New records of Chelidae species from the state of Piauí, Brazil

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New records of Chelidae species from the state of Piauí, Brazil

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Resumo: Pesquisas envolvendo ciência cidadã têm conquistado cada vez mais espaços dentro da pesquisa científica devido às informações voluntárias por parte da comunidade. A utilização da internet e das mídias sociais tem proporcionado a participação das pessoas nos estudos voltados à conservação ambiental. Com isso, a ciência cidadã surge como uma importante ferramenta para preencher prováveis lacunas de ocorrência de espécies negligenciadas por carência de pesquisas, uma vez que os cidadãos participam ativamente fornecendo informações que contribuem com informações das espécies, por exemplo, sobre os cágados-de-água-doce, tema do presente estudo. Foram realizados, inicialmente, levantamentos de dados primários em fontes bibliográficas, base de dados e coleções zoológicas. Posteriormente, criou-se um folder ilustrativo com fotos das espécies, solicitando informações sobre elas no estado do Piauí. As principais plataformas utilizadas foram Instagram, Facebook e Whatsapp. A comunidade foi incentivada a contribuir enviando o maior número de informações sobre o avistamento das espécies. Nos locais de avistamento, ao encontrarmos os espécimes, foram utilizadas armadilhas do tipo *funnel trap* ou puçá, em seguida, os espécimes foram depositados na coleção de História Natural do Piauí (CHNUFPI). As redes sociais com melhores resultados foram: WhatsApp com 40 contribuições e o Instagram responsável por 12 registros. Com tais dados e coletas foi possível ampliar a ocorrência da espécie *Mesoclemmys tuberculata*, Itaueira e Floriano e três novas ocorrências de *Phrynops geoffroanus* para São Raimundo Nonato, Guadalupe e Canto do Buriti. As abordagens envolvendo a ciência cidadã têm contribuído significativamente com dados de monitoramento e auxiliando na conservação das espécies, no nosso caso, expandiu a área de distribuição das espécies.

Palavras-chave: Cágados, Ciências cidadã, Conservação das espécies, Redes sociais.

Abstract: Research involving citizen science has gained increasing relevance in scientific studies due to the voluntary contributions of information provided by the community. The widespread use of the internet and social media has enabled public participation in research focused on environmental conservation. As a result, citizen science has emerged as an important tool for addressing potential knowledge gaps regarding

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species occurrences that may have been overlooked due to limited research efforts. Citizens actively contribute by sharing valuable information about species, such as freshwater turtles, which are the focus of this study. Initially, primary data were collected from bibliographic sources, databases, and zoological collections. Subsequently, an illustrative flyer containing photos of the target species was created to request information regarding their occurrence in the state of Piauí. The main platforms used for outreach were Instagram, Facebook, and WhatsApp. The community was encouraged to contribute by submitting as much information as possible regarding sightings of the species. At reported sighting locations where specimens were found, funnel traps or hand nets were used for collection. The captured specimens were then deposited in the Coleção de História Natrual da Universidade Federal do Piauí (CHNUFPI). The most effective social media platforms were WhatsApp, with 40 contributions, and Instagram, with 12 records. Based on the gathered data and collected specimens, the known distribution of *Mesoclemmys tuberculata* was expanded to include the municipalities of Itaueira and Floriano. Additionally, three new records of *Phrynops geoffroanus* were documented in São Raimundo Nonato, Guadalupe, and Canto do Buriti. Citizen science approaches have made significant contributions to biodiversity monitoring and species conservation efforts. In this case, they directly contributed to expanding the known distribution range of the studied turtle species.

Keywords: Freshwater turtles, citizen science, species conservation, social media.

Nuevos registros de especies de Chelidae en el estado de Piauí, Brasil.

