabo Corrientes range of the Sierra Madre Occidental Mountain range in Jalisco to Colima state (TTWG 2021, 2025). A specimen was recently reported from Puerto Vallarta City (López-Luna et al. 2020; Butterfield 2023a), which likely originated from the local pet trade. *Kinosternon hirtipes* occurs in the western part of Jalisco and many other Mexican provinces, separated from *K. vogti* by the main Sierra Madre Occidental Mountain range (see TTWG 2021, 2025).

Description. — The following description is mainly based on López-Luna et al. (2018) and some of our own

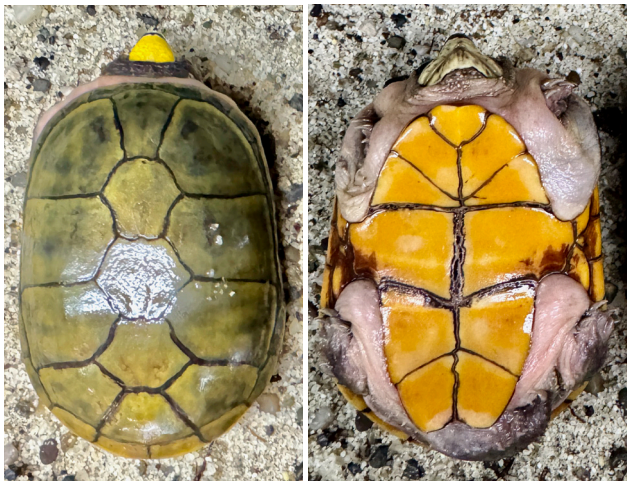

Figure 2. Adult male *Kinosternon vogti* from Puerto Vallarta, Jalisco, Mexico; note the long tail with a "claw". Photos by Torsten Blanck.

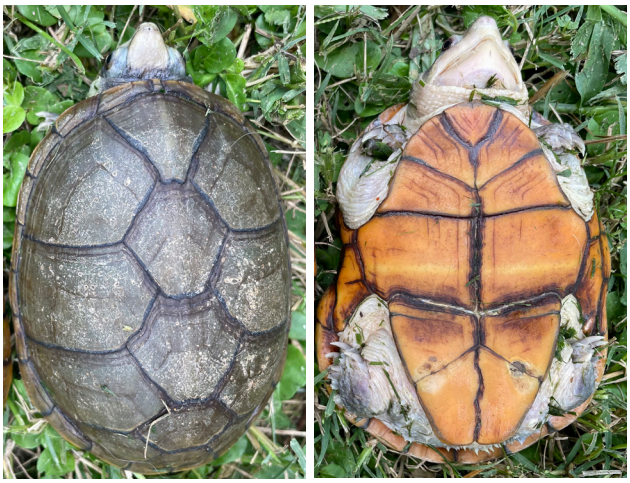

Figure 3. Adult female *Kinosternon vogti* from Puerto Vallarta, Jalisco, Mexico; note the short tail. Photos by Craig B. Stanford.

Figure 4. Adult male *Kinosternon vogti* from Puerto Vallarta, Jalisco, Mexico. Photo by Carolina Sánchez Arias.

Figure 5. Old adult female *Kinosternon vogti* from Puerto Vallarta, Jalisco, Mexico, with unusually prominent light yellow rostrum. Photo by Torsten Blanck.

observations. The olive-brown to brown carapace, usually lighter in color in males compared to females, is depressed and weakly unicarinate, and more elongate in males and more round in females. A weakly developed longitudinal keel runs along the center of the vertebral scutes in adults. Hatchlings are more tricarinate with longitudinal keels present on the costal scutes; growth rings on each scute are visible and exhibit a dark bar between them. The first vertebral is in contact with marginal 1 only, as in *K. cora* (see figure 5 in Loc-Barragán et al. 2020), while it is in contact with marginals 1 and 2 in *K. chimalhuaca* and *K. hirtipes*. Marginals 9 are smaller than marginals 10 and 11, while in *K. cora*, marginals 10 are higher than marginals 9 and 11.

The plastron is small compared to most other species of the subgenus *Kinosternon*, except for *K. cora* and *K. hirtipes megacephalum*, with a PL/CL ratio of ~80%. Two well-developed hinges are present at the level of the bridge in front of and behind the abdominal scute. The front lobe is movable but does not close completely, as is the case also in *K. integrum*. The plastron color is yellowish to orange, with darker brown patches on individual scutes in adults, while intensely orange with a large black central figure in hatchlings, turning into the adult pattern within the first year. The inguinal scute is only in contact with marginals 6 and 7, similar to *K. cora*, while it is in contact with marginals 6 to 8 in *K. chimalhuaca* and *K. hirtipes*.

The head has a width/SCL ratio of ~23–25% and is slightly wider and blunter in males than in females. The rostral shield covers most of the anterior head up to about the middle of the eyes and is bright yellow in males, often with some darker reticulations or spots associated with algae in wild-caught animals that disappear after living

Figure 6. *Top Row*: Three different male *Kinosternon vogti* from Puerto Vallarta, Jalisco, Mexico. Photos by Torsten Blanck. *Bottom Row*: Three different female *Kinosternon vogti* from Jalisco and Nayarit, Mexico. Photos by Torsten Blanck.

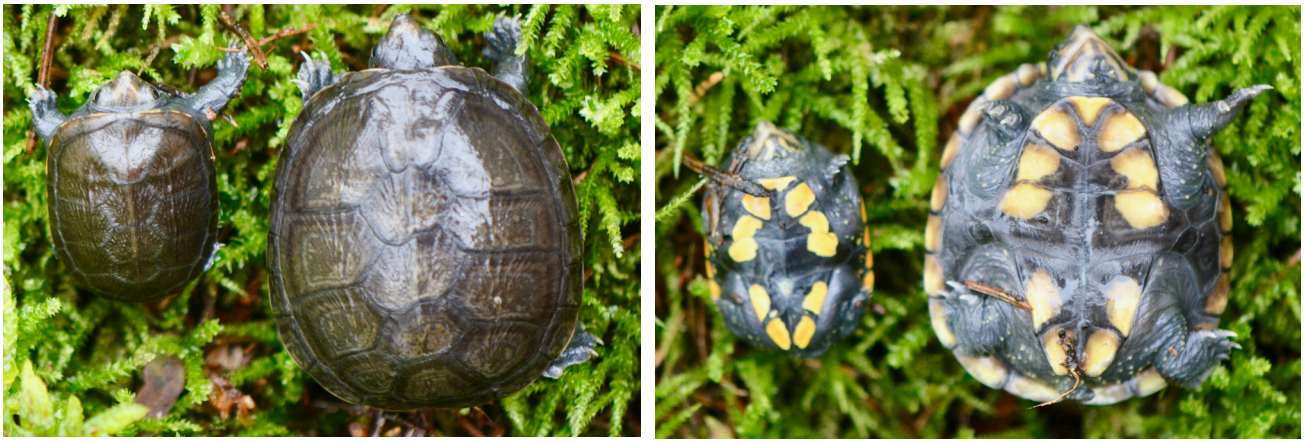

Figure 7. Hatchling (1-week old) and juvenile (1-month old) captive-bred *Kinosternon vogti* from Puerto Vallarta, Jalisco, Mexico. Photos by Torsten Blanck.

in clean water for a while, while some specimens show true dark brown to blackish spots on the yellow rostrum.

In females, the anterior head shape is more elongated and pointed, and the rostral scute is thus comparatively smaller. Females usually have a dark brown to olive brown rostrum, which has been observed to brighten during the mating and egg-laying season from an orange brown to light yellowish (present authors, pers. obs.).

The rostrum in hatchlings is dark brown and changes into the adult coloration at a straight-line carapace length (SCL) of 55–60 mm (present authors, pers. obs.), at which size the species becomes sexually distinguishable by the color of the rostrum and the size of the tail, the latter being wider and longer in males. In its sister species, *K. cora*, the rostral shield forms a horseshoe pattern, also present in several other *Kinosternon* species, that varies from brown to cream-yellow with black reticulations.

The head is generally greyish brown, covered with fine orange-yellowish to reddish-orange reticulations of varying intensity and coverage, and usually more intense in females. Some individuals exhibit a conspicuous, often broken, yellowish lateral line behind the eye extending onto the neck, and another yellow line often extends from behind the jaw below the tympanum, connecting to the creamy-white chin pattern, which can often be suffused with darker spots. In adult males, the jaws are primarily creamy-white to yellowish with dark brown to black mottling and reticulations of varying intensity, becoming lighter with age. In females, the jaw coloration is greyish brown to cream, with darker stripes and spots and lighter cream-colored stripes. In juveniles, the jaws are dark brown with grayish reticulations, which are also present behind the eye. The eyes are dark brown.

Two sets of barbels are present on the chin, the anterior pair being more pronounced. The neck is covered with small papillae dorsally and laterally, more so in males, as are the ventral soft parts which are dark grayish in juveniles, turning to cream-white to grayish yellow in adults. The legs are grayish, often with orange reticulations in males. The claws are fully webbed, with 5 digits on the front legs and 4 digits on the hind legs.

