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## COMMUNITY SCIENCE REDISCOVERS THE SYRIAN SPADEFOOT TOAD, *PELOBATES SYRIACUS*, IN WAR-TORN REGIONS OF SYRIA

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**Abstract.**—The Syrian Spadefoot Toad (*Pelobates syriacus*) is an anuran native to parts of the Middle East and the Caucasus. The species status in Syria is questionable, however, with the sole historical record consisting of a single specimen at the Natural History Museum in London, whose locality data suggests unsuitable habitat for the species in Damascus. Due to its largely fossorial and secretive nature, there are no confirmed records of the Syrian Spadefoot Toad in the country, and these issues have been exacerbated by a lack of herpetological funding and research for comprehensive conventional biodiversity monitoring in a country torn by conflicts, likely contributing to the scarcity of detections. Modern technology, however, has generated new opportunities to engage with community scientists to expand biodiversity knowledge, particularly in underserved communities and conflict zones. Here, we describe such an effort. The Facebook group Huwāt al-Ḥayāt al-Barriyah al-Sūriyah (Syrian Wildlife Hobbyists) sought assistance from Syrian community members to rediscover the Syrian Spadefoot Toad. Three confirmed sightings emerged from the group: tadpole observations in Lake Sedd al-Rabwa, Western Hama, and two adult specimens found in a greenhouse in Burj Arab, Tartous Governorate. Notably, these observations were approximately 35 km from each other and 120 km from the nearest confirmed occurrence in Lebanon. These new records confirm the presence of the Syrian Spadefoot Toad in Syria and highlight the potential of community science initiatives to contribute to the documentation and conservation of understudied, poorly known species, particularly in underserved communities and conflict zones.

**Key Words.**— community science; conservation in conflict zone; distribution; rediscovery; Syrian Spadefoot Toad

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### INTRODUCTION

The sixth mass extinction event, a hallmark of the Anthropocene, continues unabated (Dirzo et al. 2014; Ceballos et al. 2015; Johnson et al. 2017) and represents an existential threat to critical ecosystem functions and services derived via biodiversity (Wilson 1985; Mooney et al. 2005; Cardinale et al. 2012; Oliver et al. 2015; Capps et al. 2022). Amphibians are the most threatened terrestrial vertebrates (Pounds 2001; Stuart et al. 2004; Mendelson et al. 2006; Jetz and Pyron 2018) and, given their status as sentinel or indicator species (Marque and Alberch 1995; Van Der Schalie et al. 1999; Roy 2002, but see Kerby et al. 2010), their losses are of particular concern. Conflict zones significantly harm biodiversity, complicating monitoring, and conservation efforts, particularly for local biologists facing risks during data collection and fieldwork (Hanson et al. 2009; Hanson 2018; Guarasci 2022).

Emergent technologies provide novel opportunities to improve monitoring, including in conflict zones (e.g., bioacoustics, environmental DNA, camera traps). Community science via social networking platforms has emerged as a viable means of gaining valuable insights into the status and trends of amphibians (Pocock et al. 2018; Estes-Zumpf 2022; Johnston et al. 2022). In addition to providing critical biodiversity data at scale (Chamberlain 2018; Callaghan et al. 2019), including for rare, threatened, or endangered (RTE) species (Morais et al. 2021; Chowdhury et al. 2023), community science via social media has the added benefits of civic engagement (O'Reilly 2022) and education (Niemi et al. 2021). Ultimately, this may provide important, crowd-sourced opportunities for biodiversity monitoring, particularly in conflict zones.

Since the outbreak of the war in Syria in 2011, the country has experienced significant political instability and violence, which has had a devastating

impact on its people, infrastructure, and environment. As a result, biodiversity monitoring, despite its importance (Mobaied and Rudant, 2019), has become extremely difficult, if not impossible (Qandeel and Sommer 2022). Here, we sought to leverage community science via social media to attempt to rediscover the Syrian Spadefoot Toad (*Pelobates syriacus*) in this area of conflict. The historical record from Syria consists of a single specimen at the Natural History Museum, London, collected in 1892 (NHMUK ZOO:1892.4.19.18-20); however, its collection location is vague and only given as the province of Damascus. We suggest that this locality may be in error, as habitat suitability models and climate models indicate unsuitable habitat (Tarkhnishvili et al. 2009; Iosif et al. 2014; Dufresnes et al. 2019b). At the time of the collection of this specimen in 1892, the country was under the Ottoman mandate, and the area from Aleppo, Damascus, the Beqaa Valley in Lebanon, and Mount Hermon was known as the Vilayet of Damascus (Masters 2013). Therefore, the label Damascus on the specimen might refer to the entire region of the eastern Mediterranean known as the Vilayet of Damascus during that period (Masters 2013). The broad geographic extent of the region covered by this label highlights the potential difficulty in precisely locating the collection site of the specimen. Here, we attempted to locate and document the presence of the Syrian Spadefoot Toad via a Facebook group dedicated to documenting Syrian wildlife. We reviewed the reported observations by qualified researchers; herpetologists, and experts in Syrian herpetofauna, to confirm the identification and to document the distribution and habitat preferences of the Syrian Spadefoot Toad in Syria.