Resumen: Las investigaciones que implican ciencia ciudadana han ido ganando cada vez más espacio dentro del ámbito científico, gracias a la información voluntaria proporcionada por la comunidad. El uso de Internet y de las redes sociales ha facilitado la participación de las personas en estudios orientados a la conservación ambiental. En este contexto, la ciencia ciudadana se presenta como una herramienta importante para cubrir posibles lagunas en la distribución de especies que han sido desatendidas por la falta de investigaciones, ya que los ciudadanos participan activamente proporcionando datos que contribuyen con información sobre las especies, como es el caso de los galápagos de agua dulce, tema del presente estudio. Inicialmente, se realizaron recopilaciones de datos primarios en fuentes bibliográficas, bases de datos y colecciones zoológicas. Posteriormente, se creó un folleto ilustrado con fotos de las especies, solicitando información sobre ellas en el estado de Piauí. Las principales plataformas utilizadas fueron Instagram, Facebook y WhatsApp. Se animó a la comunidad a contribuir enviando la mayor cantidad posible de información sobre los avistamientos de las especies. En los lugares de avistamiento, cuando se encontraron los ejemplares, se utilizaron trampas tipo **funnel trap** o salabres, y a continuación los ejemplares fueron depositados en la Colección de Historia Natural de Piauí (CHNUFPI). Las redes sociales con mejores resultados fueron: WhatsApp, con 40 contribuciones, e Instagram, con 12 registros. Gracias a estos datos y a las colectas realizadas, fue posible ampliar el área de distribución de la especie *Mesoclemmys tuberculata* a los municipios de Itaueira y Floriano, así como registrar tres nuevas ocurrencias de *Phrynops geoffroanus* en São Raimundo Nonato, Guadalupe y Canto do Buriti. Los enfoques que implican ciencia ciudadana han contribuido de forma significativa al monitoreo de datos y al apoyo en la conservación de especies. En nuestro caso, permitieron ampliar el área de distribución de las especies estudiadas.

Palabras-clave: Galápagos de agua dulce, Ciencia ciudadana, Conservación de especies, Redes sociales.

INTRODUCTION

The preservation of biodiversity has become a global concern, primarily due to the exploitation of natural resources, climate change, and population growth (Comandulli et al., 2016). The involvement of the local populations has proven crucial to scientific research, monitoring initiatives, conservation planning, and species preservation –

particularly in regions with limited data on species occurrence (Dickinson et al., 2012; Peters et al., 2015; Bradter et al., 2018; Ryan et al., 2018; Bovo et al., 2024). Furthermore, citizen participation helps fill information gaps, generating economic, social, and ecological benefits (Sullivan et al., 2014).

Research involving citizen science has been gaining ground, mainly due to its relevance to biodiversity and environmental preservation (Martins; Cabral, 2021). Citizen science seeks to engage individuals voluntarily in scientific processes (Roy et al., 2012), encompassing activities such as data collection for scientific research, participation in environmental management, collaboration with researchers, and information sharing via the internet (Kruger; Shannon, 2000; Riesch; Potter, 2014; Silva; Santana, 2023).

Scientists and citizens alike have made significant efforts to expand scientific knowledge through research focused on public interest, species, and their habitats (Dickinson; Zuckerberg; Bonter, 2010; Soares; Santos, 2011; Mamede; Benites; Alho, 2017). This approach has transformed science by enabling non-specialists to actively participate in the scientific domain.

Global platforms such as iNaturalist (http://inaturalist.org/Z), eBird (http://ebird.org/), Reef Life Survey (http://reeflifesurvey.com/), and Biofaces (https://www.biofaces.com/) are notable examples that foster interaction between the community and scientific research. With the rise of mobile technologies and the widespread use of social media and digital communication, it is now possible to develop innovative approaches that enhance environmental preservation efforts (Fonseca et al., 2021). These communication tools encourage public engagement in conservation initiatives by facilitating the sharing of photos, videos, audio recordings, and geolocation data (Cooper et al., 2007; Danielsen et al., 2009; Pires; Faria; Antunes, 2022).

Studies involving chelonians face significant challenges, particularly regarding data collection and long-term monitoring. Many populations inhabit remote or hard-to-access areas, such as protected zones or regions that are rarely explored by researchers. These conditions make field studies more complex and logistically demanding (Erickson; Farias; Zuanon, 2020; Topping; Valenzuela, 2021). Furthermore, the need for extended observation periods often prevents researchers from conducting continuous, direct monitoring of these species (Attademo et al., 2022).

Citizen initiatives offer participants the opportunity to acquire new knowledge (Sullivan et al., 2014). When associated with environmental education, such initiatives play a crucial role in raising community awareness of ecological issues and motivating efforts toward species conservation (Rumenos; Paoli; Faciolla, 2021). In addition to providing valuable data for scientific research, they promote environmental education and highlight the importance of conserving groups such as chelonians (Rumenos; Spazziani, 2020; Luz; Malvasio, 2023).

In this context, the objective of the present study was to raise community awareness and encourage the sharing of information regarding the occurrence and distribution of freshwater turtle species in the state of Piauí.

