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Investigating the Illegal Online Trade of Spur-thighed Tortoises on an Iranian Marketplace Website: a Preliminary Survey

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***Abstract*—Testudines are among the most traded group of animals on the online marketplace. We focused on the Spur-thighed Tortoise (*Testudo graeca*) to characterize its illegal online trade on Sheypoor.com, an Iranian marketplace website. Trade of *T. graeca* is illegal internationally, as well as domestically, without special permits. We used a web scraping method to extract advertisements selling *T. graeca* on the Sheypoor website from 25 August to 1 December 2021. During this survey, we found 173 advertisements selling 358 *T. graeca*. Most advertisements were posted from Tehran (n = 40), Yazd (n = 35), and Isfahan (n = 26), and juveniles were advertised significantly more often than adults (W = 2,261, df = 160, $P < 0.001$). We found the average price of *T. graeca* in Iran is $5 USD, and there was no significant difference between the prices of juveniles and adults (W = 8303, df = 128, P = 0.840). Online trade could potentially threaten *T. graeca* populations in Iran if it is not more strictly regulated. We believe more research is needed to understand the motivations to buy and/or sell *T. graeca* in Iran, which may lead to a program to curb the illegal trade of this species.**

Key Words.—illegal wildlife trade; online marketplace; *Testudo graeca*; pet trade; reptile trade; market surveillance

Introduction

The illegal wildlife trade (IWT) threatens biodiversity and can lead to the unsustainable harvest of wild populations (Di Minin et al. 2022). This trade affects many (if not all) taxa, including amphibians and reptiles, which are frequently harvested from the wild for the pet trade (e.g., Auliya et al., 2016), medicinal purposes (Dufour et al. 2022), and meat (Hitchens et al. 2020). Illegal trading is estimated to be the second-largest contributor to reptile and amphibian decline after habitat loss (Böhm et al. 2013). According to Marshall et al (2020), thousands of reptiles are threatened by global trade. At the local scale, wildlife trade might drive reptile populations to extirpation (Nijman et al. 2012; Hinsley et al. 2023).

Central, Southeast, and East Asian countries rank among the world's leading nations for exporting wildlife and wildlife products (Nijman 2010). In this study, we focus on the comparatively understudied country of Iran, where illegal wildlife trade is known to occur and to be poorly regulated (Sardari et al. 2022). We focused on the Spur-thighed Tortoise (*Testudo graeca*), which is widely distributed in Iran and can be found from Northwest to South and Central Iran (Zadhoush et al. 2021). *Testudo graeca* is listed as a Vulnerable species by the International Union for Conservation of Nature (IUCN) Red List of threatened species and as Appendix II in the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), meaning it cannot be traded internationally without a CITES-granted permit. This species is also protected nationally in Iran, meaning both the trade and breeding for the trade of *T. graeca* in Iran are illegal without permits, which are not granted to the public (https://rc.majlis.ir/fa/law/print_version/96050).

The illegal trade of Testudines is a major factor in the decline of many species (e.g., Madagascar's Ploughshare Tortoise (*Astrochelys yniphora*; Mandimbihasina et al. 2020). The illegal trade of *T. graeca* threatens its Mediterranean populations (Segura et al. 2020). The trade of *T. graeca* has also been documented in other countries within its range (e.g., Morocco and Spain; Perez et al. 2004; Nijman and Bergin 2017; Segura et al. 2020), and trade is known to be a major threat to this species in these countries (Graciá et al. 2020). In the Middle East, and particularly Iran, however, this issue has yet to be investigated. To our knowledge, this is the first study addressing the illegal trade of *T. graeca* in Iran.