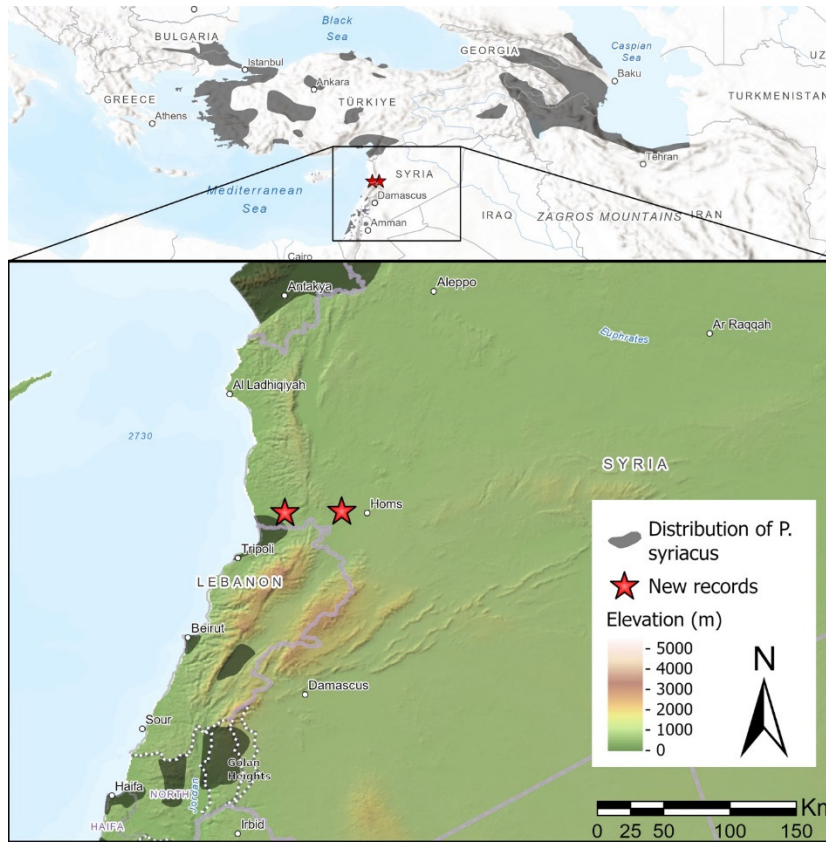
#### MATERIALS AND METHODS

**Focal species.**—The Syrian (Eastern) Spadefoot Toad is an anuran in the family Pelobatidae native to parts of the Middle East and the Caucasus (Dufresnes 2019). The holotype was described by Boettger in 1889 with a type locality of Haiffa in Syrien (Haifa), Palestine, and the type specimen as SMF 1437.1a (Boettger 1892). The Syrian Spadefoot Toad is a largely fossorial species. It can be found in various terrestrial habitats, including open uncultivated lands, steppe, semi-desert, and rocky areas (Dufresnes 2019). This species is not selective in terms of soil preference (Agasyan et al. 2021). The Syrian Spadefoot Toad breeds in a variety of aquatic habitats, including stagnant temporary waterbodies, river or

lakeside temporary waterbodies, and large permanent pools (Dufresnes 2019; Agasyan et al. 2021).

The Syrian Spadefoot Toad occurs in mostly scattered populations across its range, mainly present from an elevation of 0–2,000 m above sea level (Agasyan et al. 2021; Uğurtas 2001; Džukić et al. 2008; Sofianidou 2012; Dufresnes et al. 2019a). This species is found in scattered populations across Türkiye along both the Black Sea and Mediterranean coasts, from Georgia to Azerbaijan, southeastern Bulgaria, and northern Iran, and south to the Levant (Dufresnes 2019; Agasyan et al. 2021). The population along the eastern Mediterranean coast ranges from the Syrian coast at the border of Lebanon to the southern coast of the occupied Palestinian territories, as well as in the Golan Heights and southwestern Syria (Boettger 1889; Sofianidou 2012; Dufresnes et al. 2019b; Fig. 1).