MATERIAL AND METHODS

Primary data collection

To identify the distribution records of the three turtle species of the *Chelidae* family in Piauí — *Mesoclemmys perplexa* Bour & Zaher, 2005, *Mesoclemmys tuberculata* (Luederwaldt, 1926), and *Phrynops geoffroanus* (Schweigger, 1812) — an extensive search was conducted using bibliographic sources and online databases. The main platforms consulted were: SciELO, Periódicos CAPES, Google Scholar, and the Brazilian Digital Library of Theses and Dissertations (Biblioteca Digital Brasileira de Teses e Dissertações – BDBTD), as well as the online databases Global Biodiversity Information Facility (GBIF) [https://www.gbif.org/], Biodiversity Portal – Instituto Chico Mendes de Conservação da Biodiversidade (ICMBio), and SpeciesLink [https://specieslink.net/].

Additionally, a review of specimens deposited in the Coleção de História Natural do Piauí (CHNUFPI) was carried out. These on-site analyses allowed for the validation and detailed examination of the information obtained from online platforms.

Social media

To expand species records and identify new occurrence locations, social media was used as a tool for community engagement. An illustrative flyer was created (Figure 1), containing images and information about the three target species of this study. This material was widely shared on platforms such as Instagram, Facebook, and WhatsApp. These platforms were selected due to their potential to reach a large and diverse audience (Liberatore *et al.,* 2018; Oliveira *et al*., 2021).

The community was encouraged to contribute information about species sightings. When individuals reported encountering or observing any of the species in streams, ponds, or other water bodies, they were asked to submit photos or videos along with the geographic coordinates of the location.

Figure 1: Image posted on social media to encourage contributions of new records of species and locations of occurrence.

Search for individuals and capture

The search for specimens was initially based on information gathered from social media. The specified locations were visited, and the initial search was conducted through visual surveys (Diniz; Latini, 2015).

Individual and collective funnel traps or hand nets were used to capture specimens, as well as barbless hooks (Balestra et al., 2016). Chicken skin and sausage were used as bait for the traps, which were left in place for approximately 60 minutes, with checks conducted every 15 minutes. When specimens were captured with hooks, a hand-held net (puçá) was used to assist in safely containing and removing them.

The captured specimens were taken to the Herpetology Laboratory of the Universidade Federal do Piauí, located in the municipality of Floriano. There, they underwent detailed taxonomic identification based on the original species descriptions (Schweigger, 1812; Luederwald, 1926; Bour; Zaher, 2005) and a key developed by Andrade et al. (2023) to facilitate their classification. After identification, the specimens were euthanized (Lima et al., 2021) and subsequently deposited in the Coleção de História Natural da Universidade Piauí (CHNUFPI), with specimen collection authorized under Sisbio 61118.

RESULTS

Georeferenced data obtained via social media yielded a total of 52 records. WhatsApp was the most frequently used platform, contributing 40 records, while Instagram accounted for 12. This approach enabled the expansion of the known distribution of *Mesoclemmys tuberculata* and *Phrynops geoffroanus*.

Through social media outreach, new occurrences of *M. tuberculata* were identified in three municipalities: Paes Landim (n=1), Itaueira (n=4), and Floriano (n=1). In Paes Landim (Figure 3-A), the specimen was recorded in a rural lake frequently used by the local population for fishing. Similarly, in Itaueira, the sightings occurred in lakes commonly used by the community for the same purpose (Figure 3-B). In Floriano, the specimen was discovered in a stream characterized as an anthropized environment.

The geographic separation between the new and previously known records underscores the need for further data collection on these species. The most recent records of *M. tuberculata* prior to this study were located in Serra das Confusões National Park (Dal Vechio et al., 2016), approximately 239 km from the new records in Floriano and Itaueira. Additionally, records from São Raimundo Nonato (Cavalcanti et al., 2014) are situated 166 km from the newly reported locality in Paes Landim."