It is important to compare the proportions of adults and juveniles advertised for sale because this comparison might help us understand how the trade might affect the future population demographics of the species. For example, poaching juveniles might alter future population size and structure, while differential poaching of adults could alter reproductive capacity of the population (Segura and Acevedo 2019). Understanding the specific contexts of illegal online wildlife markets can facilitate effective supply-side interventions ('t Sas-Rolfes et al. 2019). For example, pricing for items in populated provinces may vary from those in less populated areas (Roos 2006). Thus, enforcement or campaigns targeted at changing human behavior could be focused on regions where more trade occurs, or governments could be lobbied to institute greater regulatory oversight over online market spaces, particularly smaller and less regulated markets such as local online marketplaces.

Over the past few years, studies have pointed out the role of internet marketplace websites and social media platforms in the illegal trade of wildlife, including reptiles, worldwide (Xu et al. 2020; Sung et al. 2021; Sardari et al. 2022). Following the increasing development of internet marketplace websites and social media platforms, trading wildlife has become easier for sellers and buyers, and more challenging to regulate by government authorities (Sung and Fong 2018; Van et al. 2019). Many tortoise and turtle species are widely traded on internet platforms (Van et al. 2019; Wong et al. 2020). More specialized platforms specific to local contexts can also be prolific trading posts; for instance, the Hong Kong based Pet Trade was found to be trading numerous CITES-listed turtle species (Wong et al. 2020).

Web scraping has become a popular method for consumer research by extracting data from marketplace websites and online services (e.g., Hillen 2019; Jorge et al. 2020; Han and Anderson 2021). The technique has proven to be effective in wildlife trade research, with studies on the quantification of trade worldwide (Masters et al. 2022). For example, web scraping has been used to study the online trade of non-native animals in Australia (Toomes et al. 2023), online songbird trade in Indonesia (Fink et al. 2021), and online stingless bee trade in Brazil (Carvalho 2022). These studies demonstrate the versatility and efficacy of web scraping as a tool for data collection and analysis across various domains.

Here, we present preliminary data on the online trade of *T. graeca* in Iran. Our main objectives included identifying the provinces where most advertisements are posted from and comparing adult and juvenile prices from advertisements. We expected that juveniles would have higher prices than adults because there is more demand for them in the market.

Materials and Methods

Data collection from the marketplace website.— Several specialized marketplace websites operate in Iran including Sheypoor (https://www.sheypoor.com/), Divar (https://www.divar.ir/) and Basalam (https://www.basalam.com/). They all operate similarly to eBay, where people can post advertisements of their goods either anonymously or with their real names. We searched the appropriate keywords in Farsi (i.e., tortoise for sale) on the websites mentioned above to find relative advertisements trading *T. graeca*. We only found advertisements for *T. graeca* posted on the Sheypoor website. Thus, we focused on it to study the online trade of *T. graeca* in Iran. The Sheypoor website was launched in August 2013 to actively connect online customers and sellers. This website operates in more than 110 cities, and all provinces in Iran, enabling users to expand their ability to market goods across the country (https://www.sheypoor.com/).

From 25 August to 1 December, we systematically surveyed the Sheypoor website with ParseHub, a free web scraping software (https://www.parsehub.com), to find advertisements selling *T. graeca*. First, we designed a web scraping algorithm on ParseHub for the website and saved it as a project. Then we ran the project every night at midnight with each keyword meaning turtle and tortoise, in Farsi *Lakposht* and *Lak posht*. Whenever the algorithm found an advertisement containing the desired keywords, it