Tarkhnishvili et al. (2009) modeled a potential range map based on environmental and occurrence data that suggests potentially suitable sites on the northern Syrian coast and in the southwest where the Syrian Spadefoot Toad might be present. Similarly, Iosif et al. (2014) investigated the distributions of both the Syrian Spadefoot Toad and the European Common Spadefoot (*P. fuscus*) using ecological niche modeling across various climatic scenarios, leveraging known occurrence points and fossil records. The resultant model specifically highlighted high-suitability sites along the Syrian coast, particularly in the vicinity of Homs, and in the southwest around the Golan Heights. Almasri et al. (2010) conducted comprehensive surveys at Fronlok Protected Area and Abu Qbeis Protected Area on the northern coast of Syria, aligning with the predicted suitability range for the Syrian Spadefoot Toad. Their extensive fieldwork encompassed diurnal visual surveys, nocturnal surveys targeting amphibian habitats, dip netting for larvae and egg masses, trap placements, and night road cruising. Despite these efforts to find the Syrian Spadefoot Toad and other species, no specimens were ultimately found (Tarkhnishvili et al. 2009; Almasri et al. 2010a; Almasri et al. 2010b; Iosif et al. 2014). The species is currently listed as Least Concern by the Amphibian Specialist Group of the International Union for Conservation of Nature Species Survival Commission (IUCN SSC) due to its wide distribution and large population (Agasyan et al. 2021); however, it faces numerous threats, including habitat destruction through drainage or loss of breeding wetlands, conversion of land for agricultural and industrial purposes, and related



**FIGURE 1.** (Top map) World distribution of the Syrian Spadefoot Toad (*Pelobates syriacus*) as depicted by the International Union for Conservation of Nature (IUCN; 2021). The Syrian Spadefoot Toad occurs across Turkey, Georgia, Azerbaijan, southeastern Bulgaria, northern Iran, Lebanon, and the occupied Palestinian territories. The bottom map illustrates the range of the species showing recent records from Syria (red stars), featuring scattered populations spanning elevations from sea level up to 2,000 m.

water pollution (Agasyan et al. 2021).

**Database search.**—We performed a systematic search of multiple online databases, including VertNet(2022), iDigBio(2022), and GBIF(2022), for occurrences of the Syrian Spadefoot Toad, its nominate subspecies (*P. s. syriacus*), the Anatolian Spadefoot (*P. s. boettgeri*), and its related taxa and synonyms; the Caucasian spadefoots (*P. transcausicus* and *Pseudopelobates transcausicus*), using the word Syria as the specified geographic region. In addition to these resources, we consulted the database of the University of Illinois Museum of Natural History (USA), and we also communicated with the Natural History Museum, London (UK), to locate additional specimens and occurrence records.

**Community science project.**—We initiated the project through the Facebook group called Huwāt al-Ḥayāt al-Barriyah al-Sūriyah (Syrian Wildlife Hobbyists; Syrian Wildlife Hobbyists; Facebook Group. 2023. Available from <https://www.facebook.com/groups/393649654827265>

[Accessed 16 June 2023]). This group is dedicated to raising awareness about Syrian wildlife and documenting Syrian biodiversity. The Facebook group in question has a total membership of 38,724 individuals (in 2023), with a significant proportion of the members from Syria. On 9 October 2019, Mudar Salimeh launched a search campaign for the Syrian Spadefoot Toad through a post on the Facebook group Huwāt al-Ḥayāt al-Barriyah al-Sūriyah (Syrian Wildlife Hobbyists; Facebook Post. 2019. Available from <https://www.facebook.com/groups/393649654827265/permalink/466617594197137/> [Accessed 16 June 2023]). On 23 April 2020, Yaman Omran released a follow-up post on the group, detailing the characteristics of the Syrian Spadefoot Toad and its distinguishing features from the more common Green Toad (*Bufo viridis sitibundus*) Huwāt al-Ḥayāt al-Barriyah al-Sūriyah (Syrian Wildlife Hobbyists; Facebook Post. 2020. Available from <https://m.facebook.com/groups/393649654827265/permalink/614684999390395/> [Accessed 16 June



**FIGURE 2.** Lake Sedd al-Rabwa, western Hama, Syria, a breeding habitat for the Syrian Spadefoot Toad (*Pelobates syriacus*). This site marks the location of the first confirmed record of the species in Syria. The lake is formed as a result of a dam and serves as a destination for local fishermen. (Photographed by Tammam Helal, 2023)].