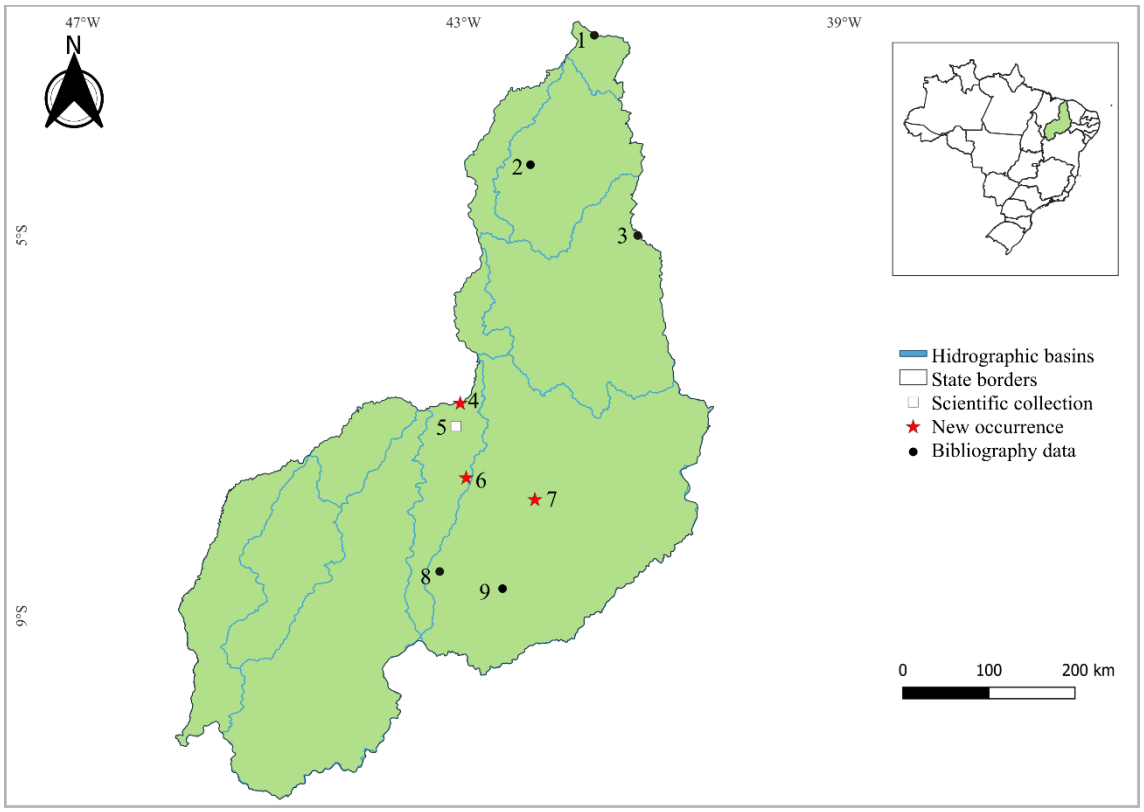

Figure 2: Records of the species *Mesoclemmys tuberculata*. Municipalities: 1- Luís Correia, 2- Barras, 3- Buriti dos Montes, 4 and 5- Floriano, 6- Itaueira, 7- Paes Landim, 8- Serra das Confusões, 9- São Raimundo Nonato. Source: J.S. Andrade (2024).

In addition to the new records, this study incorporated five previously published occurrences and one from a scientific collection in the state of Piauí, resulting in a total of nine known localities for *M. tuberculata* in the region.

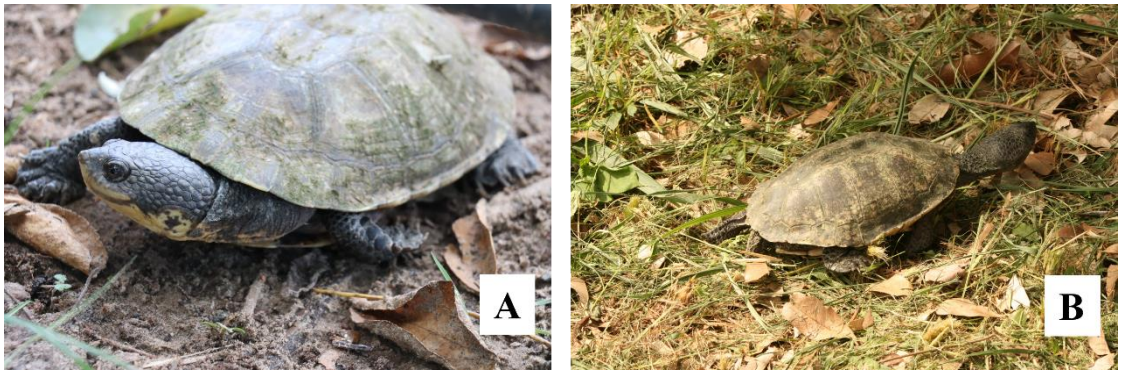

Figure 3: A - *Mesoclemmys tuberculata* in Paes Landim; B - *M. tuberculata* in Itaueira. Source: J.S. Andrade (2024).

For the species *Phrynops geoffroanus* (Figure 4), three new occurrences were recorded in the municipalities of São Raimundo Nonato (n = 3), Guadalupe (n = 1), and Canto do Buriti (n = 1). In São Raimundo Nonato and Canto do Buriti, the specimens

were found in anthropized areas with domestic effluents, while in Guadalupe, the specimen was captured in an irrigation canal.

The distances between the newly recorded occurrences and previously published ones highlight their significance in expanding the known distribution of the species. In the case of São Raimundo Nonato, the nearest documented location is approximately 96 km away (Figure 5A). For the Canto do Buriti record, the closest known occurrence is about 89 km away. Regarding the Guadalupe record (Figure 5B), the nearest point previously reported by Lima et al. (2021) is in the municipality of Floriano, located 111 km away.