Falciform scales are present on the antebrachium and heel, typically kinosternid, keratinized in males. The tail in mature males is well-developed with a relatively small "claw" on the tip; four dorsolateral longitudinal rows of poorly developed papillae are present on the tail. The species possesses clasping organs, which are opposed patches of horny scales on the hind legs that play an important role during mating. These organs are present in several species of *Kinosternon*, including the sister species, *K. cora* (Hurtado-Gómez et al. 2024).

Although the typical coloration was described above, some aberrant coloration has been observed for *K. vogti*. For example, López-González et al. (2025a) observed a female turtle (SCL = 83 mm) that showed a carapace that appeared grayish olive with external margins of the marginal scutes being yellow to cream to pink to green (chamois) in color, and the body exhibited a medium green to strong yellowish-green color. The hyperpigmentation observed across the entire body was congruent with melanism.

Cupul-Magaña and Rubio-Delgado (2003) erroneously recorded 100 mm SCL (carapace length) for a male specimen. López-Luna et al. (2018) recorded a maximum length for a female shell of 101.5 mm SCL, erroneously cited as male by TTWG (2021, but corrected in TTWG 2025), with 95 mm as a maximum for a male. Ramírez-Ramírez et al. (2019) provided a mean SCL of 91.3 ± 11.8 mm for males (n = 3) and 90.9 ± 2.8 mm (n = 2) for females. Cupul-Magaña et al. (2022) reported an average adult SCL for *K. vogti* of 85 mm (n = 20), an average male SCL of 72.5 mm (n = 3), an average female SCL of 86.1 mm (n = 18), and a maximum SCL for males of 89.0 mm and for females of 96.1 mm, respectively.

Based upon the data used in López-González et al. (2025b), including additional data from 2025, we measured the SCL of a total of 194 sexually assignable specimens, which ranged from 51.6 mm to 101.6 mm,

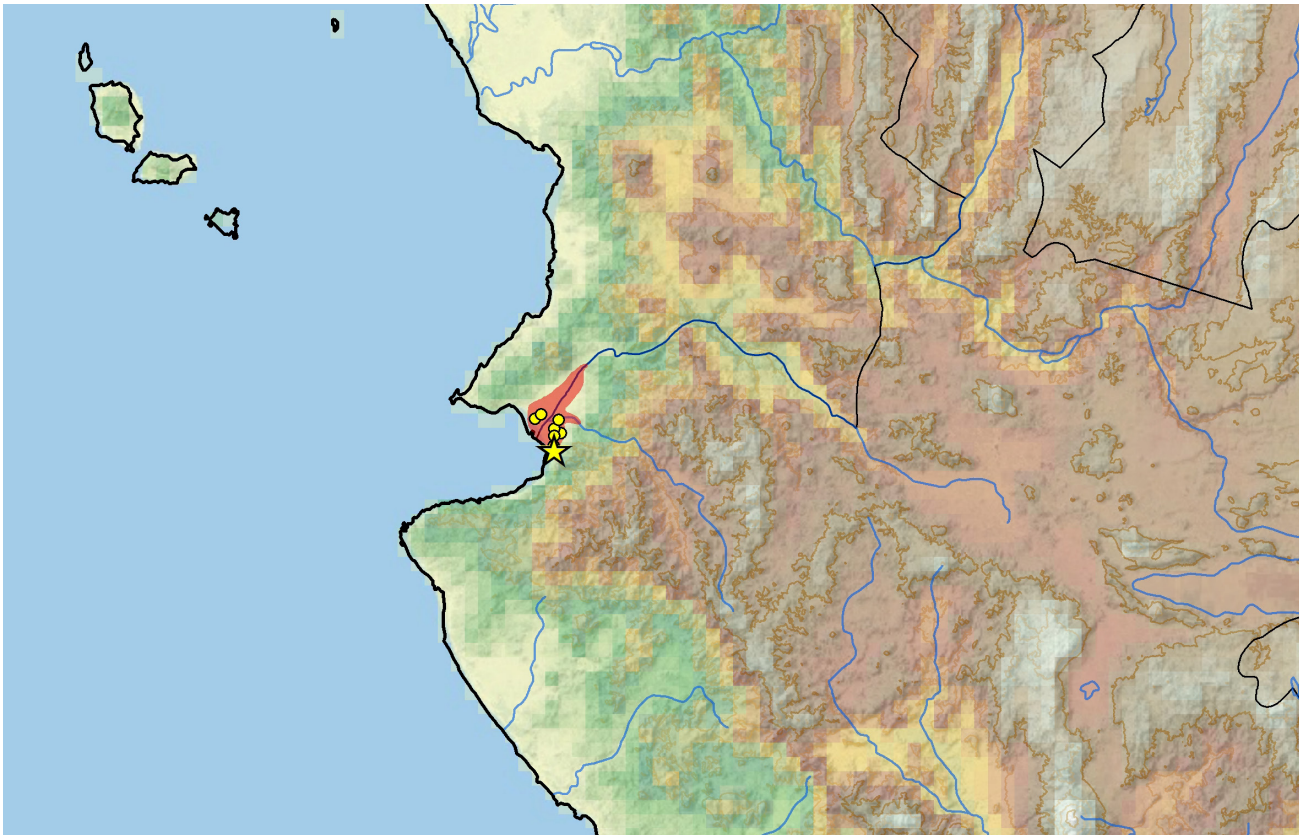

Figure 8. Estimated historical distribution of *Kinosternon vogti* in Jalisco and Nayarit, western Mexico. Yellow dots = museum and occurrence records of native populations (some now extirpated) based on literature records (López-Luna et al. 2018; Cupul-Magaña et al. 2022; TTWG 2025); star = type locality. Colored shading = estimated historical indigenous range. 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, then converted into a smaller estimated custom polygon further adjusted based on data from the literature and the authors. Map by Chelonian Research Foundation.

with a mean (± SD) of 77.7 ± 13.4 mm (n = 194). The SCL of sexable males (based on head coloration and tail size) ranged from 56.2 to 95.3 mm with a mean of 76.4 ± 8.3 mm (n = 53). Sexable females had a SCL ranging from 51.6 to 101.6 mm, with a mean (± SD) of 78.4 ± 15.3 mm (n = 141). Weights of adult males were 58–126 g (n = 32) and adult females 83–195 g (n = 60). López-González et al. (2025b) considered females adult if their SCL exceeded an SCL of 88.4 mm, while males were classified as adults if their SCL was greater than 78.7 mm, as suggested by Rosales-Martínez et al. (2022). A comparison of mean SCLs between sexes in their study suggested that females were on average 8.8% larger than males. Their results showed significant differences in morphological characters such as maximum SCL, maximum plastral length, bridge length, maximum carapace height, midline abdominal scute length, maximum plastral hindlobe width at the midfemoral area, length of the third central scute, and body mass. The sex ratio of their captured specimens was 1.35 female to 1.0 male. Based on these data, the species clearly exhibits female-biased sexual size dimorphism (López-González et al. 2023, 2025b).

According to Cupul-Magaña et al. (2022), an SCL of 82.2 mm might be reached by females around the age of five years, although captive observations indicate that this size might be reached even faster. A male specimen that hatched in February 2023 with an SCL of 23 mm reached an SCL of 56 mm in October 2023, 68 mm in May 2024 and 79 mm in June 2025 (Blanck, pers. obs.) showing all sexable traits, that started to develop at 12 months of age. A female from the same clutch, raised under identical conditions measured 49 mm SCL in May 2024. This fast growth is also substantiated by 15 specimens of a similar size found in our fence trapping efforts in February 2023, which were estimated to be a year old, based on their growth annuli. These observations suggest that sexual maturity is reached at a smaller size than estimated by previous studies (i.e., males at 65 mm and females at 80 mm; Cupul-Magaña et al. 2022; Rosales-Martínez et al. 2022).

