



The midday sun reveals what the waters hide: *Podocnemis unifilis* Troschel, 1848 (Testudines, Podocnemididae), another exotic species in the Pantanal of Mato Grosso state

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Abstract: The process of exotic species introduction is recognized as one of the greatest threats to the ecology and economy of the planet, due to changes in interactions in native biological communities. In this sense, reporting bioinvasions is the first step to understanding its introduction process and creating strategies to mitigate possible socio-environmental damages. Here we report the first records of *Podocnemis unifilis* introduced in the Northern Pantanal, Mato Grosso, Brazil. We obtained the species' first records occasionally during 2014 and 2015. In the following years from 2016 to 2019, we carried out systematic observations through nautical incursions on the Paraguay River, between the Sepotuba River mouth and the Taiamã Ecological Station (TES). We also included third part records, when it was possible to prove the species identification and registration sites. *Podocnemis unifilis* adults, hatchling and nests were recorded at different points along the Paraguay River. Our results indicate that *P. unifilis* was introduced close to the urban nucleus of Cáceres about 30 years ago. Currently, it has an established population, recording nests and hatchling for years in a row. A particular one is its occurrence at the TES, an important natural fish nursery and refuge for the wetland fauna. Thus, continuous monitoring is suggested from *P. unifilis*, since the Pantanal's environment with several different aquatic environments, offers favorable conditions for the species population increase in the Northern Pantanal.

Keywords: Chelonian distribution; Conservation Unit; Floodplain; Invasive fauna; Tracajá.

O sol do meio-dia revela o que as águas escondem: *Podocnemis unifilis* Troschel, 1848 (Testudines, Podocnemididae), outra espécie exótica no Pantanal mato-grossense

Resumo: O processo de introdução de espécies exóticas é reconhecido como uma das maiores ameaças à ecologia e economia do planeta, devido às mudanças nas interações em comunidades biológicas nativas. Nesse sentido, relatar as bioinvasões é o primeiro passo para entender seu processo de implantação e criar estratégias para mitigar possíveis danos socioambientais. Aqui relatamos os primeiros registros de *P. unifilis* introduzidos no Pantanal Norte, Mato Grosso, Brasil. Obtivemos os primeiros registros das espécies ocasionalmente durante 2014 e 2015. Nos anos seguintes, de 2016 a 2019, realizamos observações sistemáticas por meio de incursões náuticas no rio Paraguai, entre a foz do rio Sepotuba e a Estação Ecológica Taiamã (TES). Incluímos também registros de terceiros, quando foi possível comprovar os locais de identificação e registro das espécies. Adultos de *Podocnemis unifilis*, filhotes e

ninhos foram registrados em diferentes pontos ao longo do rio Paraguai. Nossos resultados indicam que *P. unifilis* foi introduzido próximo ao núcleo urbano de Cáceres há cerca de 30 anos. Atualmente, ela tem uma população estabelecida, registrando ninhos e filhotes por anos consecutivos. Uma em particular é a sua ocorrência no TES, importante viveiro natural de peixes e refúgio da fauna pantaneira. Assim, sugere-se o monitoramento contínuo de *P. unifilis*, uma vez que o ambiente do Pantanal com diversos ambientes aquáticos distintos, oferece condições favoráveis para o aumento da população da espécie no Pantanal Norte.

Palavras-chave: Distribuição de quelônios; Unidade de Conservação; Várzea; Fauna invasora; Tracajá.

Introduction

The process of exotic species introduction is recognized as one of the greatest threats to the ecology of species and the economy of the planet (Gisp 2005, Doherty et al. 2016). Its impacts, in a given environment, can vary in different degrees of severity, which has led researchers to seek to understand the relationship dynamics of invasive species with the native biological community of the invaded areas (Crystal-Ornelas & Lockwood 2020). From a harmful perspective to biodiversity, it concerns the interactions change of the of native biological communities, such as competition, predation, parasitism, changes in the food web, hybridization, which can lead to changes in the community structure and even local extinctions (Mack et al. 2000, Simberloff & Rejmáne 2011, Doherty et al. 2016, Frehse et al. 2016).