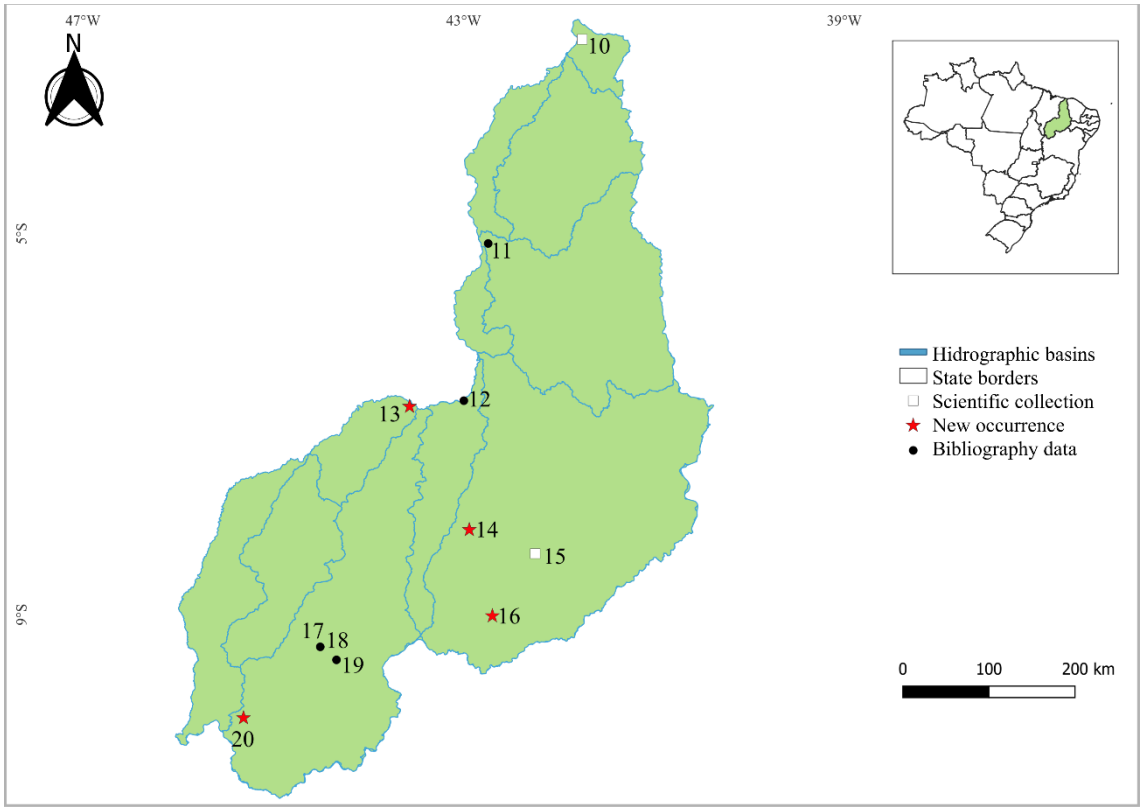

Figure 4: Occurrence records of the species *Phrynops geoffroanus*. Municipalites: 10- Parnaíba, 11- Teresina, 12- Floriano, 13- Guadalupe, 14- Canto do Buriti, 15- São João do Piauí, 16- São Raimundo Nonato, 17 a 19 Redenção do Gurguéia, 20- São Gonçalo do Gurguéia. Source: J.S. Andrade (2024).

In addition to the new records mentioned earlier, six other occurrence records were identified in the state. These records originate from previously published studies, and two were obtained from scientific collections. Notably, a specimen from São Gonçalo do Gurguéia, located in the southern region of the state, was identified through a review of specimens deposited in the Coleção de História Natural da Universidade Federal do Piauí (CHNUFPI).

