other studies and may instead reflect a spontaneous mutation of genetic origin or a rare variant within the natural range of phenotypic variability in the species (Bechtel, 1995). Nevertheless, there is the possibility that axanthism in the genus *Dryophytes* is only temporary, and related to abnormal hormonal expression, that could be linked to environmental disturbance (Maslova et al. 2018)

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NATURAL HISTORY NOTE

A Horn-shaped Choristoma on the Neck of a Southwestern Pond Turtle: Are Turtles Growing Horns?

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Reptiles and amphibians exhibit a wide variety of malformations and atypical morphological variations (Hildebrand 1930, Murphy et al. 1987, Bechtel 1995, Castro-Torreblanca and Blancas-Calva 2021, von Ehrenkrook et al. 2024). Among amphibians, many species that undergo metamorphosis are especially prone to malformations because errors can arise at multiple, distinct developmental stages (Lunde and Johnson 2012, Johnson et al. 2013). In contrast, reptiles develop directly and therefore lack this additional source of teratogenesis. Nevertheless, a wide array of reptilian malformations is documented, including kyphoscoliosis (Horváth 2025), supernumerary tails (Henle and Grimm-Seyfarth 2020), polydactyly (Ineich and Miralles 2014), and pigment anomalies (Bechtel 1995).

Turtles, in particular, have been reported with bicephaly (Hilebrand 1930, Ingle et al. 2021), malformations of the carapace and plastron (Newman 1906, von Ehrenkrook et al. 2024), and other deformities (Zangerl and Johnson 1957, Davy and Murphy 2009). Malformations of the plastron or carapace are observed with some regularity, ranging from minor scute anomalies to substantial shell deformities (Lynn and Ullrick 1950, Pavaliko 1986). A single Chinese Pond Turtle (*Mauremys reevesii*) was reported in the grey literature (no published work) as having horn-like structures arising from its eyelids (*https://mainichi.jp/english/articles/20200718/p2a/00m/0et/023000c*). Although this malformation was not scientifically described, it was suggested to be a cuticular mutation. Based on available photographs, the growths may represent choristomas—normal tissue occurring in an abnormal location. The horns in the Chinese Pond Turtle may have originated from tissue typically forming the carapace or plastron. Choristomas in turtles are believed to arise primarily from congenital developmental anomalies, with both genetic factors—such as mutations, chromosomal aberrations, and reduced genetic diversity—and

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environmental influences during embryogenesis, including temperature extremes and contaminant exposure, playing important roles in their formation (Velo-Antón et al. 2011, Martín-del-Campo et al. 2021). Here, we report a similar phenomenon in a Southwestern Pond Turtle (*Actinemys pallida*), in what we believe is the first published account of a horn-shaped choristoma in this species.

We trapped Northwestern (*A. marmorata*) and Southwestern Pond Turtles as part of a 12-year monitoring project to determine pond turtle (*Actinemys* spp.) nest locations at Moorhen Marsh, a 9.5 ha site managed by Mt. View Sanitary District in Martinez, California. The site includes six ponds used for tertiary wastewater treatment and to support wildlife habitat. Turtles were trapped annually, marked or remarked, and evaluated for demographic and health parameters to facilitate long-term monitoring of population dynamics and nesting activity (Alvarez et al. 2014, Davidson and Alvarez 2020, Alvarez 2021).

On 21 June 2025, we captured 20 pond turtles, which were examined for age, sex, injuries, signs of predation, species designation, and marginal scute marks from previous work on the site. Among a smaller group of 10 males and one female, we observed a single 7-year-old male (210 mm carapace length, 1,293 g) with a distinctive horn-like projection on the ventral side of the neck (Fig. 1). Initially, the neck was retracted, but upon voluntary extension, the protrusion became evident. The structure measured 4 mm at the base, tapering to a point, and 27 mm from base to tip. Close examination revealed annular rings that matched the spacing and number of those found on the carapace and plastron (Fig. 2).

We acknowledge that the protrusion is not a true horn, but likely represents a choristoma consisting of cutaneous tissue that would normally develop into a scale or scute. The color and texture closely resembled the adjacent plastron, and the presence of annular rings suggest it is plastron-derived tissue that developed ectopically. The form, shape, and location did not appear to restrict head or neck movement. This malformation does not appear to be maladaptive, and given that the individual has reached adult size, it is unlikely to impact survival or fitness.

While malformations in special-status species warrant investigation, this case appears to be benign. Given the rarity of reports—this being the first published account in *Actinemys* and only one other anecdotal case in *Mauremys*—such choristomas are unlikely to have population-level impacts.

Acknowledgements—We are grateful to Stacey Ambrose of the Mt. View Sanitary District for access to the site and for continued support towards working with turtles at Moorhen Marsh. We also thank the Board of Directors of the Mt. View Sanitary District for long-term support of turtle management at this site. We further thank the following for assistance in the field: Rebecca Acosta, Sage Bylin, Kelly Clack, Ben DeLancey, Tiana Honigman, Julie King, Jessica Ma, Joe Medley, Kathryn Pitkin, Alec Williams, and Chris Winchell. Pond turtle trapping was conducted with permits from the California Department of Fish and Wildlife and was conducted under SCP Legacy permit no. 000040, and SCP no. 192240005.

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Fig. 1. Horn-shaped choristoma (red arrow) protruding from the ventral side to the neck of a Southwestern Pond Turtle (*Actimeys pallida*) after the head was voluntarily extended. Photo by Jeff A Alvarez.

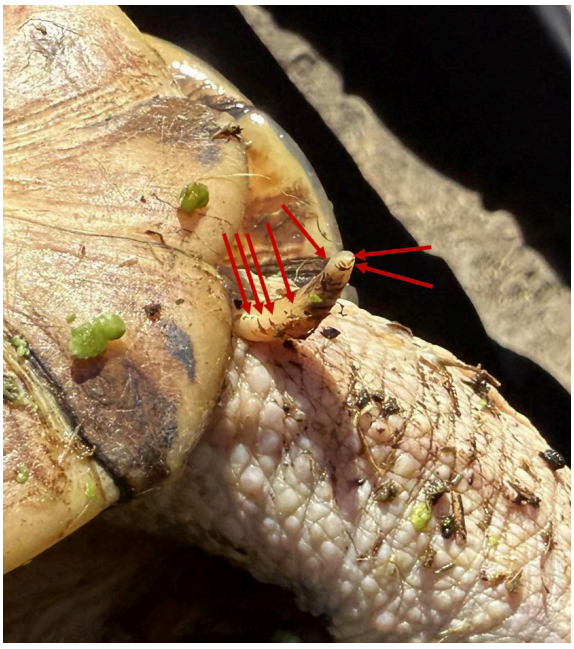

Fig. 2. Horn-shaped choristoma showing apparent annuli (red arrows). Photo by Jeff A. Alvarez.

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