Reviewing publications on biological invasions in Brazil, Frehse et al. (2016) describe the introduction of 980 animal species in the country and point out that almost a third of these were intentionally introduced for some economic purpose. Regarding vertebrates, the occurrence of 137 invasive species in Brazil is reported, which represents about two percent of the non-marine vertebrate fauna, registered for the country (Rocha et al. 2011). Have also to consider the existence of internal bioinvasions, that is, environments occupations by national species, but not native to that environment.

Despite the increasing number of studies, aquatic bioinvasion systems are still little reported in Latin America (Pysek et al. 2008). In Brazil, from the end of the last century, scientific research on bioinvasion in aquatic systems has been intensified, increasing the introduced exotic species registration (Sousa et al. 2009). However, available data on aquatic bioinvasions are still sparse and restricted to certain species or regions (Sousa et al. 2009), which results in concern about the biodiversity of Brazilian aquatic systems.

The Pantanal biome is no exception to the occurrence of exotic species, since after human occupation, non-native plants and animals were introduced, either intentionally or accidentally, altering the natural ecological communities (Alho et al. 2011). This biome has the largest continuous wetland on the planet, with approximately 140,000 km², distributed along the Paraguay River basin (Harris et al. 2005). The main Pantanal characteristic is its alternation of habitats between flooded and dry periods, causing the lateral overflow of rivers and lakes (Alho 2008). These characteristics mainly favor the establishment of aquatic or semi-aquatic species. This biome is still poorly studied and has only two federal conservation units in the territory, the Taiamã Ecological Station (TES) and the Pantanal National Park. Therefore, the occurrence of an invasive species in these protected areas in the Pantanal is worrying, and the introduction and species reproduction in a conservation unit area is prohibited by Federal Law N^o. 9985/00 Art. 31 (Sampaio & Schmidt 2013).

Several taxonomic groups have the potential for bioinvasion including reptiles (Gisp 2005). Among reptiles, turtles are an important invasive fauna, because many species of this group are capable to adapt to a wide variety of environments and are easily established in different aquatic environments (Gisp 2005). Currently, Brazil has records of invasive turtle species, including introductions from other countries or even native species in non-native environments, as is the case with *Trachemys scripta*, an United States native species that was introduced in Brazil and today can be found for example in the central-west, northeast and south regions of the country (see Vieira & Costa 2006, Leão et al. 2011, Tortato et al. 2014, Ferreira et al. 2016). *Trachemys dorbigni*, whose original distribution is Uruguay, Northeast Argentina and the central southern portion of Rio Grande do Sul, Brazil, was recently registered as introduced of Santa Catarina and São Paulo states (see Santos et al. 2009, Tortato et al. 2014). *Trachemys scripta* and *T. dorbigni* are species officially listed as invasive in Santa Catarina state (Consema 2010). *Podocnemis expansa* and *P. unifilis* are originally described for the Orinoco, Amazonas and Araguaia-Tocantins river basins, (Vogt 2008, Santos & Blamires 2012; van Dijk et al. 2014, Cantarelli et al. 2014), however, both species have already been found in Pernambuco state (Santos et al. 2016, Souza et al. 2019) and *P. unifilis* also in Mato Grosso do Sul state (Ferreira et al. 2016, Caramaschi 2020). These are some works that demonstrate the invasive potential of the Chelonians, including species native to Brazil introduced outside their natural origin areas.

Podocnemis unifilis, popularly known as “tracajá”, is one of the most widely distributed species of the genus *Podocnemis* (see Ferrara et al. 2017). It has high plasticity, occupying a wide variety of aquatic habitats, such as large rivers, lakes, meandering lakes, swamps, marshes, white, black or clear water rivers (Vogt 2008). Females of this species can reach a little more than 50 cm in length with an approximate weight of 12 kg and can spawn in several places, such as beaches and river banks (Vogt 2008). Their nests can be dug either in the sand, in the clay or a mixture of soil with plant remains (Vogt 2008, Ferrara et al. 2017). A female can spawn 15 to 30 eggs (Ferrara et al. 2017), and the offspring born after a period of 48 to 89 days (Vogt 2008, MMA 2016).