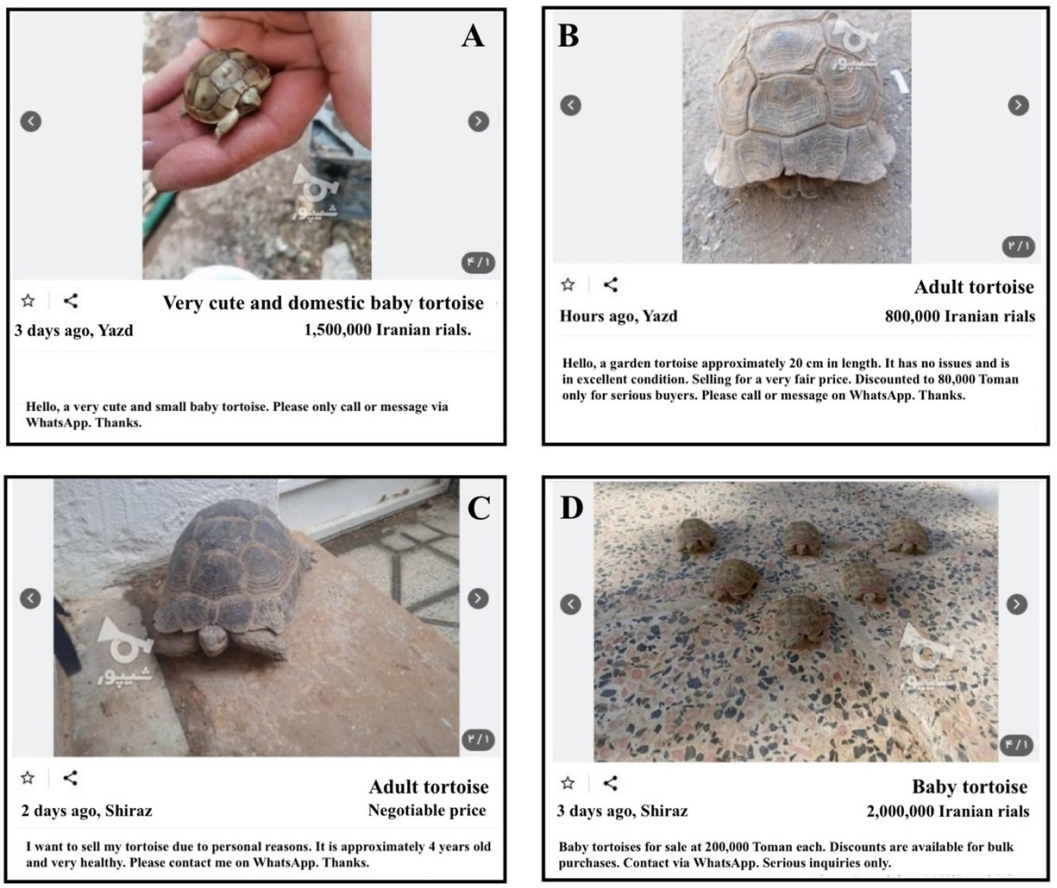

Figure 1. Typical online advertisements selling Spur-thighed Tortoises (*Testudo graeca*) on the Sheypoor website: (A) selling a juvenile tortoise; (B and C) selling adult tortoises; and (D) selling six juvenile tortoises. All the text in the advertisements have been translated from Farsi to English.

extracted and saved the following information in a JSON file containing the advertisement title: (1) URL; (2) images; (3) price; and (4) location. No personal identifying information (such as names and addresses) was collected. Finally, we opened the extracted JavaScript Object Notation files in a web explorer platform and collected the required information in a spreadsheet removing any duplicates in the dataset for future analyses.

Because it was difficult to distinguish between wild-caught and captive-bred animals from photographs, some of the tortoises advertised could have been captive-bred. Also, breeding and trading of all native species is prohibited in Iran, except with special permits (https://rc.majlis.ir/fa/law/print_version/96050). Such permits are not usually issued to individuals, but only to organizations (i.e., universities, research facilities, and zoos). Therefore, we considered every advertisement to be illegal. All of the animals in the advertisements were identified by the first and fourth authors to the species level. Based on the size of the individuals and comparing it to what the sellers claimed, we grouped the animals into two age classes, juveniles and adults (Fig. 1).