Distribution. — The Vallarta Mud Turtle was originally described from urban streams in the city of Puerto Vallarta, northwestern Jalisco, Mexico, situated in the Bahía de Banderas Valley of the Ameca River basin, with the river forming the boundary with Nayarit

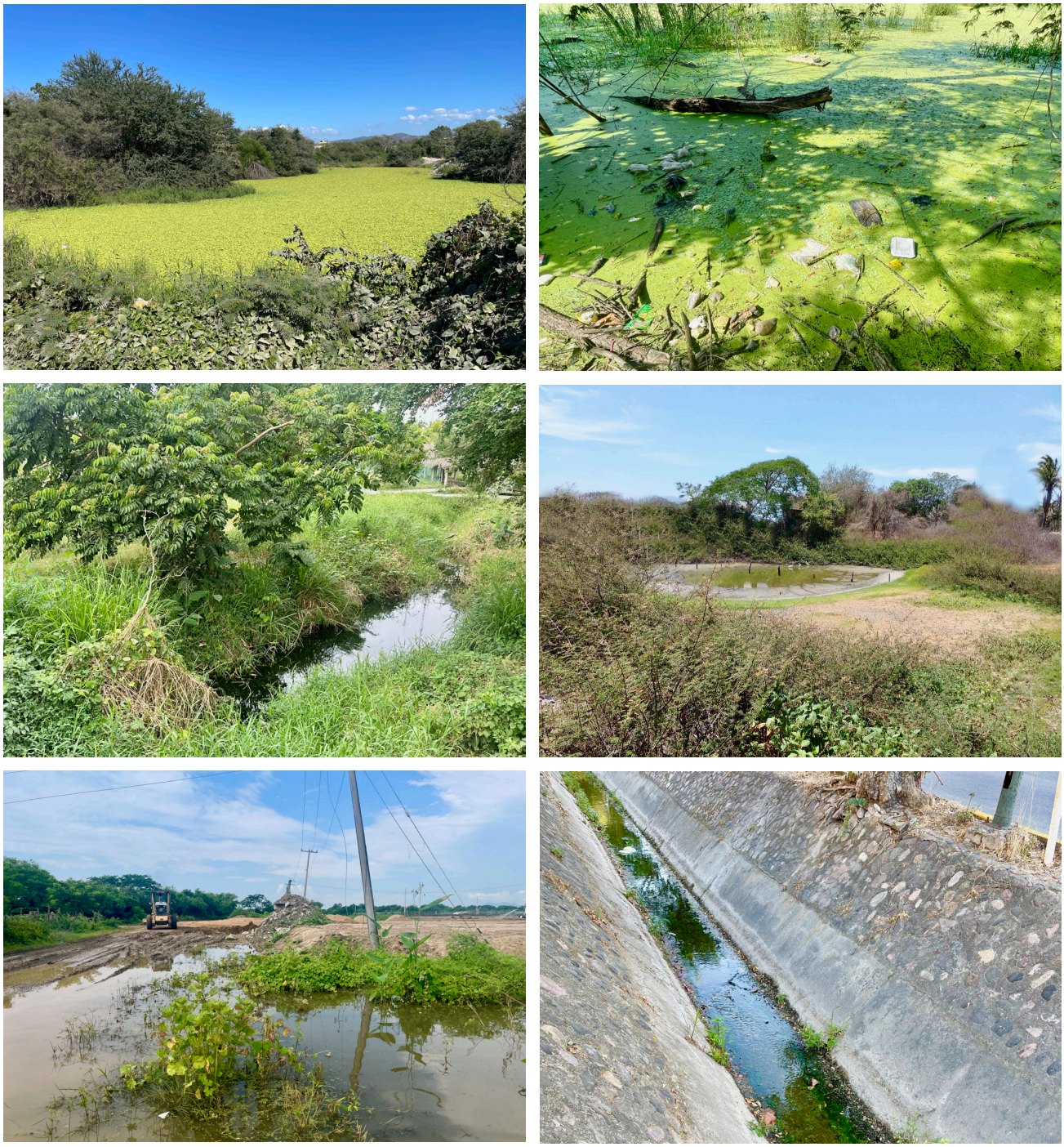

Figure 9. Former and current habitats of *Kinosternon vogti* in Jalisco and Nayarit, Mexico (some no longer present). *Top Left.* Marshy pond habitat in Puerto Vallarta, Jalisco. Photo by Torsten Blanck. *Top Right.* Marsh habitat in Puerto Vallarta showing extensive pollution. Photo by Torsten Blanck. *Center Left.* Small stream habitat in Puerto Vallarta. Photo by Craig B. Stanford. *Center Right.* Dry-season pond habitat in Nayarit. Photo by Torsten Blanck. *Bottom Left.* Former habitat in Nayarit undergoing development destruction. Photo by Torsten Blanck. *Bottom Right.* Concrete-lined drainage gutter in Puerto Vallarta where the holotype of *K. vogti* was first collected. Photo by Torsten Blanck.

state to the north. Since its original description, it has also been recorded from the Nayarit side of the Bahía de Banderas Valley (Rosales-Martínez et al. 2021; TTWG 2021, 2025). Surveys north of the Sierra de Vallejo in adjacent Nayarit and south of the Cabo Corrientes area in Jalisco have not yielded any evidence of *K. vogti*, and as such, the species seems to be endemic to the Bahía de Banderas Valley (present authors, pers. obs.). The valley spans about 15 km along the coast and 30 km inland and covers an area of about 263 sq. km (Cupul-Magaña et al. 2022). López-Luna et al. (2018) assumed that it might occur throughout the entire valley, but Rosales-Martínez

et al. (2021) estimated that the species has a distribution range of no more than 38.1 sq. km, while Cupul-Magaña et al. (2022) estimated that the area of occupancy of the species was less than 100 sq. km.

Our recent field surveys indicate that less than an estimated 0.3 sq. km of suitable habitat for the species remains. Because of severe habitat destruction, the Nayarit and Jalisco populations are now separated, consisting of one to two fragmented subpopulations each. It is important to note that genetic studies have not yet been carried out to determine if there is a genetic structure among subpopulations, which is possible due to the Ameca River, which forms a potential dispersal barrier for the species.

Habitat and Ecology. — *Kinosternon vogti* inhabits the lowland wetlands of the Bahía de Banderas Valley, at elevations of up to 20 m a.s.l. (Cupul-Magaña and Rubio-Delgado 2003; López-Luna et al. 2018; Cupul-Magaña et al. 2022; present authors, pers. obs.), formed by the delta of the Ameca River, which once offered a variety of swamps, ponds, lagoons, lakes, and slow-flowing streams and rivers intermixed with subtropical deciduous and thorn scrub forests. The area was once protected by the coastal estuaries and mangroves that stretched along the entire bay (Márquez-González 2007; Morales-Hernández et al. 2016; Cupul-Magaña et al. 2022).

A subtropical climate characterizes the valley, with a yearly average temperature of 25.4°C and an annual precipitation of about 1400 mm (Velázquez Ruiz et al. 2012), falling mainly between July and September. The region experiences a hot wet summer and a cooler dry winter season. The dry winter begins in November and lasts until May, with temperatures ranging between 7°C and 30°C (average 23.3°C), while the rainy season starts in June and lasts until October, with intense hurricanes and temperatures ranging between 16°C to 45°C (average 28.3°C). On average, February is the coldest month at 21.4°C and October is the hottest at 34°C (Morales-Hernández et al. 2016).

The wetlands have largely been converted to agriculture, farming, tourist resorts, and amenities like golf courses (Cupul-Magaña et al. 2022; present authors, pers. obs.) to support a rapidly growing human population in a tourism economy. The species is now confined to a few scattered swamp patches connected by small streams, ponds, and lakes, which are used for dispersal (Butterfield 2023a, 2023b; present authors, pers. obs.). The species is a bottom dweller, but capable of moving long distances overland.

The preferred habitat seems to be shallow, often temporary, swamps, small lakes, creeks, and ponds with dense aquatic and terrestrial vegetation covering and surrounding them. Plants identified by Rosales-Martinez et al. (2021) and additional observations by these authors include *Thalia geniculata, Salix humboldtiana, Enterolobium cyclocarpum, Pistia stratiotes, Eichhornia crassipes, Lemna* sp., and *Ficus* sp. Water temperatures vary between 20°C to 32°C, with 20°C measured in February, the coldest month at the beginning of the dry season. In October water temperatures can reach 32°C at the end of the rainy season (present authors, pers. obs.). During the peak of the dry season, the remaining water bodies inhabited by the species fall considerably or dry up completely for at least 1–2 months annually (present authors, pers. obs.).

Artificial water bodies, such as concrete channels, ditches, artificial lakes, and ponds on golf courses and recreational areas, seem uninhabited by the species, but may be used as dispersal routes (present authors, pers. obs.). So far, surveys have also failed to record the species from estuaries, and brackish water appears to be avoided. Some individuals, especially males, have even been found in dried-up riverbeds and wandering on roads, often several kilometers away from the remaining habitats (López-Luna et al. 2018; Rosales-Martínez et al. 2021; present authors, pers. obs.). Females seem more sedentary, staying in the main swamp habitats most of the time, only dispersing into streams during the egg-laying season in search of suitable nesting sites (Montaño-Ruvalcaba et al. 2020; Rosales-Martínez et al. 2022; present authors, pers. obs.).

At the beginning of the dry season, in a relatively short span of just a few weeks, many if not all specimens migrate from the nearly dried swamps to the surrounding forested areas, where they estivate by burrowing 5–10 cm deep into sandy soil areas (present authors, pers. obs.). The mating season starts once sufficient rainfall again provides aquatic habitat, usually between late June to October, with a peak in August and September (Cupul-Magaña et al. 2022; Rosales-Martínez et al. 2022; present authors, pers. obs.).