The species *P. unifilis* occurs naturally in the Amazon, Oniroco and Araguaia-Tocantins basins, covering Brazil, Colombia, Venezuela, Peru, Equator, Bolivia, Guyana, French Guiana and Suriname (Vogt 2008, Schneider et al. 2012, Rhodin et al. 2017, Ferrara et al. 2017). However, in none of Testudines' assessments, (Vogt et al. 2015, Ferrara et al. 2017, Rhodin et al. 2017) or studies with reptiles in the Northern Pantanal (see Strüssmann et al. 2011, ICMBIO 2017) reports the species *P. unifilis* or any congener to this portion of the Pantanal. Furthermore, the records of the introduction of *P. unifilis* in the Paraguay River in the state of Mato Grosso do Sul are punctual and the structure of the population species is still unknown to the Pantanal.

Thus, the present work aims to report the first records populations of *P. unifilis* for the Northern Pantanal, Mato Grosso state, Brazil, considering a case of introduction and presenting the species first records at the Taiamã Ecological Station (TES), one of two federal conservation areas in the Pantanal biome.

Material and Methods

1. Species identification

To identify the specimens we used it as a base taxonomic key of Amazonian chelonians (Ferrara 2017). Voucher specimens deposited in the herpetological collection of the Limnology, Biodiversity, Ethnobiology of Pantanal Research Center (CELBE), of the State University of Mato Grosso (UNEMAT) were also used to identify the species. We carried out morphological characteristics analyzes of adult specimens, hatchling turtles and eggs, found in the Paraguay River. We also got the help of Dr. Richard C. Vogt, a researcher with extensive experience in South American turtles, who confirmed the identification of the specimens through pictures.

2. Study area

The study area comprises a stretch of the Paraguay River of approximately 440 km long, located between the confluence of the Sepotuda and Paraguay rivers (15° 55'26.51" S and 57° 39'8.69" W), and approximately 15 km to the downstream of the Taiamã Ecological Station (17° 1'37.07" S 57° 22'38.77" W) (Figure 1). Within this stretch, the largest beach found is "Furo do touro" (16° 11'02.87" S and 57° 46'55" W), approximately 25 km, downstream from the Cáceres-MT city center. The "Furo do touro" beach is formed by white sand, with an approximate 400 m length × 105 m wide, parallel to the Paraguay

River, which forms between the months of July and November with the water level reduction, in the dry season. This region constitutes the Upper Course of the Paraguay River and is described as Pantanal of Cáceres (Silva and Abdon 1998, Leandro & Souza 2012) consisting of the beginning of the Pantanal floodplain.

According to Alvares et al. (2014), the region's climate is of the Aw type (wet and dry tropical, or of savanna climate). The average annual precipitation is 1,330 mm with temperatures ranging from 10°C in June to 38°C in December (Resende et al. 1994). The vegetation in this area diverges, with the transition area between the Cerrado and the Amazon Forest biomes in its upstream portion (Silva-Júnior et al. 2019). In its intermediate portion, between the urban centre of Cáceres and further downstream, in TES the vegetation is characterized by typical tree formations of riparian forest, with trees belonging to the Cerrado biome or the semideciduous forest and covered fields composed of grasses, both seasonally flooded (ICMBIO 2017).

3. Taiamã Ecological Station (TES)

TES is located in the Mato Grosso state, in its northern portion, within the limits of the municipality of Cáceres, between the meridians W 57° 24' and W 45° 40' and parallels S 16° 48' and W 16° 58' (ICMBIO 2017). It has a total area of 11,555 ha strongly influenced by the marked seasonality of the Paraguay River hydrological regime, which leads to the structuring of a wide variety of aquatic environments such as permanent, temporary lagoons, meandering lagoons and small channels that connect lakes and river (ICMBIO 2017). TES has an important role in protecting the Pantanal biodiversity, as it is one of the few areas, institutionally, protected within the Pantanal. The station presents a series of measures that provide for the control of the impact of invasive alien species on the biological diversity of native species. However, until now *P. unifilis*