These posts also included photographs to help illustrate the differences between the two species. In these posts, group members were encouraged to report any observations of the Syrian Spadefoot Toad or other amphibians and reptiles in Syria. We carefully examined the visual characteristics of the individuals depicted and thoroughly reviewed and confirmed the identification of each of the reports received.

### RESULTS

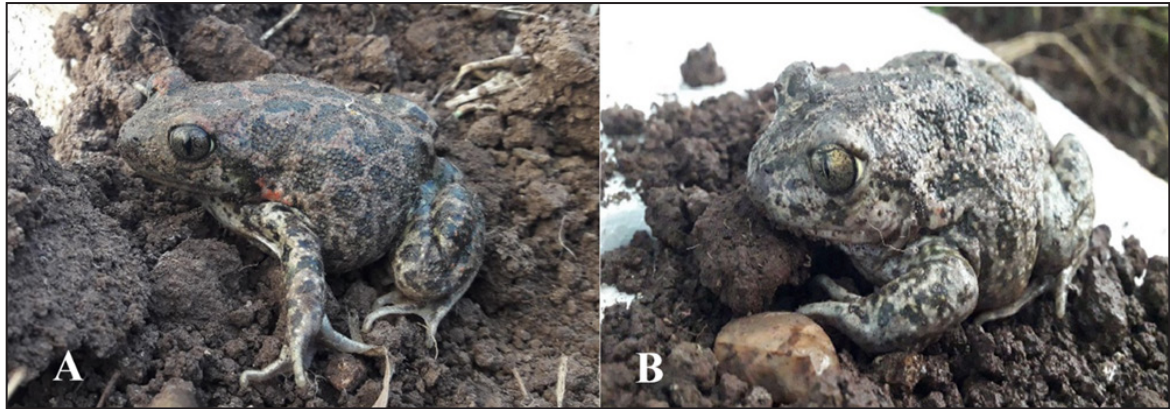
The two Facebook posts regarding the Syrian Spadefoot Toad generated considerable engagement from the members of the wildlife enthusiast group,

with the first post receiving 31 likes, five comments, and no shares, and the second post gathering 226 likes, 103 comments, and four shares. The collective efforts of the group were focused on understanding the distribution and appearance of the species, as well as distinguishing it from other frog species such as the Green Toad. Following the posts about the Syrian Spadefoot Toad, several members took the opportunity to reach out to the group administrators privately, sharing their pictures and alleged sightings of the elusive creature. While most of the photographs received were of the common Green Toad, three submissions stood out as legitimate sightings of the Syrian Spadefoot.

**Sightings.**—On 16 May 2021, Tammam Helal provided a photograph of an unusually large tadpole caught in Lake Sedd al-Rabwa (Fig. 2), western Hama, Syria, suspected to be the Syrian Spadefoot Toad. Several similar tadpoles had been caught in the same location. Helal kept one specimen in captivity for observation. On 11 June 2021, the captive tadpole showed signs of limb development and fully metamorphosed by 19 June 2021 (Fig. 3). The second report of a sighting was by Naeil Khozam who reported discovering an adult Syrian Spadefoot Toad, confirmed through clear photographs provided 18 March 2022 (Fig. 4). The specimen was found hiding in a crevice within the greenhouse of Khozam in Burj Arab, Tartous Governorate. On 23 February 2023, Khozam reported a third sighting of another toad in one of his agricultural greenhouses. The research team examined the photograph provided by



**FIGURE 3.** The developmental stages of a tadpole, culminating in the transformation into an adult Syrian Spadefoot Toad (*Pelobates syriacus*). This specimen, collected 16 May 2021 from Lake Sedd al-Rabwa, Syria, underwent limb development by 11 June 2021, completing full metamorphosis by 19 June 2021. This documentation marks the initial confirmation of the presence and breeding activity of this species within the country. (Photographed by Tammam Helal).



**FIGURE 4.** (A) Adult Syrian Spadefoot Toad (*Pelobates syriacus*) discovered in a greenhouse in Burj Arab, Tartous Governorate, Syria, 18 March 2022, the second confirmed sighting of the species in the region. (B) Adult Syrian Spadefoot Toad, similar in appearance to previously identified specimens, found in an agricultural greenhouse in the same greenhouse complex in Syria, 23 February 2023, the third sighting of the species in the area. (Photographed by Naeil Khosam).

Khozam (Fig. 4) and confirmed that this was different individual of the same species, distinguished by its unique blotch pattern compared to the previously observed toad.