Reproduction. — The reproductive biology of *K. vogti* in the wild has not been studied in detail. Montaño-Ruvalcaba et al. (2020) reported a drowned female inside a trap on 7 November 2019 that contained a clutch of 4 eggs measuring 26–28 mm x 15–16 mm. In 2022, 14 females were captured in the field then x-rayed for the presence of eggs, and an additional 4 and 49 female individuals were palpated in the field during the 2022 and 2023 field seasons, respectively (Butterfield et al., unpubl. data). Of the turtles x-rayed in 2022, 8 of 14 had eggs (57%), and of the turtles palpated in 2022, 2 of 4 (50%) had eggs. In 2023, 21 of 49 (43%) palpated females in the field had eggs. Turtles were palpated or x-rayed in the months of August, October, November, December and February, and females were only found gravid during the months of August, October, and November. Based on the 8 gravid radiographed females, *K. vogti* had clutches ranging from 2–4 eggs (mean = 3.125), with two individuals having clutches with two eggs, three individuals with three, and three individuals

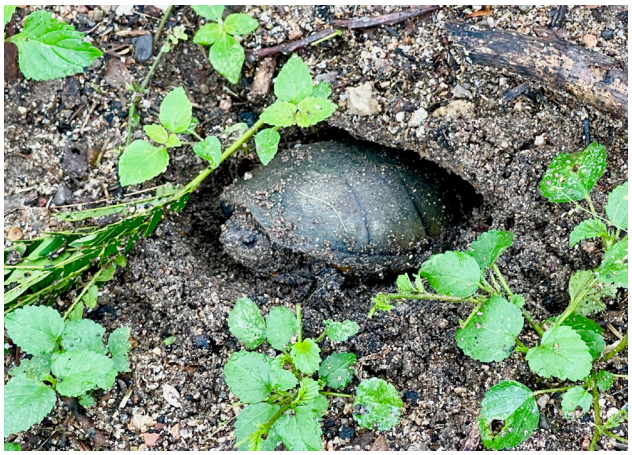

Figure 10. Wild female *Kinosternon vogti* nesting in Nayarit, Mexico, October 2022. Photo by Torsten Blanck.

with four eggs. Females with clutches of four eggs had smaller eggs on average (average width, EW = 13.9 ± 0.55 mm, average length, EL = 24.6 ± 1.7 mm, *n* = 10), compared to individuals with three eggs (EW = 15.2 ± 0.58 mm, EL = 27.9 ± 1.7 mm, *n* = 8), or two eggs (EW = 15.6 ± 0.66 mm, EL = 26.9 ± 3.7 mm, *n* = 4). Overall average egg size for the 22 eggs that were measured was EW = 14.7 ± 0.9 , EL = 26.3 ± 2.6. The smallest female palpated with eggs was 82.1 mm in SCL.

On 23 October 2022, a female *K. vogti* was observed during a nesting event in the wild in Nayarit. At 0900 hrs, the female was seen excavating a nest approximately 20 m away from the pond it inhabits, using only her hindlegs in a sandy soil substrate. Upon checking the nest later that afternoon at 1230 hrs, three eggs were found deposited at a depth of 8 cm, and measured 25.0–25.7 mm x 13.5–14.0 mm. Despite protective measures (wire nest covers) and daily monitoring of the site, the nest was depredated a few days later (present authors, pers. obs.).

Hatching in the wild has not yet been observed, but hatchlings in captivity emerge after 100–263 days of incubation, possibly requiring a diapause, simulating the cooler dry season and the warmer wet season. Hatchlings in captivity measure 19–24 mm SCL and have a weight of 2.7–4.0 g (*n* = 22), attaining an SCL of 45–64 mm in 15 months and 75–79 mm in 20 months (Blanck, pers. obs).

Rosales-Martínez et al. (2022) reported the reproductive behavior of two mating pairs of *K. vogti* in captivity. Males exhibited aggressive head and tail biting with other males when attempting to copulate with the same female. The authors observed that during courtship, the male blocks female movements with his body, the female bites at the male´s rostrum scute, the male displays titillation behavior (side-to-side head movements), and then finally moves to position himself over the back of the female for copulation (Rosales-Martínez et al. 2022). Six and two eggs per clutch were reported (non-viable eggs; average size: 28.83 ± 1.19 x 15.95 ± 0.55 mm; *n* = 5) by Rosales-Martínez et al. (2022). The reproductive size of the females and males were 88.4 mm SCL and 78.7 mm SCL, respectively (Rosales-Martínez et al. 2022).

Egg laying at both Turtle Island in Austria and the Centro Universitaro de la Costa (CUC), Universidad de Guadalajara, occurred between August and December, with females depositing 1 to 4 clutches annually, consisting of 1 to 5 eggs per clutch (present authors, pers. obs.). Eggs (*n* = 30) ranged from 25.0–31.9 mm in length (mean [± SD] 27.9 ± 2.9 mm), 13.5–16.6 mm in width (mean 15.4 ± 1.9 mm), and 2.2–4.8 g in mass (mean 3.3 ± 0.2 g), which corresponds well with the reported field data.

These observations suggest that the reproductive season begins with the start of the rainy season (June–August), and egg laying occurs during the peak of the rainy season (September–December). In the field, eggs apparently overwinter in the nest, and hatch during the following rainy season.

Diet. — Ramírez-Ramírez et al. (2019) classified *K. vogti* as an omnivorous species (*n* = 5), based on the presence of unidentified plants and seeds, Spittlebugs (*Aeneolamia albofasciata* [Insecta: Hemiptera]), and Pill-bugs (*Armadillidium vulgare* [Crustacea: Isopoda]). López-González (2023, 2025b) captured 24 individuals (17 females and 7 males) and observed at least 10 different prey items. The most common items were seeds, freshwater shrimps and snails, as well as insects and fish. Recently, Cupul-Magaña et al. (2023) reported the ingestion of shed snakeskin (*Masticophis lineatus*) by a female *K. vogti*. Some other shed snakeskins have been defecated by individuals during field surveys (Butterfield, pers. obs.). An additional record of keratophagy was observed in an adult male, with the shed skin of the snake *Thamnophis validus* (López-González, pers. obs.).

To date, 50 stomach contents of *K. vogti* have been analyzed (8 males and 42 females). We identified 14 orders of insects, and plant matter such as seeds and leaves. We have found great diversity in the orders of Coleoptera with seven genera, and Hemiptera with six genera (López-González et al., unpubl. data).

These observations suggest that *K. vogti* shows an opportunistic foraging behavior, though mostly carnivorous. In addition, some potential prey species observed during fieldwork included fish (*Gambusia affinis* and *Dormitator latifrons*, shrimp (*Macrobrachium tenellum*), crayfish (*Procambarus* sp.), unidentified freshwater crab species, snails (*Pomacea* sp.), and water insects (*Lethocerus medius, Tropisternus lateralis*, and *Megadytes lhermineri*).

Population Status. — From 2000 to 2018, only 20 *K. vogti* specimens were known to science (López-Luna et al. 2018), almost all of which were males typically encountered on rainy days on roads within Puerto Vallarta (Rosales-Martínez et al. 2021). Including the data published by Cupul-Magaña et al. (2022), and our sampling

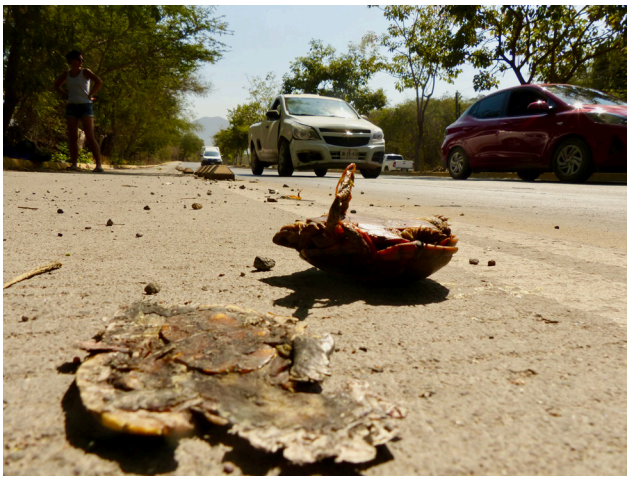

Figure 11. Road-killed *Kinosternon vogti* in Puerto Vallarta, Jalisco, Mexico. Photo by Peter Praschag.

between 2019–2023 we surveyed 45 different sites in the Bahía de Banderas valley, using aquatic traps, pitfall traps and hand capture, and representing all potential habitat types except for estuaries. This total systematic sample effort, representing more than 800 trap nights, yielded a total of 240 *K. vogti* from only 8 sites. This was far exceeded by the number of *K. integrum* (>2,000) that were trapped during this same trapping effort.

In the recent IUCN Red List assessment of *K. vogti*, Cupul-Magaña et al. (2022) estimated that fewer than 1,000 animals survived in the wild, with an estimated population reduction of over 80% in the last 36 years. Most of the remaining habitat has been transformed by construction, with only three or four highly fragmented subpopulations persisting, based on our current knowledge. Based on our sampling, we estimated that fewer than 600 individuals remained in the wild in late 2024 (unpubl. data). Due to the marked increase in poaching over the past year, with more than 200 specimens illegally poached and smuggled to China in combination with ongoing rapid and severe habitat destruction, we now hypothesize that fewer than 300 animals may remain in the wild.