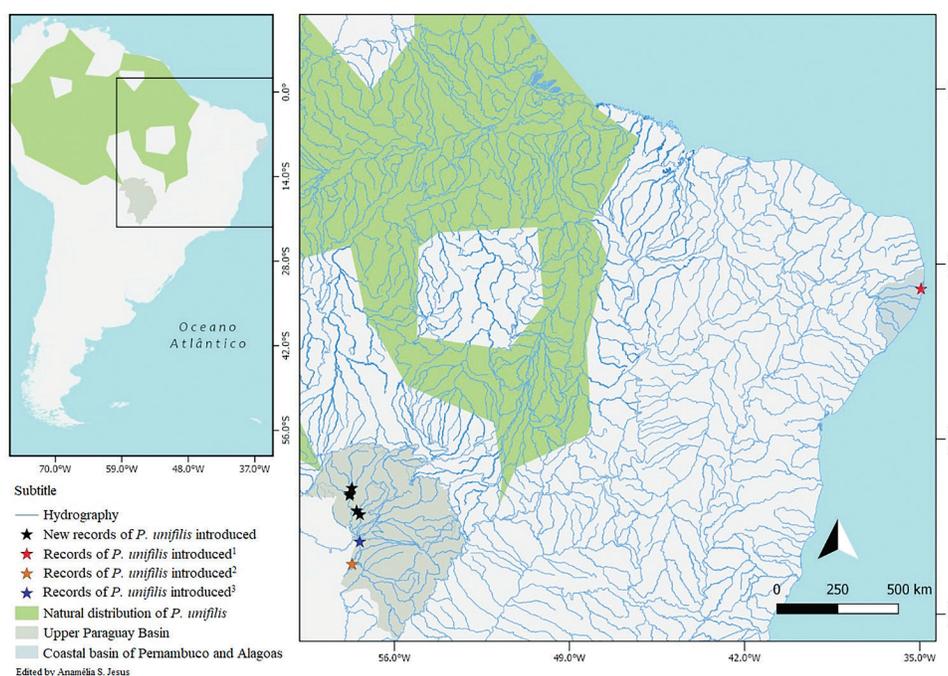


Figure 1. Distribution map of *P. unifilis*. Green polygon represents the species natural distribution as compiled by data from Ferrara et al. (2017); Red star corresponds to Santos et al. (2016); The orange star corresponds to Ferreira et al. (2016); The blue star corresponds to Caramaschi (2020); and the black stars corresponds to the new records of *P. unifilis* in the Paraguay River, Northern Pantanal, Mato Grosso state, Brazil.

is not one of the invasive species for the Northern Pantanal region and occurs in TES (ICMBIO 2017).

4. Field data collection

The *P. unifilis* species' first records in the Paraguay River occurred occasionally, during sport fishing activity, carried out by the researchers in the years 2014 and 2015. During the following years, from 2016 to 2019, systematic observations were made through nautical incursions courses along the Paraguay River, in the studied stretch. The incursions were carried out during the drought period between July and November. Sampling took place using the direct observation method when the specimens were found lounging on beaches. This method consists of counting animals that are exposed to the sun on logs or the river banks and lakes. This strategy has been used successfully by authors such as Pluto and Bellis (1986), Conway-Gómez (2007) and Segurado and Figueiredo (2007).

We also include records made on occasional or opportunistic collections, which occurred during the conduct of other research or fishing activity by professional fishermen and/or amateurs. These records were confirmed utilizing photos and the location of the visualization. Subsequently, these points were located on maps and the geographic coordinate was obtained.

We collected some hatchling that were found dead after birth. The collected animals were deposited in the herpetological collection at Centro de Pesquisa em Limnologia, Biodiversidade, Etnobiologia do Pantanal (CELBE), of State University of Mato Grosso (UNEMAT), (permanent license from Sistema de Autorização and Informações on Biodiversidade – SISBIO – número 8849-1).

We also carried out a historical bibliographic review in scientific articles and relief maps, observing the main natural barriers that separate the watersheds with the natural occurrence of *P. unifilis* and the Paraguay river basin, to verify a possible natural migration of the species. Finally, we analyzed historical records related to the municipality of Cáceres. Through historical documents, historians, official websites such as the city hall website, International Fishing Festival (Festival

Internacional de Pesca esportiva – FIPE) and the Institute of National Artistic Historical Patrimony (Instituto of Patrimônio Histórico Artístico Nacional – IPHAN). We also obtained information from fishermen from pioneer families in the city of Cáceres.

