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Citizen science and non-indigenous species: a new record of the introduced freshwater turtle *Trachemys scripta scripta* (Thunberg, 1792) in Tunisia

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Abstract: *Trachemys scripta scripta*, commonly called the Yellow-bellied Slider, is a freshwater turtle native to the southern United States, from Virginia to northern Florida. It has since been introduced into various European countries. Here, we report the first introduction of *T. scripta scripta* to Tunisia, recorded through the Tunisian Facebook group 'TunSea,' dedicated to aquatic species conservation. This study highlights the role of citizen science in early detection and raising awareness about the potential impacts of releasing non-native turtles into the wild.

Keywords: Non-indigenous species; freshwater tortoises; Citizen science; monitoring system; Tunisia.

1. Introduction

Around the world, biological invasions are seen as a serious danger to biodiversity. (Lowe et al., 2004). The primary drivers of the species invasion are the rise of the pet industry and increased transportation, as well as by human practice or accidentally. Freshwater turtles are arguably the most popular species kept as pets among reptiles (Bush et al., 2014). As a result, many of these species have spread and established themselves outside of their natural habitats, leading to several ecological issues (Cadi and Joly, 2004). Through competition, the transmission of parasites, and hybridization with native species, non-native turtle proliferated quickly and had

an adverse effect on the local ecosystem. (Cadi et al., 2003; Jo et al., 2017).

According to a list of the 100 worst invasive species, the Red-eared Slider *Trachemys scripta elegans* (Wied-Neuwied, 1839) is one of them (Scalera, 2006). In practically all of Europe, this species has been released into the wild (Orevi and Anelkovi, 2015; Uroevi et al., 2016). By means of Council Regulation (EC) No. 338/97 on the Protection of Species of Wild Fauna and Flora by Regulating trading, the EU placed a restriction on the import and trading of the red-eared slider as that of December 22, 1997 (Bringse, 1998; Bringse, 2006). Numerous species have entered the pet trade after this ban, including the Yellow-

bellied Slider *Trachemys scripta scripta* and the Cumberland Slider *Trachemys scripta troostii* (Holbrook, 1836) (Schoepff, 1792). Consequently, numerous natural ecosystems were invaded by these turtles (Bringse, 2006; Izquierdo et al., 2010; Kleewein, 2014). Eastern distribution of the Yellow-bellied Slider *T. scripta scripta* (Schoepff, 1792) includes southeastern Virginia, north and South Carolina, Georgia, and Alabama. (Ernst and Lovich, 2009). *T. s. scripta* primarily enters its invaded region through pet releases and escapes (Storm et al., 1995; Lamar, 1997; Porras, 2002). Pond sliders may have been brought to Baja California, Mexico, for food, according to Stebbins (1985), though it's not certain whether he correctly identified them as (*T. scripta*). The Yellow-bellied Slider has been reported to have expanded to Sweden, Finland (Bringse, 2006), France (GTIBMA, 2017), Austria (Kleewein, 2014), and Spain (Martnez Silvestre et al., 2006; Alarcos et al., 2010). This subspecies has been mentioned online in reports from numerous Greek islands, including Corfu, Crete, Kos, and Serbia. (Balej and Jablonski, 2006). Recently, the MNHNL-mdata portal made 7 records of *Trachemys scripta scripta* in Luxembourg available (UEDA, 2021). (Fig.1).

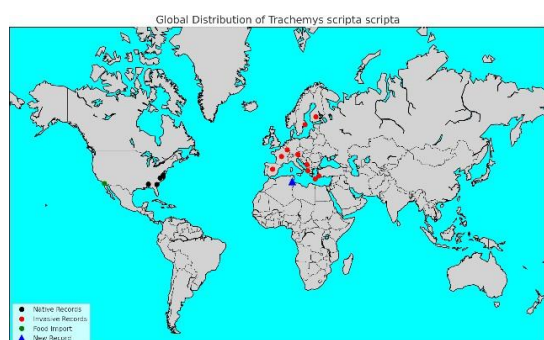


Fig.1 Global distribution of the yellow-bellied slider *Trachemys scripta scripta* records

In this paper, we describe the first record of the yellow-bellied slider *Trachemys scripta scripta* in Tunisia with the introduction of two specimens.