#### DISCUSSION

Based on the reported observations and examination of the photographs, we accurately identified the Syrian Spadefoot Toad by comparing the observed features with documented traits, such as the vertically aligned pupil, absence of parotoid glands, and lack of tympanic membrane and male resonators, distinguishing it from the Green Toad. These sightings represent the first confirmed records of the species in the country. The confirmation of the presence of the Syrian Spadefoot Toad (*Pelobates syriacus*) in Syria is significant because it adds to our knowledge of the distribution and habitat preferences of this species. Our results provide valuable insights into the distribution and habitat preferences of the Syrian Spadefoot Toad in Syria and highlight the potential of community science initiatives in contributing to the documentation and conservation of understudied and poorly known species. Moreover, given the challenges of conventional biodiversity monitoring in conflict zones, community science via social media may be a viable means of gaining critical insights into amphibian and reptile occurrences in war-torn regions.

The three recent records were from agricultural areas, retention ponds, and near urban areas. These discoveries fill a distribution gap on the east coast of the Mediterranean, which is consistent with the predicted distribution range modeled by

Tarkhnishvili et al. (2009) and Iosif et al. (2014). The initial observation at Lake Sedd al-Rabwa in western Hama, occurring approximately 35 km apart from the second and third sightings at Burj Arab in the Tartous Governorate, reflects the geographic spread of these encounters. The location of the sightings in Burj Arab in the Tartous Governorate is situated on the eastern coast of the Mediterranean and is known for its high biodiversity and diverse habitat types, making it a potential hotspot for further discoveries of rare or endemic species. The village is surrounded by several small, man-made ponds created by damming small seasonal coastal streams. We suspect that these ponds are suitable breeding grounds for the Syrian Spadefoot Toad.

Our new records from Syria are approximately 140 km from the most recent record in Rachaya, Lebanon (Khashab, R. 2023. Syrian Spadefoot Toad observation in Syria [Observation ID:104539136]. iNaturalist. Available from <https://www.inaturalist.org/observations/104539136> [Accessed 30 April 2023]) and 120 km from the nearest known record in Hasbani Valley and the Bekaa Valley near the Aammiq marshes in Lebanon (<https://lebanon.arocha.org/wp-content/uploads/sites/17/2015/04/ARL-SC-05-2-Rocha-2nd-Discoglossus-nigriventer-rediscovery-.pdf>). In addition, historical accounts from Lebanon by Werner (1939) mention the presence of the Syrian Spadefoot Toad near Tripoli and Beirut; however, Hraoui-Bloquet et al. (2002) raised concerns about its possible extinction from the Lebanese coastal areas. Our observations in Syria, coupled with the suitable habitat conditions and proximity to the Lebanese coastline, suggest that the Syrian Spadefoot Toad may still persist in

coastal regions, including the vicinity of Tripoli and the Akkar district. This significant gap in distribution within Lebanon indicates that there is still much to be explored regarding the distributional range and population status of the species in the country. These findings emphasize the need for further research to investigate the presence and abundance of the Syrian Spadefoot Toad in previously unexplored regions of Lebanon and the Syrian coastline.

The use of community science for species identification and documentation does come with some challenges and limitations. One limitation is that not all members of the public have the necessary skills and knowledge to accurately identify species, which can lead to misidentifications or incomplete data. It is, therefore, important to carefully review and verify the reports provided through community science to ensure the accuracy of the data. In the case of the Syrian Spadefoot Toad, community science led a large-scale search for the species, covering a wide geographic area across Syria (185,180 km<sup>2</sup>), which increased the chances of detection and obtaining data. The gathered information can inform conservation efforts to protect and conserve the Syrian Spadefoot Toad, as well as other species in Syria. Additionally, the collaborative nature of community science projects can increase awareness and understanding of the value of biodiversity and the need for conservation efforts among the general public, which can also contribute to the protection and preservation of biodiversity in Syria.

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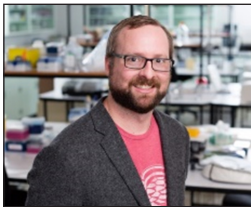
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**YAMAN OMRAN** graduated with a Bachelor's degree in Fine Arts, specializing in sculpture, from the University of Aleppo in Syria. Yaman is an environmental activist and a self-taught expert in wildlife in the Middle East. Yaman has played a pivotal role in identifying and documenting numerous species of amphibians and reptiles in the Levant Region of the Middle East. Notably, he is a co-author of the book *Snakes of the Syrian Arab Republic*, a collaborative effort aimed at providing comprehensive insights into the snake species of the region. (Photographed by Yaman Omran).



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