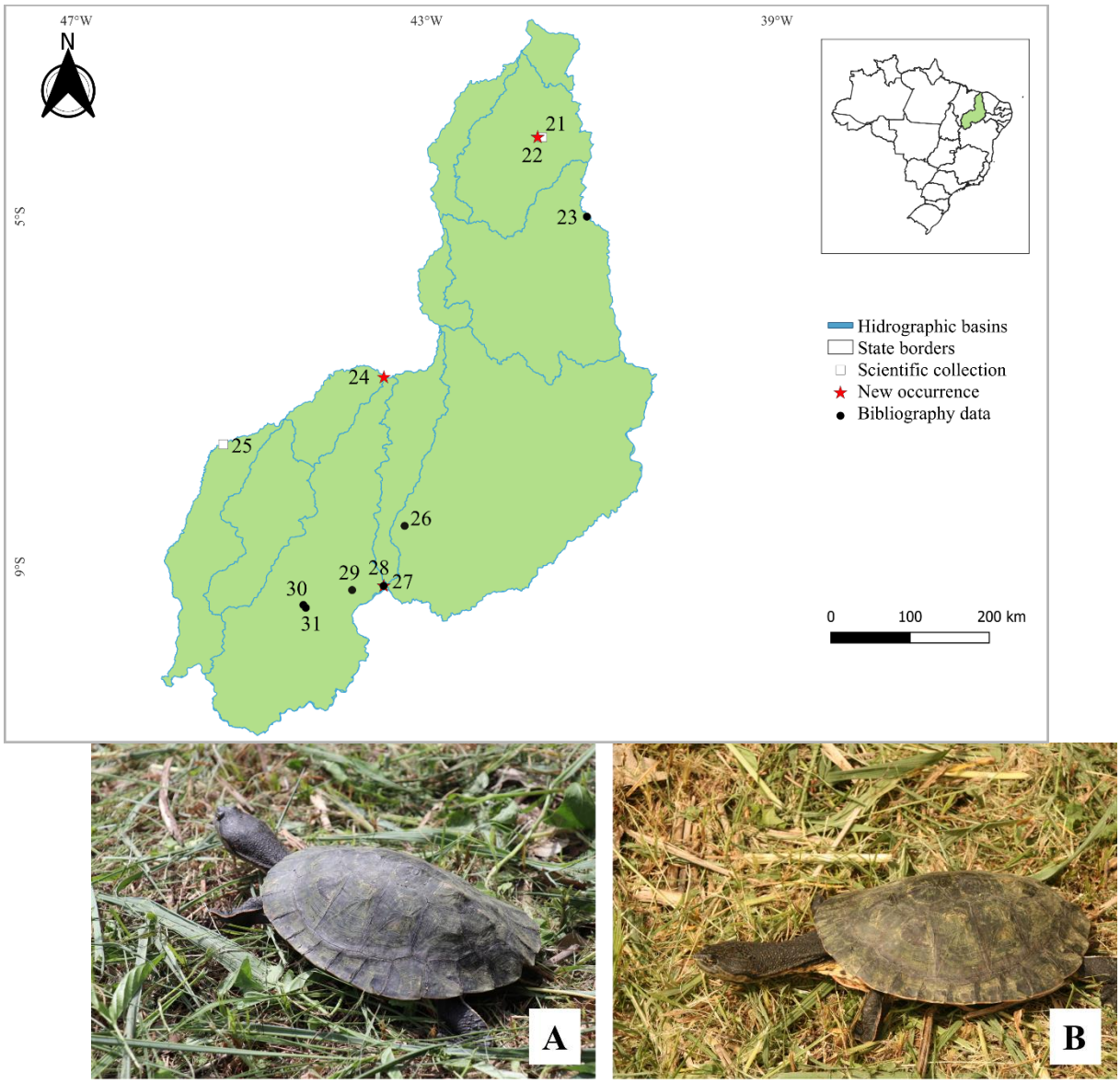

Figure 5: A- *Phrynops geoffroanus* found in São Raimundo Nonato; B- *P. geoffroanus* in Guadalupe. Source: J.S. Andrade (2024).

Regarding *Mesoclemmys perplexa* (Figure 6), preliminary information was collected about potential locations where the species might occur. Unfortunately, during the fieldwork, no specimens were captured. One area was dry, and in the other — the Parnaíba River — no individuals were observed or collected. However, a review of specimens vouchered at CHNUFPI revealed new occurrence sites for the species: Sete Cidades National Park, located between the municipalities of Brasileira and Piracuruca, and Artur Passos, a community near the municipality of Guadalupe.

Figure 6: Occurrence records of *Mesoclemmys perplexa*. Municipalities: 21- Piripiri, 22- Piracuruca, 23- Buriti dos Lopes, 24- Artur Passos, 25- Ribeiro Gonçalves, 26, 27 e 29- Serra das Confusões, 28- Caracol, 30 e 31- Redenção do Gurguéia. Source: J.S. Andrade (2024).

DISCUSSION

Citizen science projects have been widely applied in the sciences and related fields (Bonney et al., 2014; Peters, Eames, & Hamilton, 2015; Bautista-Puig et al., 2019). In this study, social media facilitated the collection of 52 georeferenced records, with WhatsApp emerging as the most effective platform, accounting for the majority of contributions. This approach enabled the identification of new occurrence sites for both *Mesoclemmys tuberculata* and *Phrynops geoffroanus*, highlighting the value of such methods in regions with limited data on these species. Therefore, citizen science proves essential, as the data collected are vital for developing conservation plans (Elith et al., 2006; Cohn, 2008; Amano, Lamming, & Sutherland, 2016; Edwards et al., 2021).