Statistical analysis.—Based on the Shapiro–Wilk normality test, most of our data were not normally distributed: number of adults ($W = 0.1915$, df = 86, $P < 0.001$), number of juveniles ($W = 0.4939$, df = 76, $P < 0.001$), price of adults ($W = 0.6399$, df = 61, $P < 0.001$). Price of juveniles was normally distributed ($W = 0.9736$, df = 69, P = 0.15). For all comparisons, we used the Mann–Whitney U test to compare the number of individuals for sale and their prices between adults and juveniles ($P \leq 0.05$). We used R statistical software Version 4.2.1 to analyze data (R Core Team, 2024).

Results

General overview of the advertisements.—We found 173 advertisements selling 358 animals on the

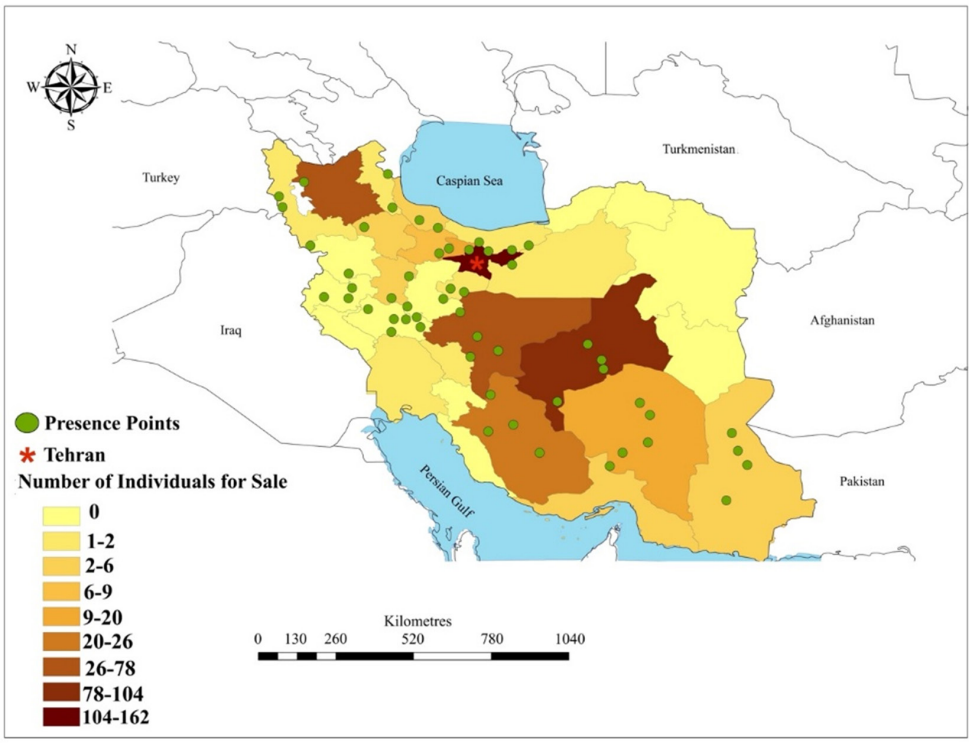

Figure 2. Map of Iran illustrating georeferenced Spur-thighed Tortoise (*Testudo graeca*) presence points (green dots) and the number of individuals for sale per province.

Sheypoor website over our sampling period of 128 d. Most advertisements were posted from the provinces Tehran (n = 40), Yazd (n = 35), and Isfahan (n = 26). The same provinces had the most individuals for sale: Tehran (n = 101); Yazd (n = 74); and East Azarbaijan (n = 65; Fig. 2). There were 238 juveniles and 115 adults advertised for sale. Juveniles were advertised significantly more often than adults (W = 2,261, df = 160, $P < 0.001$). We could not specify an age class for five of the individuals. It should be noted that no seller claimed their animals were captive-bred.