Results

1. Records

In October 2014, seven nests of *P. unifilis* were observed, with eggs already hatched (Figure 2a, b and c), and 18 hatchling turtles on the “Furo do touro” beach (Figure 3).

In September 2015, 22 adult individuals were sighted near the confluence of the Sepotuba River with the Paraguay River. In October 2017, two young specimens of *P. unifilis* were accidentally collected from fishing nets, while researchers from the State University of Mato Grosso collected fish in a bay downstream from the beach “Furo do touro”, these animals were collected and deposited in the herpetology collection at the CELBE (CELBE-Q-0001; CELBE-Q-0002). At the end of August 2019, we registered four nests, with about 26 eggs each, on a beach 2 km upstream of the “Furo do touro” beach. In October 2019, the largest number of nests was observed, where we observed traces of 85 nests with eggs already hatched on the “Furo do touro” beach. In that same month, we recorded an adult specimen of *P. unifilis* looming on a dirt and clay beach downstream from TES. Besides, between 2016 and 2019, adult and young specimens were regularly observed in bays and on beaches along the “Furo do touro” beach and the mouth of the Sepotuba river, along the course of the Paraguay river, (Figure 4). In November 2019, two specimens were recorded lounging on a beach within the perimeters of TES. Four nests were also recorded, which indicates that the species is established and reproducing within the conservation unit.

2. Historical surveys

According to information from residents, the specimens were introduced into the Paraguay River in the 1970s, released near the



Figure 2. (a) “Furo do Touro” beach, on the Paraguay River, in the Pantanal of Cáceres, Mato Grosso state; (b and c) Traces and nest of *P. unifilis*, found on the “Furo do touro” beach in October 2014.

Photographs by Dionei J. Silva.



Figure 3. (a) Nest with eggs, (b, c) Live baby *P. unifilis* e (d) dead baby turtles of *P. unifilis* on “Furo do touro” beach, in the Pantanal of Cáceres, Mato Grosso state, Brazil. Photographs by Amabilen Furlan; Claumir For Review Only Muniz and Dionei Silva.



Figure 4. (a–d) Records of specimens of *P. unifilis*, young and adult on logs and beaches along the study area in the Pantanal de Cáceres, Mato Grosso, Brazil. Photographs by Claumir Muniz and Dionei J. Silva.

urban center of the municipality of Cáceres. The first specimens were reportedly brought from the Amazonas state by the Fanaia family patriarch (family report). These animals remained close to the urban nucleus, where there are reports from residents that around 1985 some specimens were recaptured and placed in a fountain, located in the Major João Carlos square, where they remained for years (residents’ report).

Discussion

1. Migration hypothesis

The hypothesis of *P. unifilis* specimens migration to this portion of the Paraguay River from the Guaporé River, which belongs to the Amazon basin where the species presence is recorded (Vogt 2008, Schneider

et al. 2012, Rhodin et al. 2017, Ferrara et al. 2017), is initially discarded. The possibility is unlikely considering that there is no direct connection between the Paraguay and Guaporé rivers and that the distance between them, at the nearest record point, is approximately 160 km.

Due to the residual plateaus, it is not considered that the Paraguay River basin is connected to the Guaporé River basin (MMA 2006). However, the Upper Paraguay-Guaporé depressions are indirectly connected by a slightly sloping segment, where the distance between the Guaporé River and the Upper Jauru River basins is approximately 5 km (Ross 1985), where Jauru River is an important tributary of the Paraguay River.

By the aforementioned connection, a remote possibility of transposing the species from the Guaporé basin to the Paraguay River basin could be considered, however, there are no species occurrence records in these regions (Vogt 2008, Schneider et al. 2012, Ferrara et al.

2017, Rhodin et al. 2017). Likewise, there are no records of any floods that have established water contact between the two basins. Another point that rules out natural migration is the fact that our *P. unifilis* records in the Paraguay River are concentrated close to the urban nucleus of the municipality of Cáceres and the record closest points of *P. unifilis* in the Guaporé River (Ferrara et al. 2017) are about 425 km away from our records (see Figure 1). Migration from another basin is also ruled out, since the closest occurrence point of *P. unifilis*, in our records, besides the Guaporé River, is in the Araguaia River, in locations that are about 650 km from this portion of the Paraguay River.