Costa et al. (2025) reported the three species in the municipality of Pedro II, located in the northern region of the state. Marques et al. (2023) also recorded all three species in a protected area in the Serra das Confusões region, in the southeastern part of the state, which lies in a transitional zone between two biomes: the Cerrado and the Caatinga (Alves et al., 2020; Lima et al., 2020). Previously, *Mesoclemmys tuberculata* was recorded in Barras (Benício et al., 2015), a municipality in the northwestern region of the state, characterized by a phytophysiognomy typical of the Caatinga, Cerrado, and *Matas de Cocais* vegetation types (CEPRO, 1992; Castro, 2003).

Dal Vechio et al. (2016) recorded the species *Mesoclemmys tuberculata* in the Serra das Confusões region. Subsequently, Madella-Auricchio, Auricchio, and Soares (2017) reported the species in the southern region of the state. The first formal record of *M. tuberculata* in Piauí was provided by Loebmann, Mai, and Garcia (2006), followed by Cavalcanti et al. (2014).

Given that Piauí has a total area of 251,755.499 km² (IBGE, 2024), and considering the timeline of previous records—typically spaced six to ten years apart—it is important to highlight that our study generated new records via social media in a significantly shorter time frame. Notably, we documented new occurrences in the state within just 12 months.

The first documented record of *Mesoclemmys perplexa* was made by Bour and Zaher (2005) in Serra das Confusões National Park, located in the southern part of the

state. Subsequently, Marques et al. (2023) recorded the species at the same location. More recently, Costa et al. (2025) reported its occurrence in the municipality of Pedro II, situated within a transition zone between the Cerrado and Caatinga biomes in the northern region of the state.

When comparing the initial description with recent records, a gap of approximately 20 years between occurrences becomes evident, spanning a distance of about 750 km from the southern to the northern regions of the state. This gap may be attributed to a lack of surveys focusing on the expansion of the species' distribution. The present study indicates that the occurrence of *Mesoclemmys perplexa* in Piauí is more widespread than previously documented. A review of collections has allowed us to expand its known range, raising the expectation that social media can further enhance our understanding of this species, as well as the results obtained for *M. tuberculata*.

The species *Phrynops geoffroanus* is widely distributed throughout Brazil (Baldo et al., 2007; Rueda-Almonacid et al., 2007; Ferronato et al., 2013; Cacciali, 2016; Uetz et al., 2024). However, the scientific literature contains only a few records of this species within the state of Piauí. The first documented record in the state dates back to 1990, in the municipality of São João do Piauí, which lies within a region influenced by the Caatinga biome (Lima, Macêdo, and Silva, 2023).

Subsequently, individuals were recorded in Barras (Benício et al., 2015), located in the northwest of the state, in a transition zone between the Cerrado and Caatinga biomes, as well as areas of Cocais vegetation. In the same year, another record was made in the municipality of Batalha (Silva, Carvalho, and Rodrigues, 2015), in the northern part of the state, in a region that also encompasses the Cerrado and Caatinga biomes.

Additional records were documented in Serra das Confusões National Park (Dal Vechio et al., 2016), situated in southwestern Piauí and characterized by the overlap of the Cerrado and Caatinga biomes. More recently, the species was observed in the municipality of Floriano (Andrade et al., 2020), located in a transitional area between the Cerrado and Caatinga biomes, where the vegetation exhibits semiarid characteristics (Dantas, Sousa Junior, and Monteiro, 2024).

The records highlight the widespread distribution of *Phrynops geoffroanus* in the state. Furthermore, this study provides new data on the species' presence in previously

undocumented locations, including São Raimundo Nonato, Guadalupe, and Canto do Buriti. These findings expand our understanding of its geographic distribution and underscore the importance of conducting regional investigations into the herpetofauna of Piauí.

Such approaches have significantly enhanced the monitoring of data for endangered or rare species, as well as the tracking of migrations (Chandler et al., 2017; McKinley et al., 2017; Fontaine et al., 2022). Citizen science has been effectively applied in various fields, including studies on birds (Libertore et al., 2018), whales (Cranswick et al., 2022), terrestrial mammals (Oliveira et al., 2021), and sea turtles (Mancini and Elsadek, 2019).