Threats to Survival. — The biggest threat to the survival of *K. vogti* is ongoing habitat destruction and modification (López-Luna et al. 2018; Cupul-Magaña et al. 2022; CITES 2022). As noted by Cupul-Magaña et al. (2022), a habitat and population reduction of more than 80% has occurred for *K. vogti* within the last four decades. The Bahía de Banderas Valley represents one of the most popular tourist destinations in Mexico and is densely populated by humans, especially in the core area of the turtle's occurrence. Continuing urbanization, farming, and hotel construction projects result in the backfilling of swamps and ponds, conversion of streams into concrete channels, and destruction of the last remaining habitats. According to Márquez-González (2007), 60.9% of the former wetlands were modified between 1973 and 2000, and Morales-Hernández et al. (2016) reported further conversion to agriculture and construction until 2013. Between 2022 and 2024, we have observed the destruction of nearly 30% of the remaining habitat due to residential construction.

Road construction intersects migration pathways, resulting in road mortality incidents, as noticed in February 2022 when more than a dozen dead specimens were recorded along a 300 m stretch of a heavily trafficked road next to a swamp inhabited by the species. Another dozen living individuals were rescued along that same road section. Wildfires pose another threat to the species during their estivation period. A wildfire occurred at a nearly dried 0.8 ha lake in Nayarit in April 2023, killing at least 16 *K. vogti,* among several other dead turtles. In December 2023, another wildfire at the same site destroyed more than 6 ha of remaining habitat and led to more uncounted dead turtles (present authors, pers. obs.).

Kinosternon vogti is the smallest turtle species, with males rarely exceeding 85 mm and females reaching a known maximum of 101 mm SCL, which makes it an attractive potential pet species. Furthermore, the males are especially appealing visually due to the bright yellow rostral shield on their heads. In addition, both their small size and their rarity are fueling demand from the national and international pet trade (Cupul-Magaña et al. 2022). The international pet trade was not overtly focused on this species until mid-2024, unlike its sister species *K. cora*, which had been heavily trafficked, mainly to Asia, since its description in 2020. In 2024, this changed dramatically when Chinese turtle traders visited the Puerto Vallarta region and hired locals to catch *K. vogti* in a similar way as they did previously in *K. cora* habitat, and extensive poaching of the species began as a result.

Additionally, on 9 December 2024, the Arca de Conservación Casquito de Vallarta (Conservation Ark of the Vallarta Mud Turtle) at the CUC was robbed of 40 captive breeding *K. vogti* by two Mexicans who impersonated inspectors from Procuraduria Federal de Proteccion al Ambiente (PROFEPA). The suspects were arrested by Mexican law enforcement authorities on 26 May 2025 (PROFEPA 2025a), and are under ongoing legal proceedings. On 13 January 2025 a second robbery occurred at the center, during which intruders broke in at night around 0400 hrs and stole an additional 15 *K. vogti* (Montiel 2025). Both cases remain under investigation by the Fiscalia General de la República in collaboration with PROFEPA and the CUC.

Shortly after both of these thefts, several specimens from these incidents were identified in the Chinese turtle trade, including on the Chinese platform Douyin. Identification was possible through photographs, as all turtles at the center had been individually marked by small carapacial notches.

Although photographic evidence and trader information were provided to Chinese law enforcement authorities—both in Hong Kong and on the Chinese mainland—no confiscations of any of these identified animals have taken place to date. This is particularly concerning given that the species has the highest possible CITES protection status (Appendix I).

However, one additional specimen from the thefts was seized together with five unmarked turtles on 30 April 2025 at Hong Kong International Airport (Government of the Hong Kong Special Administrative Region 2025). These six animals are currently under care in Hong Kong, and legal negotiations for their repatriation to Mexico are ongoing.

To protect the many remaining specimens at the Centro Universitario de la Costa (CUC), a decision was made to relocate the animals to a more secure location. Owing to the close collaboration with the Zoológico Guadalajara (Zoo Guadalajara), >100 turtles were transferred there in February 2025, after which the CUC underwent extensive security enhancements.

On 25 September 2025, PROFEPA confiscated 2,339 poached turtles in a suburb of Guadalajara, Jalisco, Mexico, consisting of eight *Kinosternon* species, including over 40 *K. vogti* (PROFEPA 2025b). These turtles were moved to the Zoológico Guadalajara for immediate care (Turtle Survival Alliance 2025). Several other smaller confiscation (e.g., at the Airport of Mexico City) have occurred over the past few years, and also at the international airports of Chicago in 2024 and Los Angeles in 2025.

The species is now frequently seen openly offered at Chinese turtle Expos and online platforms, and more than 200 specimens are believed to have been illegally exported to China and Hong Kong within the last 12 months (2024–2025).

Poachers are still placing traps in the few remaining habitats for *K. vogti*, often without adding flotation devices, claiming countless turtle lives. Between June and August 2025 alone, we found and destroyed around 40 traps. Inside them, we discovered 16 live and 8 drowned *K. vogti*, 16 live and 25 drowned *K. integrum*, and 7 live and 3 drowned *Trachemys ornata*. The actual number of unreported poaching cases is likely much higher.

Another potential threat is competition from native turtle species like the sympatric *K. integrum*, which can be found in very high densities in most current habitats of *K. vogti*, as well as *Trachemys ornata* (Cupul-Magaña et al. 2020). Non-native invasive turtle species found in these habitats include *Staurotypus triporcatus* (known to actively prey on turtles; present authors, pers. obs.), *Chelydra serpentina* (Cupul-Magaña and Rubio-Delgado 2003), *Trachemys scripta,* and *Apalone ferox* (Cupul-Magaña 2012; Fuentes-Castrejón and Maldonado-Gasca 2015; Cupul-Magaña et al. 2022), all of which also pose potential threats. Recently, Paz-Urbina et al. (2023) captured 83 individuals of *K. integrum* and less than 10 *K. vogti* in a seasonal wetland, and Butterfield (2023a, 2023b) captured 2 *K. vogti*, 25 *K. chimalhuaca*, 60 *K. integrum*, 26 *T. ornata*, and 184 *T. scripta* at the same site.

The occurrence of *K. chimalhuaca* in Puerto Vallarta raises concerns about potential hybridization between these closely related species (López-Luna et al. 2020). On the other hand, there could also be competition for food resources (trophic niche) between *K. vogti* and *K. chimalhuaca*, which might contribute to the low abundance of *K. vogti* observed by Butterfield (2023a, 2023b) in habitats where *K. chimalhuaca* is also present, not to mention potential negative interactions with *T. scripta,* including predation and food competition (these authors, pers. obs.).

Potential predators include mammals such as Coatis (*Nasua narica*), Raccoons (*Procyon lotor*), Rats (*Rattus* spp.), Armadillos (*Dasypus novemcinctus*), Opposums (*Didelphis virginiana*), as well as feral dogs (*Canis familiaris*) and cats (*Felis catus*). Avian predators such as *Anhinga anhinga, Nannopterum brasilianum, Egretta* spp*., Eudocimus albus, Plegadis chihi, Mycteria americana, Fregata magnificens, Pelecanus occidentalis*, and reptilian predators like *Crocodylus acutus* and several snake species also pose threats. During a 2023 survey, we found a freshly decapitated male *K. vogti* next to a pond, likely killed by a raccoon.

Conservation Measures Taken. — *Kinosternon vogti* is a cryptic and uncommon species throughout its restricted distribution range. Therefore, specific conservation programs to ensure its survival are a high priority. The species is currently protected by Mexican legislation, NOM-059-SEMARNAT-2019, which prohibits collection from the wild for commercial trade or keeping in captivity as a pet. The species was provisionally assessed as Critically Endangered by the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group in 2018 (TTWG 2021) and officially assessed as Critically Endangered by the IUCN Red List in 2022 (Cupul-Magaña et al. 2022; TTWG 2025). Recently, *K. vogti* and its sister species *K. cora* were included on CITES Appendix I, while 18 other members of the genus *Kinosternon* were placed on Appendix II (CITES 2022), which aims to monitor and regulate international trade in these turtles.

Despite national and international laws protecting this species, the remaining habitats for this species occur on the most highly valuable private land in Jalisco and Nayarit. No populations are known to exist in any protected areas. In October 2022, the Turtle Survival Alliance (TSA), Turtle Island (TI), Estudiantes Conservando la Naturaleza AC (ECN), and Centro Universitario de la Costa (CUC) organized an informal three-day workshop at the University of Guadalajara installations in Puerto Vallarta to discuss and develop strategies to protect the

species. Since that meeting, both ECN and CUC have been engaging local stakeholders, including schools, government, and businesses to raise awareness of the species through outreach activities. TSA and TI have helped to fund or been actively involved in these efforts. Local stakeholders have also been engaged to protect areas for the species, including city officials, developers, and landowners. No habitats have been conserved yet, but progress has been made to achieve relationships with the City of Puerto Vallarta, developers, and private landowners to mitigate the impact of their construction on a key turtle population. Since this meeting, CUC and TI in 2024 established an in-situ UMA (Unidad de Manejo para la Conservación de la Vida Silvestre – Unit for the Management and Conservation of Wildlife) consisting of a Conservation Center on the University grounds, the Arca de Conservación Casquito de Vallarta (Conservation Ark of the Vallarta Mud Turtle), which maintained a captive breeding assurance colony of *K. vogti*, consisting of rescued specimens from all currently known 5 remaining subpopulations in the Bahía de Banderas Valley (but see above concerning the subsequent theft of many animals from this facility).