2. Materials and Methods

In Mai 13, 2021, a citizen shared, in a Tunisian facebook group "TunSea" involved in the conservation of aquatic species, a photo of two freshwater turtles, she asked about returning the specimen to the natural environment. The two specimens (Fig. 2) have been introduced from Belgium since 2012 with a total carapace length not exceeding 7 cm according to the girl who shared the call on 'TunSea Group'. The two specimens were introduced by a father on a boat trip who gave the two turtles as a birthday present to his daughter. Until the appeal was published on "TunSea Group", they kept the turtles in their home in an aquarium.

These turtles were admitted to the Sea Turtle First Aid Centre at the Sfax Faculty of Sciences (FSS). This centre was established in FSS within the framework of the 'Life Med Turtles project' funded by the EU, with the FSS is the Tunisian partner. The objective of the project is to strengthen efforts to conserve marine turtles in Tunisia and in particular in the Gulf of Gabès. Sadly, the two turtles were in poor health and had not eaten for two weeks. We tried to keep them alive with the help of our vet at the centre, but unfortunately, they died within two weeks. Tissue samples from the two turtles were taken from either tail tips or oral swabs, for later molecular analysis, and they were stored in absolute alcohol. The carapace length, width and weight were recorded following Veenvliet and Bringsøe (2002a) methodology; sex of the turtles was determined according to tail sexual dimorphism described by Bringsøe (2002b). Finally, an individual photo-documented report for each of the turtle was presented for their identification and monitoring.

3. Results and discussion

Based on i) the file marked with 3 yellow lines (which have tendency to disappear when the individual ages), one yellow band that starts at the back of the eye and the bright yellow plastron composed of some black spots, ii) Carapace disc-shaped, smooth, and slightly domed and iii) colors feature yellow-green patterns, the specimens were identified sexually male *Trachemys scripta scripta* (Gibbons, 1990). The yellow-bellied slider, exhibits sexual dimorphism, which means that males and females of the species show distinct physical differences. In fact, Females are generally larger, with shell lengths typically ranging from 20 to 33 cm. Males are smaller, with shell lengths ranging from 13 to 23 cm. Males also possess significantly longer front claws, which they use during courtship to stimulate the female, but females have a shorter one. Finally, males have longer and thicker tails, with the vent (cloaca) positioned farther from the base of the tail. The total carapace length of the two adult turtles at the date of recovery in the rescue centre were 21 cm and 17 cm with a carapace

width of 20 cm and 16 cm respectively. Plastron length were 13.3 cm and 11.4 cm respectively. The weight registered were 700 g and 500 g respectively (Fig. 2).

In Tunisia, two freshwater turtle species are recorded: the Mediterranean bassin turtle *Mauremys leprosa* (Schweigger, 1812) and the European turtle *Emys orbicularis* (Linnaeus, 1758) (Chaieb 2004). In this study, we report for the first time the presence of the Yellow-bellied Slider *Trachemys scripta scripta* (Thunberg in Schoepff, 1792) in Tunisia. The rapid and widespread invasion of *Trachemys scripta scripta* provides an opportunity to propose a preventive action for the Tunisian freshwater turtle. Due to the wide extent of introductions of this species its presence is not unexpected. However, as only male individuals were observed and not released in nature that doesn't appear to be an established population in Tunisia. Due to its extensive introduction throughout the world the International Union for Conservation of Nature has placed *Trachemys scripta* on its list of the World's Worst Invasive Species (IUCN, 2012).