Citizen science is not only advantageous for developing conservation strategies but also serves as a cost-effective and time-efficient method for collecting information about species (Nascimento et al., 2024). Countries around the world have adopted this approach in various projects, particularly in research focused on environmental protection and biodiversity conservation (Groom; Weatherdon; and Geijzendorffer, 2017; Owen and Parker, 2018; Bautista-Puig et al., 2019).

CONCLUSION

This research highlights the significance of using social media as a citizen science tool, demonstrating its efficiency and low cost in collecting data essential for georeferencing turtle occurrences in the state of Piauí. This methodology enabled the expansion of the known distribution of the species *Mesoclemmys tuberculata* and *Phrynops geoffroanus*, resulting in the documentation of previously unrecorded locations within the state.

WhatsApp emerged as the most effective platform compared to Instagram and Facebook in this study. Active community participation played a crucial role in addressing gaps in species distribution data. This underscores the importance of citizen science in uncovering under-reported information that is often overlooked by the broader scientific community or absent from official records.

This research contributes to a better understanding of turtle distribution in Piauí and underscores the important role of citizen science in species conservation.

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APPENDIX:

Coordinates of Chelidae species in Piauí.

Chelidae of Piauí		
Locality/municipality	**Geographic coordinates**	**Source**
Mesoclemmys tuberculata		
Luís Correia	2°53'43"S, 41°37'31"W	Loebmann, Mai, Garcia, 2008
Complexo Planto da Ibiapaba, Buriti dos Montes	5°00'00"S, 41°10'09"W	Loebmann & Haddad, 2010
Floriano	7°00'20"S, 43°44'45'W	GBIF (MHNCT)
Riacho Irapuá, Floriano	6°46'11"S, 41°12'22'W	Este estudo**
Paes Landim	7°46'47"S, 42°50'20'W	Este estudo***
Itaueira	7°33'22"S, 42°20'27'W	Este estudo***
Parque Nacional da Serra da Capivara, São Raimundo Nonato	8°24'47.8"S, 42°32'29.9'W	Cavalcanti et al., 2014
Barras	4°15'24.8"S, 42°17'46.0'W	Benicio et al., 2015
Mesoclemmys perplexa		
Complexo Planto da Ibiapaba, Buriti dos Lopes	5°00'00"S, 41°10'09"W	Loebmann & Haddad, 2011
Parque Nacional da Serra das Confusões	8°32'03"S, 43°15'00'W	Bour & Hussam, 2005
Parque Nacional da Serra das Confusões	9°16'05"S, 43°18'03'W	Bour & Hussam, 2005
Parque Nacional Sete Cidades, Piripiri	4°53'55"S, 41°48'38'W	Carvalho, V.T.*
Ribeiro Gonçalves	7°36'48"S, 41°14'14'W	Carvalho, V.T.*
Parque Nacional Serra das Confusões, Guaribas	9°31'16"S, 43°15'44'W	Este estudo**
Parque Nacional Sete Cidades, Brasileira e Piracuruca	4°53'59"S, 41°43'53'W	Este estudo**
Fazenda Floresta, Guadalupe	6°50'15"S, 42°19'13'W	Este estudo**
Olho d'Água da Santa, Caracol	9°13'18"S, 43°24'27'W	Marques et al., 2023
Açude 2, Redenção do Gurguéia	9°26'12"S, 42°24'44'W	Marques et al., 2024
Açude 4, Redenção do Gurguéia	9°28'9"S, 42°24'48'W	Marques et al., 2025
Phrynops geoffroanus		
Riacho do Leite, Floriano	6°45'11"S, 42°59'47.5'W	Lima et al., 2021
Teresina	5°6'9"S, 42°44'26.2'W	Melo et al., 2020
Parnaguá	2°57'33"S, 41°45'12'W	MPEG
Lagoa do Muquém, São João do Piauí	8°21'30"S, 42°14'48'W	SpeciesLink (UNICAMP)
Lagoa do Mato, São Raimundo Nonato	9°34'6.8"S, 42°34'6.0'W	Este estudo***
Guadalupe	6°48'52.8"S, 43°34'0'W	Este estudo***
Canto do Buriti	8°6'30.8"S, 45°26'20.4'W	Este estudo***
Baixão do Paraguaí, Redenção do Gurguéia	9°28'28.2"S, 42°20'5'W	Marques et al., 2023
Rio Gurguéia, Redenção do Gurguéia	9°28'38.3"S, 43°16'22'7'W	Marques et al., 2023
Cupins, Redenção do Gurguéia	9°28'38.3"S, 43°16'22'7'W	Marques et al., 2023
São Gonçalo do Gurguéia	9°28'38.3"S, 43°16'22'7'W	Este estudo***

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