In February 2023 Turtle Island and CUC installed a drift fence along what is potentially the largest remaining habitat, blocking the access of turtles to an adjacent road with heavy traffic during the spring migration period between January and March; 48 *K. vogti* were successfully rescued during the first 2 months of this effort. Only one road-killed specimen was reported in that year from the area, which was found at the beginning of the fence construction. In 2024, this effort was successfully repeated, saving another 8 specimens from being killed on the road. The much lower number trapped in 2024 as compared to 2023 might indicate a severe population decline in this area, but may also have been related to the removal of the trapped specimens from 2023 to the CUC captive breeding facility. Due to increased poaching, no fence was erected in 2025, leading to at least 4 observed roadkills.

The ECN has been focused on protecting the species by installing reptile fences along one of the ponds where it is known to occur and where its surroundings are currently being converted into urban development. Several dead and dying specimens have been found due to damage from construction. Another lake where the species is known has been surrounded by a stone wall, supported by the city council of Puerto Vallarta, and constructed by ECN to prevent refill and rubbish dumping. Another heavily poached site is currently fenced with the help of a private landowner.

Law enforcement in the habitats of *K. vogti* is still at an insufficient level, but during the next few years two full-time field technicians will be dedicated to sampling the species across the entire rainy season, installing cameras, and patrolling among habitats to help prevent illegal poaching. PROFEPA is also actively monitoring poaching by patrolling known poaching sites. University students will also continue their investigation of the ecology of the species. The goal is to monitor the species' conservation status and develop a positive relationship with local law enforcement in order to protect the turtles and their habitats.

Captive Breeding Populations. — Several captive breeding populations (assurance colonies) for *K. vogti* have been established to date. An adult pair, collected in 2017, is kept at the Center of Research and Conservation of Endangered Species (CICEA) at the Universidad Juárez Autónoma de Tabasco in the city of Villahermosa, Tabasco. In 2020, numerous live turtles were seized at the Mexico City Airport, including *K. vogti*, which were deposited in the PIMVS (Predios o Instalaciones que Manejan Vida Silvestre de forma Confinada fuera de su hábitat natural – Spaces or Installations with Wildlife Management in indoor conditions outside their natural distribution), El Almendro in Cuautla, Morelos (SEMARNAT-PIMVS-CR-INT-0116-MOR/19).

The Zoológico Guadalajara started maintaining a group consisting initially of 19 specimens of *K. vogti* in 2023, increasing to 24 specimens in 2024 (Zoológico Guadalajara 2024a, 2024b), with many further additions after the thefts at the CUC and from the recent large confiscation in 2025. The Zoo also serves as the reception site for turtles seized or rescued by PROFEPA. The visitor center at the Estero El Salado in Puerto Vallarta has housed *K. vogti* on occasion after receiving rescued specimens. The Assurance Center at the University of Guadalajara has received numerous specimens through turtle rescues.

Additional ex-situ assurance colonies include those maintained by Turtle Island in Austria. Furthermore, specimens confiscated in Chicago and Los Angeles and the ones in Hong Kong could either form further assurance colonies or possibly be returned to Mexico. Fewer than 30 specimens not involved in any conservation measures are maintained in the USA, Europe, and Japan, and a similar number are kept by hobbyists in Mexico itself. Due to the poaching events, more than 200 specimens illegally made their way into the Chinese pet trade. We estimate the number of specimens being kept in legal captivity and part of current conservation efforts to preserve the species to be about 230.

Conservation Measures Proposed. — The best measure of immediate successful conservation for the Vallarta Mud Turtle will be several captive breeding assurance colonies that are producing offspring for future release programs, with a strong relationship between local, state, and federal governments to monitor, conserve, and restore habitats/populations of this species. This effort will require the cooperation of developers

and local landowners to ensure that the last remaining habitat patches are not destroyed, but rather preserved during construction projects. Additional proposed longer-term measures include establishing artificial habitats outside of the tourist zone, in more rural areas of the valley which face less pressure from developers, as well as the establishment of at least a few protected natural areas.

Conserving habitat in the city of Puerto Vallarta will require major habitat restoration, and solutions for invasive species like the Red-eared slider (*Trachemys scripta elegans*). For example, one of the city lagoons that is currently "semi-protected" is in poor condition with a high level of sediment and has an estimated 1,200 individuals of *T. s. elegans* (Butterfield 2023a, 2023b). The closely related *K. chimalhuaca* occurs in the same lagoon, and an ongoing study aims to show if *K. chimalhuaca* is native or invasive, and if it poses a risk of hybridization with *K. vogti*. In the two sampling events in this lagoon in spring 2024, we trapped three female *K. vogti*, one of which was gravid. Hence, there is still hope for the species in the lagoon, but we propose an immediate intervention involving the ethical removal of Red-eared Sliders. In late 2024 during another sampling, two specimens that potentially resemble *K. chimalhuaca* x *K. vogti* hybrids were captured; genetics studies are currently underway to test if this is the case.

As a species occurring in a highly urbanized environment, habitat loss is the main threat to the survival of *K. vogti* in the short and medium term. With less than an estimated 0.3 sq. km of remaining suitable habitat, the drastic reduction of the natural habitat for *K. vogti* in the Bahía de Banderas Valley due to rapid urban and tourist development is deeply concerning. Attempts to communicate with the owners of remaining *K. vogti* habitat have been made, but continued efforts are needed to achieve sustainable habitat conservation.

Creating artificial water bodies in or outside residential and tourist areas presents an important opportunity to create new habitat for the species outside of its main geographic range. If human-made wetlands can be designed and managed to provide semi-natural conditions mimicking the species' requirements, they could potentially serve as refuges. This creative approach of constructing artificial habitats may be one of the few feasible long-term solutions given the intense development pressures in the region, which could help maintain viable populations of the Vallarta Mud Turtle within its native distribution range. This would require close collaboration with developers and municipalities to integrate the turtle's habitat needs into design plans.

In sum, the last few remaining habitat patches require urgent protection, and cooperation from local, state, and national governments is needed. Public and private organizations will play a key role in coordinating different levels of government and ensuring that conservation projects for *K. vogti* are successful and sustainable. The long-term goal should be creating projects that can be turned over to Mexican agencies such as SEMARNAT or CONANP, and be consistent, transparent, long-term, and publicly funded.

Captive Husbandry. — Published captive husbandry data on *K. vogti* are nearly non-existent. Rosales-Martínez et al. (2022) reported that two of the paratypes, a male and a female, were maintained in Tabasco (López-Luna et al. 2018) in a 40 l aquarium measuring 26 x 50 x 35 cm with a water depth of 11 cm. In addition, three freshly captured specimens, obtained in 2019 and 2020 (one male and two females) were kept together in a terrarium in Tabasco with a dry area of 43 x 30 x 10 cm and a shallow water area of 75.5 x 97.5 x 10 cm.

Courtship was described by Rosales-Martínez et al. (2022) to include males engaging in aggressive ritualized head and tail biting, which is uncommon in *Kinosternon* sp. Mating occurred underwater, and the males were reported to exhibit wave-like movements of their front feet across the female's face, called titillation behavior, common in many turtle species. Mating finally occurred after a final stroke of the male's foreclaws across the female's face, and a bite of the female at the male's yellow rostral patch, after which the female turned and presented the posterior end of her carapace toward the male. The male then mounted her. Eggs were deposited in a hole dug by the female in the terrarium substrate. A total of 9 eggs was deposited by the 3 females. The eggs did not develop white bands, indicating infertility (Rosales-Martínez et al. 2022).

The first successful reproduction of the species in captivity occurred at Turtle Island on 8 February 2023. Specimens are maintained individually, except for mating purposes, in 80 x 60 x 40 cm aquaria with a water level of 10 cm, a land area covering 80 x 20 cm, with a sandy substrate 10 cm deep. Each aquarium contained stones, bark, and gravel as well as water plants (*Pistia stratiodes, Elodea* sp.) for hiding purposes. UV-B light was provided on a daily basis via a ZooMed T5® bar. The water temperature was maintained at above 28°C during the day and above 25°C during the night between June and December and decreased to room temperature (~20°C) between January and May.

Males were observed on land mainly during the night and rarely bask; females occasionally basked, especially shortly before egg deposition. The peak of activity occurred between dawn and midnight. All specimens estivated for several weeks, buried in the sand on the land area, sometimes with short periods in the water in between. Mating has been observed when the male is put with the female between June and October for short amounts of time. Mating was as described by Rosales-Martínez et al. (2022). Compared to its sister species *K. cora*, there

is little aggression between males and females during courtship (present authors, pers. obs.).