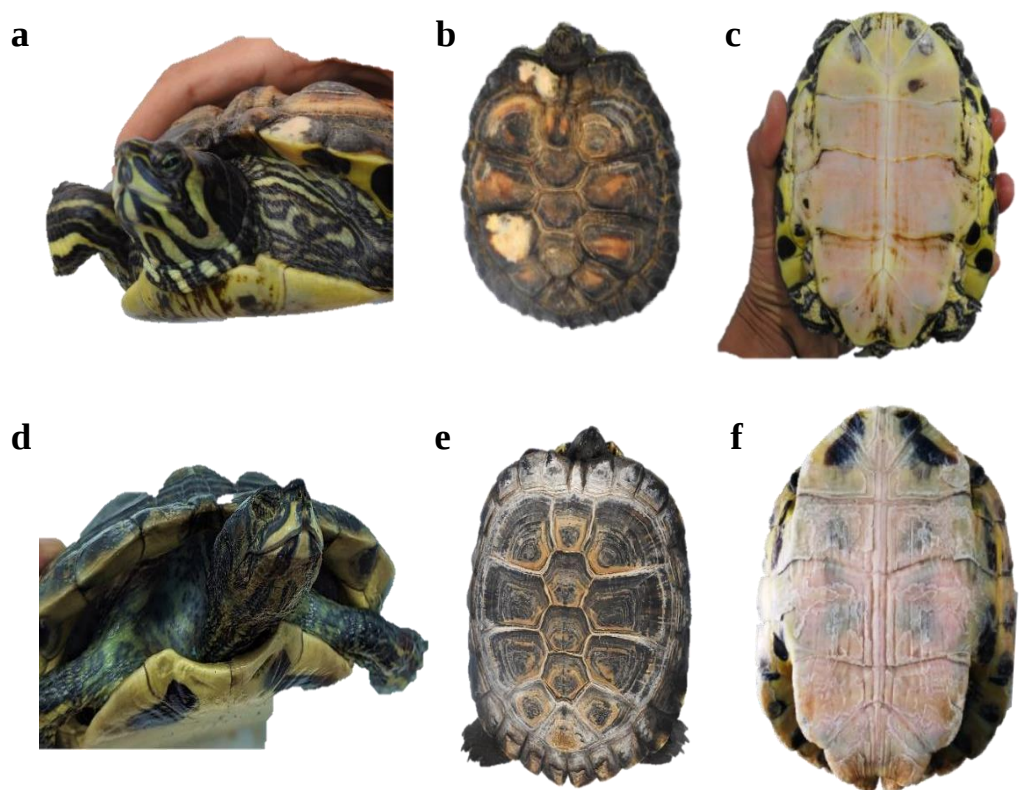


Fig.2 *Trachemys scripta scripta* from North Africa, Tunisia.

a-c: Jupiter Adult male, **d-f:** Mars Adult male.

From left to right in each row: lateral view of head and body, view of carapace, and view of plastron. Scale bar = 5 cm except a, d not to scale.

The introduction of *Trachemys scripta scripta*, can have significant ecological, and economic impacts, especially in non-native environments. According to several studies (Lindeman, 1999; Cadi and Joly, 2003), pond sliders can compete with native species for food, nesting grounds, or areas to bask. They can also co-introduce numerous pathogens that can cause catastrophic losses of indigenous species. (Iglesias et al., 2015). Some researchers believe that the European pond turtle and other species compete favorably. (Cadi & Joly, 2003). A breeding population of the foreign species must first be established in the newly invaded range for settlement to be successful. (Lockwood et al., 2007). *T. scripta* received a score of 99 for settlement success using risk assessment models, which range from 0 to 160. (Bomford, 2008). The majority of

the Mediterranean Belt nations, including Southern France, Italy, and Spain, have affirmed the settlement's success. (Cadi and Joly, 2004). As a result, it is assumed that *T. scripta* is more competitive with native species. Therefore, it is recommended to conduct in-depth population monitoring studies for pond sliders in their invaded area as soon as possible.

There is no information on how many *T. scripta* specimens have been brought into Tunisia so far or whether any have been released or escaped into the wild because the species has not yet been monitored there. If this species is able to survive, it can establish a population that reproduces naturally, and may eventually take on an invasive nature. Therefore, it is important to monitor their entry into the country, to inform those who own animals about the

effects of invasive species and monitor them. Making training studies regarding invasive species management and refraining from releasing these species into the natural habitats would be advised

4. Conclusion

Our study supports the notion that successful conservation depends on the public's awareness of the importance of sharing information and seeking assistance from scientists. New opportunities for gathering information on public interest are presented by the development of online social networks. Citizen science has the potential to assist managers in monitoring invasive species for low expense because managing invasive species is challenging and expensive. Using social media to communicate with a worldwide audience with a variety of experiences and knowledge can be a useful tool for those working in the field about invasive species. This study showed that by better integrating scientific research with environmental education and communication, invasive species monitoring systems could be enhanced. Specifically, the presence of 'TunSea' that appeals to people's emotions and environmental awareness may encourage them to take action by sharing invasive species related posts which is the case of the first record of Florida turtles *Trachemys s. scripta* in Tunisia. Thus, this group can contribute to preserve local aquatic ecosystems and their biodiversity.

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