2. Introduction hypothesis

The municipality of Cáceres was formed from a small village named Vila Maria do Paraguay, founded in 1778, in the Pantanal of the Mato Grosso state (IPHAN 2020). At the end of the 19th century, Cáceres played a prominent role in the state economy mainly because of its location, on the banks of the Paraguay River, whereby many means of transport, exported and imported varied commodities (Pinho 2013). However, with improvements in the construction of the road network, especially with the construction of the “Marechal Rondon” bridge over the Paraguay River in the 1950s (Almeida 2014) connecting Cáceres to the western region of the state and part of the northern region of Brazil (Silva et al. 2007), made it possible to increase land transport to the city. Subsequently, the construction of the bus terminal in the center of Cáceres, as well as the improvement of the old airport called “Manoel Cuiabano” (Almeida 2014) provided Cáceres with a greater flow of people and objects.

So, considering that: (1) the majority of *P. unifilis* nest and adult records in the Northern Pantanal, are close to the urban center of Cáceres and; (2) taking into account the fact that tracajás return to the same nesting sites and feeding lakes (Andrade et al. 2015), and; (3) distance and geographical barriers in its area of occurrence and; (4) the historical reports of residents, it is palpable to assume that *P. unifilis* was introduced close to the urban center of Cáceres, in the recent past.

This hypothesis is reinforced by the fact that in conversations with fishermen and riverside dwellers and residents, we did not obtain reports of turtle registration before the 1950s. The recent introduction is also reinforced by studies with the distribution of turtles (Van Dijk et al. 2014, Vogt et al. 2015, Ferrara et al. 2017, Rhodin et al. 2017), and studies with herpetofauna in the Pantanal (Strüssmann et al. 2011, ICMBIO 2017) there is no indication of the species for the Northern Pantanal so far. This may be related to the fact that the species took several years to reach a population size in which individuals could be noticed by the population.

3. *Podocnemis unifilis* in the Taiamã Ecological Station

After the species records in November 2019, we no longer obtained records of it within the ecological station. However, taking into account its high displacement capacity (IBAMA 2016), and our species records both downstream and upstream of the ecological station, it is reasonable to assume that *P. unifilis* occurs, even in low density, in the Paraguay River in the entire extension of the Taiamã Ecological Station. The fact that the species is reproducing inside the conservation unit is worrying, as it is an area intended for the reproduction and conservation of typical Pantanal species. The presence of an invasive species can directly

generate competition with native species within the conservation unit, such as the aquatic Testudines *Acanthochelys macrocephala* and *Phrynops geoffroanus* and the pacu fish *Piaractus mesopotamicus*, which has a diet similar to *P. unifilis* and finds an important natural nursery in Taiamã (ICMBIO 2017).

4. Introduction problem

Chelonians have been used as an important food source by traditional Amazonian peoples for hundreds of years (Vogt 1994, Eisemberg et al. 2019, Stanford et al. 2020). Turtle and eggs consumption is part of the Amazon culture (Andrade et al. 2015). These explorations have aimed not only at sustainable consumption of turtles but also at illegal trade in large urban centers (Fachín-Terán 1999, Fachín-Terán et al. 2000, Stanford et al. 2020) leading to super exploration. This is one of the main factors that make turtles be considered one of the most threatened animal groups on the planet (Vogt 2008, IBAMA 2016, Ferrara et al. 2017, Stanford et al. 2020).

In this new introduction area of *P. unifilis* in the Northern Pantanal, the consumption of tracajás and their eggs is not cultural, therefore, there is a tendency for the population to grow higher than those recorded in native habitats. Also, species' natural characteristics, such as high longevity and displacement capacity (IBAMA 2016), and its reproductive capacity, laying 15 to 30 eggs per year (Ferrara et al. 2017), favor the population increase. The favoring of the establishment and population increase of *P. unifilis* in the studied region is also due to the Pantanal environmental characteristics, which has several aquatic habitats suited to the characteristics of the species. In this way, areas of the Pantanal may allow good adaptation of this species in the northern portion of the Pantanal. In addition, its ability to move is also a cause for concern, as a recent record of *P. unifilis* for the Serra do Amolar region, Paraguay river basin (Caramaschi 2020), might be the result of migration of this population described here, given that this record is located about 120 km downstream of the points at the Taiamã Ecological Station.