Nesting has been observed during the night with eggs at a depth of 8–9 cm in sandy substrate. One female remained buried beside her clutch for several days, while others usually oviposit and return to the water immediately. Egg deposition occurred between June and December, with one to four clutches per seasons, each consisting of one to four eggs. The eggs were placed in small plastic containers filled with dry vermiculite and maintained at room temperature (~20°C) for a month, a technique applied for many species that require diapause. Fertile eggs developed a white band around the middle after 2–3 days, indicating fertility. After the diapause period, the eggs were transferred into an incubator and incubated at temperatures between 27 and 31°C. On 8 February 2023, the first three hatchlings emerged from their eggs after an incubation period of 100 days.

A second clutch deposited by the same female a month after the first one was also incubated in the same way, banded, but did not show any further sign of development. The incubator was switched off in March and the eggs were later removed and discarded into a plastic box on top of the incubator for future measurements. On 2 July 2023, when candling some eggs of other species, those discarded eggs were candled again. One of the eggs showed clear signs of development, i.e., clearly visible blood vessels. That egg was placed back into the incubator and on 13 August 2023 (after 286 total days) a hatchling measuring 19.4 mm SCL and 2.7 g mass emerged from this egg. On 13 May 2024 another hatchling emerged from a clutch deposited on the 30 August 2023.

Further breeding success occurred in 2024 at the Turtle Island facility as did the first captive hatching in Mexico, at the PIMVS El Almendro in Cuautla, Morelos (R. Rosales Garay, pers. comm.), with two hatchlings emerging in late July 2024. Furthermore, two hatchlings were produced by a private Chinese breeder in July 2024 (C. Wan, pers. comm.), with a pair obtained in 2022.

The first successful hatching at the Arca de Conservación Casquito de Vallarta of a single specimen occurred on 19 May 2025 (López-González, pers. obs.). The Zoológico Guadalajara successfully reproduced the species for the first time on 30 June 2025 with a single hatchling emerging from its egg after 121 days, measuring 20 mm SCL and 2.8 g (Zoológico Guadalajara 2025). At least 10 captive-hatched specimens, derived from gravid poached females have been produced in China in 2025. Turtle Island has hatched this species on an annual basis and recorded 16 hatchlings in 2025.

Hatchlings began feeding after a week and grew at a fast rate at Turtle Island. After 3 months they reached 30–33 mm SCL and 6.5–6.9 g mass, and after 6 months they reached 40.0–49.4 mm SCL and a mass of 14.5–24 g. After 15 months they reached 48–68 mm SCL and were sexable based on the tail size and especially the change in coloration in males of the rostrum (turning yellow) and the jaws (becoming whitish), with female coloration of the rostrum staying brownish and the jaws dull.

The diet of adults in captivity at Turtle Island consisted of *Gammarus*, shrimp, turtle pellets, fresh fish (dead and alive), chopped chicken heart, earthworms, and mealworms. Juveniles were fed with earthworms, red mosquito larvae, small *Gammarus* and baby turtle pellets. Adults and juveniles are very agile hunters, that easily hunted down guppies in their tanks. Snails were consumed as well. Water plants and lettuce were occasionally consumed by the females, but not by the males.

Current Research. — Genetic analyses aimed at elucidating the population structure and genetic diversity of the species are currently being conducted by the present authors. In parallel, ongoing field studies seek to improve the understanding of the species' ecology and behavioral patterns, while also providing essential data to support future habitat restoration and management efforts. In addition, the authors are monitoring the illegal turtle trade in China to obtain a more comprehensive understanding of the current situation and its potential impact on wild populations.

Acknowledgments. — The initial long-term monitoring program for *K. vogti* was supported by Global Wildlife Conservation, Turtle Conservation Fund (TCF-0754 to López-Luna), and Turtle Conservancy. Sampling and conservation efforts from 2021–2024 have also been partially supported by Turtle Survival Alliance and Mohamed bin Zayed Species Conservation Fund via funding to Estudiantes Conservando la Naturaleza (ECN). López-González received a scholarship from the Universidad de Guadalajara (PROSNI-2023) to work as a research assistant. Nolasco-Luna thanks the Consejo Nacional de Humanidades, Ciencias y Tecnologías-CONAHCyT for a doctoral scholarship. Funding for the construction of the Conservation Center at the University of Guadalajara was provided by the Barbel Heiz Trust, Turtle Island, Nordens Ark, Berlin Zoo, Auckland Zoo, Pilsen Zoo, Wildlands Emmen, ZooMed and the Dutch-Belgian Turtle Association (NBSV). We thank Ubaldo Sebastian Flores Guerrero and Hector Andrés Medina Andrade (both ECN) for their assistance in field work and surveys, Craig Stanford and Carolina Sánchez Arias for use of their photos, and Anders Rhodin, John Iverson, Craig Stanford, Kurt Buhlmann, Peter Paul van Dijk, and Armando Escobedo Galván for their reviews and editing, which helped improve the manuscript.

Literature Cited

Berry, J.F., Seidel, M.E., and Iverson, J.B. 1997. A new species of mud turtle (genus *Kinosternon*) from Jalisco and

Colima, Mexico, with notes on its natural history. Chelonian Conservation and Biology 2(3):329–337.

Butterfield, T.G. 2023a. Primer muestreo de las tortugas que habitan en la Laguna del Coapinole. Unpublished Technical Report. Subdirección de Medio Ambiente-Estudiantes Conservando la Naturaleza A.C., 5 pp.

Butterfield, T.G. 2023b. Segundo muestreo de las tortugas que habitan en la Laguna del Coapinole. Unpublished Technical Report. Subdirección de Medio Ambiente-Estudiantes Conservando la Naturaleza A.C., 4 pp.

CITES. 2022. Include the genus *Kinosternon* (20 species) in Appendix II (with the exception of the species listed in the following paragraph, to be included in Appendix I), in accordance with the criteria set out in Resolution Conf. 9.24 (Rev.CoP17)- CoP19 Prop. 29. CITES: 29 pp.

Cupul-Magaña, F.G. 2012. *Varanus exanthematicus* (Bosc, 1792), *Apalone spinifera emoryi* (Le Sueur, 1827) y *Gopherus berlandieri* (Agassiz, 1857): reptiles exóticos en el área urbana de Puerto Vallarta, Jalisco, Mexico. Cuadernos de Herpetología 26:59–60.

Cupul-Magaña, F.G. and Rubio-Delgado, A. 2003. Distribución de dos especies de tortugas dulceacuícolas, *Kinosternon chimalhuaca* y *Chelydra serpentina* (Testudines), en Puerto Vallarta, Jalisco, México. Boletín de la Sociedad Herpetológica Mexicana 11:49–50.

Cupul-Magaña, F.G., Flores-Guerrero, U.S., and Escobedo-Galván, A.H. 2020. Distribución potencial de la tortuga mesoamericana *Trachemys ornata* en México. Intropica 15(1):66–70.

Cupul-Magaña, F.G., Butterfield, T., Gregory, T., Iverson, J.B., Macip-Ríos, R., and López-Luna, M.A. 2022. *Kinosternon vogti*. The IUCN Red List of Threatened Species 2022: e.T215164369A215164374.

Cupul-Magaña, F.G., López-González, N.E., Barraza-Soltero, I.K., Blanck, T., Praschag, P., Diruzzo, S., Butterfield, T.G., and Escobedo-Galván, A.H. 2023. Snake shed skin consumed by *Kinosternon vogti*: a case of interspecific keratophagy. Herpetozoa 36:259–262.

Fuentes-Castrejón, J.N. and Maldonado-Gasca, A. 2015. Diversidad de reptiles de la Laguna El Quelele en Nayarit, México. BIOCYT 8(31):545–556.

Government of the Hong Kong Special Administrative Region. 2025. Press Release: Man arrested for illegal import of critically endangered Vallarta Mud Turtles. https://www.info.gov.hk/gia/general/202505/02/P2025050200673.htm.

Hurtado-Gómez, J.P., Vargas-Ramírez, M., Iverson, J.B., Joyce, W., McCranie, J., Paetzold, C., and Fritz, U. 2024. Diversity and biogeography of South American mud turtles elucidated by multilocus DNA sequencing (Testudines: Kinosternidae). Molecular Phylogenetics and Evolution 197:108083:1–19.

Loc-Barragán, J.A., Reyes-Velasco, J., Woolrich-Piña, G.A., Grünwald, C.I., Venegas de Anaya, M., Rangel-Mendoza, J.A., and López-Luna, M.A. 2020. A new species of Mud Turtle of genus *Kinosternon* (Testudines: Kinosternidae) from the Pacific Coastal Plain of northwestern Mexico. Zootaxa 4885(4):509–529.

López-González, N.E. 2023. Variación morfológica y dieta de la tortuga *Kinosternon vogti*. Unpublished Technical Report, Professional Practices, Centro Univeristario de la Costa, Universidad de Guadalajara, Puerto Vallarta, México, 13 pp.

López-González, N.E, Cupul-Magaña, F.G., Butterfield, T., Blanck, T., Praschag, P., Diruzzo, S., and Escobedo-Galván, A.H. 2023. Conociendo algunos aspectos de la historia de vida de la tortuga Casquito de Vallarta, *Kinosternon vogti*. In: Aguayo Rodrigo, C.G., Mendoza-Miranda, P., and Ureña-Aranda, C. (Eds.). Memorias del XII Congreso Latinoamericano de Herpetología. Cochabamba, Bolivia, pp. 184–185.