Advertisement prices.—Although most (n = 130) advertisements indicated prices, 43 did not contain prices in their postings. Based on our data, the average price of an individual *T. graeca* was $5 USD (Iranian Rial [IRR] ﷼ 3,000,000) ± $36.3 USD (standard error). The Mazandaran Province, with two advertisements, had the highest prices for this species in Iran (i.e., $83 USD [IRR ﷼ 50,000,000]) and $20 USD (IRR ﷼ 12,000,000), followed by the Sistan and Baluchestan provinces. Fars Province had the lowest price among all provinces ($1 USD [IRR ﷼ 600,000]). We found no significant difference between the prices of juveniles and adults advertised for sale (W = 8303, df = 128, P = 0.840).

Discussion

Our surveys showed that most advertisements of *T. graeca* for sale were posted in Tehran, Yazd, and Isfahan, the most populated provinces in Iran. We suspect this means that more people correspond with larger market availability to sell exotic pets in populated cities. This finding aligns with Van et al (2019), who found in their study in Vietnam that the most advertised turtles posted on Facebook were in crowded cities.

In addition, our data suggest that juveniles were advertised more than adults. Possible reasons to explain this might be that juveniles appeal more to potential buyers because they are smaller and more charming (Moreno and Plese 2006), juveniles may be easier to get in higher quantities because capturing several animals at one time is easier, especially if poachers find a nest, or many juveniles are captive breed in Iran. We did find any tortoises advertised as captive-bred, however. Sellers might be breeding individuals but are unwilling to admit to this activity due to authenticity bias (i.e., if buyers want only wild-caught individuals). If most or all juveniles for sale come from the wild populations, the future population demographic of this species might be

affected (Tomillo et al. 2008). Unfortunately, to date and the best of our knowledge, there are no studies on the population size and dynamics of *T. graeca* in Iran. These studies are critical to managing the species to determine if the trade is sustainable or a threat to the populations of this species in Iran.

We found the average price ($5 USD) for individual *T. graeca* to be about half the average price of this species in Morocco ($9.20 USD; Nijman and Bergin 2017). Socioeconomic differences among buyers might explain this difference, with the average monthly wage in Morocco more than the average monthly wage in Iran (https://www.iranintl.com/en/202303221326). Although Nijman and Bergin (2017) documented a price difference among different sizes of *T. graeca* in Morocco, we did not find a significant difference in price between juveniles (small individuals) and adults (large individuals). *Testudo graeca* are sold for about $298–$600 USD in international markets (https://www.tortoisetown.com/), which are advertised as captive-bred. These high prices might increase global trafficking of *T. graeca* from Iran due to the greater profit to poachers compared to domestic sales.

To reduce the demand for wildlife captured for the pet trade, governmental and non-governmental organizations should invest in public education and behavior change initiatives (such as conservation marketing), especially in the provinces where more individuals are advertized and the market seems more active (Davis et al. 2021; Fukushima et al. 2021). The implementation of these recommendations will likely depend on the availability of resources, enforcement capacity, and the prioritization of wildlife conservation by relevant stakeholders. While such initiatives could be highly effective, it remains uncertain whether the necessary frameworks or commitment are currently in place to drive these changes. Encouraging collaboration between government bodies, local Non-Governmental Organizations, and international partners could help address potential gaps and support effective conservation actions.

In addition, we recommend that the online marketplace websites (like Sheypoor) collaborate with governmental and non-governmental conservation organizations to identify these advertisements on their websites and prevent them from being posted to stay within the law. In addition, these websites should have transparent guidelines for their users so that these users know what goods they can post for sale on the marketplace website. Finally, authorities in Iran should have robust and transparent legislation to deal with wildlife trade in the country; however, the effectiveness of such legislation depends on consistent enforcement and active engagement from relevant authorities. It is also essential to assess whether government agencies and NGOs are positioned to address these challenges proactively. Strengthening coordination among stakeholders and fostering greater commitment to tackling wildlife trade will be critical to achieving meaningful progress. More in-depth research is needed to identify what drives the illegal wildlife trade in Iran. We show here that a domestic market for *T. graeca* exists, but research is needed into what consumer motivations drive this market.

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