Thus, the occurrence of *P. unifilis* in the Pantanal brings ecological concerns since, in most cases, exotic species constitute threats to biodiversity, as they can modify the structure of the local community, changing the habitat and restructuring the community through new interspecific interactions (CrystalOrnelas & Lockwood 2020, Frehse et al. 2016). In this way, it can cause extinctions of native species (Cadi and Joly 2004, Alho & Gonçalves 2005, Alho 2008, Alho et al. 2011, Garcia-Diaz et al. 2015).

Although the results of an introduction are difficult to predict, the most predictable consequences are competition with closely related species (Frehse et al. 2016). In studies with the introduction of turtles, Cadi & Joly (2003) observed that *Emys orbicularis* ended up changing its thermoregulation habits, giving the best places for sunbathing to the species *Trachemys scripta elegans*, which is an introduced species. Finally, Cadi and Joly (2004) observed that the introduction of *T. s. elegans* caused weight loss and high mortality in the populations of *E. orbicularis*. Extensions of results like these can be aggravated for the Pantanal, as the Testudines constitute one of the most poorly sampled groups in this biome (Strüssmann et al. 2011) and there are still many doubts and disagreements about the distribution of aquatic Testudines in the Pantanal. However, when considering the different approaches

to invasive species (Frehse et al. 2016), it is reasonable to predict that *P. unifilis* can cause direct competition with species of aquatic Testudines occurring in the Pantanal biome such as *Acanthochelys macrocephala* and *Phrynops geoffroanus*. Since with the introduction of *P. unifilis* there was a densification of individuals, competing for food and spawning grounds, since, for example, the diet of *P. unifilis* and *P. geoffroanus* are similar and we have already recorded *P. unifilis* and *P. geoffroanus* in a radius of 1 meter on a beach of the Paraguay River (personal communication), thus suggesting that *P. unifilis* can compete with native species in the wetland.

Several invasive species are registered in the Pantanal, such as the “Porco do mato” *Sus scrofa* (Linnaeus, 1758), the golden mussel *Limnoperna fortunei* (Dunker 1857), the “tucunaré”, Amazonian fish, *Cichla cf. ocellaris* Bloch and Schneider 1801, the “tambaqui from the Amazon”, *Colossoma macropomum* Cuvier, 1816, in addition to the various domesticated animals and grasses (Alho et al. 2011). *Podocnemis unifilis* starts to constitute the first exotic chelonian known to the Pantanal, whose ecological interactions may cause effects that are quickly visible to the biodiversity of the Pantanal. However, many of them will only be observed in the long term, which requires continuous monitoring of this species in the region.

Our records are the first of this kind for the Northern Pantanal, including Taiamã Ecological Station. We found that the species was introduced in this region of the Pantanal in the recent past and is currently established since it has been reproducing in the place for several years. The typical environment structure with large rivers, where forests are flooded during the flood season, the presence of large meanders, lakes and white sand beaches during the dry season are characteristics of suitable habitats for the species, ensuring conditions of the permanent establishment in the region.

If the presence of the species *Podocnemis unifilis* in this area of the Pantanal constitutes, in fact, an impact factor on the structure of the local communities, the registration of the species and its reproduction at the Taiamã Ecological Station, which is considered a nursery for several species of fish, is worrying. These facts point to the necessity for proposing research and studies seeking to understand how *P. unifilis* is structured in the Pantanal, seeking to understand its ecological aspects, such as reproduction, main predators, competition with native species and reproduction. Local monitoring programs are also essential to detect the evolution of the species' occupation and distribution and to avoid possible damages.

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Conflicts of Interest

We have no conflicts of interest between the authors.

Ethics

The authors affirm that they followed all ethical criteria regarding the preparation of this manuscript.

Data Availability

We understand the importance of the topic and agree to deposit information in appropriate places.

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