López-González, N.E., Rosales-Martínez, C.S., Garrido, J.R., Bello-Sánchez, C.D., Escobedo-Galván, A.H., and Cupul-Magaña, F.G. 2025a. Aberrant coloration in three species of mud turtles (Kinosternidae) from western Mexico. Reptiles & Amphibians 32(1): e22785, 5 pp.

López-González, N.E., López-Luna, M.A., and Escobedo-Galván, A.H. 2025b. Sexual size dimorphism and allometric growth of the smallest turtle in the world (Testudines: Kinosternidae). Salamandra 61(1):95–100.

López-Luna, M.A., Cupul-Magaña, F.G., Escobedo-Galván, A.H., González-Hernández, A.J., Centenero-Alcalá, E., Rangel-Mendoza, J.A., Ramírez-Ramírez, M.M., and Cazares-Hernández, E. 2018. A distinctive new species of mud turtle from western México. Chelonian Conservation and Biology 17(1):2–13.

López-Luna, M.A., Escobedo-Galván, A.H., and Cupul-Magaña, F.G. 2020. Ampliación del ámbito geográfico y de la talla máxima de *Kinosternon chimalhuaca* (Testudines: Kinosternidae). Acta Biológica Colombiana 25(3):431–433.

López-Luna, M.A., Venegas-Anaya, M., Cupul-Magaña, F.G., Rangel-Mendoza, J.A., and Escobedo-Galván, A.H. 2021. Mitochondrial DNA data support the recognition of the mud turtle, *Kinosternon vogti* (Cryptodira: Kinosternidae). Chelonian Conservation and Biology 20(1):97–102.

Márquez-González, A.R. 2007. La expansión del turismo costero en Bahía de Banderas, Nayarit: un análisis de deterioro ambiental. Ph.D. Dissertation, Universidad Nacional Autónoma de México, Ciudad de México.

Montaño-Ruvalcaba, C., Loc-Barragán, J.A., Grünwald, C.I., and Reyes-Velasco, J. 2020. *Kinosternon vogti* (Vallarta Mud Turtle): Reproduction. Herpetological Review 51(2):315–316.

Montiel, A. 2025. Robo de Tortuga Casquito de Vallarta agrava riesgo de extinción. https://otramarea.com/noticias/robo-de-tortuga-casquito-de-vallarta-agrava-riesgo-de-extincion/.

Morales-Hernández, J.C., Caprillo-González, F.M., Farfan-Molina, L.M., and Cornejo-López, V.M. 2016. Vegetation change cover in the coastal region of Bahía de Banderas, Mexico. Caldasia 38(1):17–29.

Paz-Urbina, M., Nolasco-Luna, J.R., and Escobedo-Galván, A.H. 2023. Variación morfológica de una población de *Kinosternon integrum* (Reptilia, Kinosternidae). In: Aguayo Rodrigo, C.G., Mendoza-Miranda, P., and Ureña-Aranda, C. (Eds.). Memorias del XII Congreso Latinoamericano de Herpetología. Cochabamba, Bolivia, pp. 208–209.

PROFEPA [Procuraduria Federal de Proteccion al Ambiente]. 2025a. En operative conjunto detienen a persona relacionada con el robo de tortugas casquito en Puerto Vallarta. https://www.gob.mx/profepa/prensa/en-operativo-conjunto-detienen-a-persona-relacionada-con-el-robo-de-tortugas-casquito-en-puerto-vallarta?idiom=es.

PROFEPA [Procuraduria Federal de Proteccion al Ambiente]. 2025b. FGR y PROFEPA aseguran más de 2,300 tortugas y más de 2,200 kilos de aletas de tiburón y buches de totoaba durante operativo, en Jalisco. https://www.gob.mx/profepa/prensa/fgr-y-profepa-aseguran-mas-de-2-300-tortugas-y-mas-de-2-200-kilos-de-aletas-de-tiburon-y-buches-de-totoaba-durante-operativo-contra-trafico-de-vida-silvestre-en-jalisco?state=published&fbclid=IwVERTSANSlO5leHRuA2Flb

QIxMAABHt5n1eezWKKdPOblvk47dc5Mj1jYNTQwtopVyUj1yvPYBHq8dcHV6hYMC-Nl_aem_PNqYNfk5FDcZcE_SnLaCfw&sfnsn=scwspwa.

Ramírez-Ramírez, M.M., López-Luna, M.A., Escobedo-Galván, A.H., and Cupul-Magaña, F.G. 2019. *Kinosternon vogti* (Vallarta Mud Turtle): Diet. Herpetological Review 50(3):558–559.

Rosales-Martínez, C.S., Bello-Sánchez, C.D., Centenero-Alcalá, E., and Cupul-Magaña, F.G. 2021. Nota de distribución: *Kinosternon vogti* (Kinosternidae). Revista Latinoamericana de Herpetología 4(2):232–233.

Rosales-Martínez, C.S., Bello-Sánchez, C.B., López-Luna, M.A., Escobedo-Galván, A.H., and Cupul-Magaña, F.G. 2022. First observations on courtship and nesting behavior of *Kinosternon vogti* (Testudines: Kinosternidae). Cuadernos de Herpetología 36(1):95–99.

TTWG [Turtle Taxonomy Working Group: Rhodin, A.G.J., Iverson, J.B., Bour, R., Fritz, U., Georges, A., Shaffer, H.B., and van Dijk, P.P.]. 2021. Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (9th Ed.). In: Rhodin, A.G.J., Iverson, J.B., van Dijk, P.P., Stanford, C.B., Goode, E.V., Buhlmann, K.A., and Mittermeier, R.A. (Eds.). Chelonian Research Monographs 8:1–472.

TTWG [Turtle Taxonomy Working Group: Rhodin, A.G.J., Iverson, J.B., Fritz, U., Gallego-García, N., Georges, A., Shaffer, H.B., and van Dijk, P.P.]. 2025. Turtles of the World: Annotated Checklist and Atlas of Taxonomy, Synonymy, Distribution, and Conservation Status (10th Ed.). In: Rhodin, A.G.J., Iverson, J.B., van Dijk, P.P., Stanford, C.B., Goode, E.V., Buhlmann, K.A., and Mittermeier, R.A. (Eds.). Chelonian Research Monographs 10:1–575.

Turtle Survival Alliance. 2025. Over 2,000 wild turtles seized in Mexico; conservationists race to save survivors. https://turtlesurvival.org/over-2000-wild-turtles-seized-in-mexico-conservationists-race-to-save-survivors/?srsltid=AfmBOoraKUKkjznUg8ycLVG7DyjUbr_ek6gWiHdFyO1cGSuPailnzuTF.

Velázquez Ruíz, A., Martínez R., L.M., and Carrillo González, F.M. 2012. Caracterización climática para la región de Bahía de Banderas mediante el sistema de Köppen, modificado por García, y técnicas de sistemas de información geográfica. Investigaciones Geográficas, Boletín del Instituto de Geografía, UNAM 79:7–19.

Zoológico Guadalajara. 2024a. Catálogo de especies por clase–Febrero 2024. https://zooguadalajara.com.mx/uploads/transparencia/recursos/5503/Art8-V-R_Activos_animales.pdf.

Zoológico Guadalajara. 2024b. Catálogo de especies por clase–Noviembre 2024. https://zooguadalajara.com.mx/uploads/transparencia/recursos/5986/Art8-V-R_Activos_animales.pdf.

Zoológico Guadalajara. 2025. Zoológico Guadalajara logra el primer Nacimiento en México de *Kinosternon vogti* – bajo cuidado professional. https://www.facebook.com/zoologicogdl/posts/-un-hecho-hist%C3%B3rico-para-la-conservaci%C3%B3n-en-m%C3%A9xicoen-el-zoologico-guadalajara-lo/1196255952531894/.

Citation Format for this Account:

López-González, N.E., Blanck, T., Cupul-Magaña, F.G., Nolasco-Luna, J.R., Praschag, P., López-Luna,M.A., Butterfield, T.G., Barrios-Quiroz, G., and Diruzzo, S. 2025. *Kinosternon vogti* López-Luna, Cupul-Magaña, Escobedo-Galván, González-Hernández, Rangel-Mendoza, Ramírez-Ramírez, and Cazares-Hernández 2018 – Vallarta Mud Turtle, Casquito de Vallarta. In: Rhodin, A.G.J., Iverson, J.B., van Dijk, P.P., Stanford, C.B., Goode, E.V., Buhlmann, K.A., and Mittermeier, R.A. (Eds.). Conservation Biology of Freshwater Turtles and Tortoises: A Compilation Project of the IUCN/SSC Tortoise and Freshwater Turtle Specialist Group. Chelonian Research Monographs 5(19):132.1–15. doi: 10.3854/crm.5.132.vogti.v1.2025; www.iucn-tftsg.org/cbftt/.