

Rapid Communication**The spread of the parthenogenetic mourning gecko, *Lepidodactylus lugubris* (Duméril and Bibron, 1836) to Paradise Island, The Bahamas, with comments on citizen science observations of non-native herpetofauna**Eric B. Liebgold^{1,*}, Hunter L. Liebgold², Maia J. Ransom² and Tami S. Ransom³¹Department of Biological Sciences, Salisbury University, Salisbury, Maryland 21801, USA²North Salisbury School, Salisbury, Maryland 21801, USA³Department of Environmental Studies, Salisbury University, Salisbury Maryland 21801, USAAuthor e-mails: ebliebgold@salisbury.edu (EBL), tsransom@salisbury.edu (TSR)

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OPEN ACCESS**Abstract**

Tracking the introduction of non-native reptiles is important for understanding the effects of non-native species and is potentially a process aided by citizen science. We present new observations of the mourning gecko, *Lepidodactylus lugubris*, (Duméril and Bibron, 1836) on a new island in the Caribbean. *Lepidodactylus lugubris* was observed on Paradise Island, The Bahamas concomitant with citizen science observations on iNaturalist. An additional iNaturalist observation is presented, documenting a second report of *L. lugubris* on Grand Cayman, Cayman Islands. These reports demonstrate significant spreading of this non-native parthenogenetic species from its first record on a Caribbean island 10 years ago, the utility of citizen science observations for documenting the spread of non-native reptiles, as well as an observation of this species utilizing non-anthropogenic habitats in the Western Hemisphere, a potential precursor to detrimental effects on native species.

Key words: Caribbean, iNaturalist, introduced, invasive, lizard, reptile**Introduction**

The introduction of non-native reptiles is an emerging issue, especially on islands in the tropics (Kraus 2015). Non-native species that have detrimental effects on populations of native species are considered “invasive” (Beck et al. 2006), including many non-native reptiles (Kraus 2015). Other non-native species, though present, have more minor effects on native species due to low numbers or restricted distributions (Kraus 2015). Non-native parthenogenetic species can establish easily, often have rapid population expansions, and have a strong potential to be invasive (Rodríguez et al. 2016).

The mourning gecko, *Lepidodactylus lugubris* (Duméril and Bibron, 1836), is a parthenogenetic gecko originally from islands in the Pacific and Indian oceans (Yamashiro et al. 2000; Zug 2013) that has become widespread



Figure 1. *Lepidodactylus lugubris* (Individual #1) captured on a Red Mangrove (*Rhizophora mangle*) at the Atlantis Bahamas Resort, Paradise Island, The Bahamas on July 19, 2018. Image from Google Earth Pro, © 2018 Digital Globe and TerraMetrics. Map data from SIO, NOAA, U.S. Navy, NGA, GEBCO.

and found in many non-native areas in the New World (e.g., Hoogmoed and Avila-Peres 2015; Krysko et al. 2011). It is typically found on or near human habitation and its establishment is likely due to anthropogenic transport, potentially through the nursery trade (Hoogmoed and Avila-Peres 2015; Krysko and MacKenzie-Krysko 2016). *Lepidodactylus lugubris* has in the last decade, recently been documented in the Caribbean on several islands: Cuba (in 2008, Bosch and Páez 2017), Guadeloupe (in 2010, Gomès and Ibéné 2013), North Bimini (in 2016, Krysko and MacKenzie-Krysko 2016), Grand Cayman (in 2016, Goetz and Burton 2018), and Curaçao (in 2016, Behm et al., *in press*), potentially spreading from where it has become established in countries relatively close to the Caribbean islands: Brazil (in 2014, Hoogmoed and Avila-Peres 2015), Venezuela (in 2009, Guerreiro and Graterol 2011), and St. Lucie County, Florida, USA (in 2005, Krysko et al. 2011).

Materials and methods

From July 19–20, 2018, we incidentally encountered two *L. lugubris* at Atlantis Bahamas Resort on Paradise Island, The Bahamas. Individuals of *L. lugubris* were distinguished from other geckos, including the non-native Common House Gecko, *Hemidactylus mabouia*, which was also found at this location (EBL, *unpublished data*), by the beige background coloration, dark stripe from the nostril through the eye to the shoulder, and the W-shaped chevron markings on the dorsum orientated away from snout, as well as a thick tail that is tapered strongly at the base (Figure 1). On August 31,



Figure 2. Locations of the two *Lepidodactylus lugubris* (Individuals #1 and #2) located at the Atlantis Bahamas Resort, Paradise Island, The Bahamas on July 19–20, 2018. Also shown is New Providence Island, The Bahamas.

2018, we searched for “Research Grade” observations of *L. lugubris* in the Caribbean on iNaturalist (<https://www.inaturalist.org/taxa/104226-Lepidodactylus-lugubris>). iNaturalist observations qualify as “Research Grade” when they include photograph documentation that include species-specific characters, georeferenced coordinates, and species-level identification confirmation by at least 2/3 of identifiers.

Results and discussion

On July 19, 2018 at 1410, at Atlantis Bahamas Resort on Paradise Island, The Bahamas (25.086008N; -77.321667W, Figure 2), an adult *L. lugubris* (Individual #1) was dislodged from a branch of a red mangrove (*Rhizophora mangle*) above the intertidal zone at Estuary Lagoon by HLL. MJR assisted in the capture of the *L. lugubris*, which was subsequently photographed (Figure 1) and identified as *L. lugubris* (sensu Zug 2013), Clone A type (sensu Yamashiro et al. 2000) by EBL and TSR.

An additional juvenile gecko (Individual #2) was seen by EBL on July 20, 2018 at 2115 on the balcony of Dolphin Villa at Atlantis Bahamas, Paradise Island, The Bahamas (25.085522N; -77.318697W, Figure 2), 302.13 m away from the initial observation. This second individual was also identified as *L. lugubris* Clone A (sensu Zug 2013), with the same dorsal markings as the first animal, but EBL was not able to be photograph or capture this gecko. The gecko was however, approximately half the size of the initial gecko, so it was clearly a different individual.

Two observations of *L. lugubris* in the Caribbean have been reported on iNaturalist, both with “Research-grade” photograph documentation. On

July 22, 2018, a juvenile *L. lugubris* (Individual #3) was photographed at Atlantis Bahamas, Paradise Island on a balcony of an undisclosed building. While it may have been the same juvenile that we observed (Individual #2), Individual #3 had an autotomized tail, which was not present on the juvenile seen on July 20, 2018. Additionally, on July 7, 2018, two *L. lugubris* (Individuals #4 and #5) were reported from a building on Grand Cayman, Cayman Islands (19.336339N; -81.380611W), 1723 m from the observation on Grand Cayman recently reported by Goetz and Burton (2018). Other than these two observations, there are no additional records of *L. lugubris* on Caribbean islands documented on iNaturalist.

Lepidodactylus lugubris has been previously reported from the nation of The Bahamas, but only from the island of North Bimini (Krysko and MacKenzie-Krysko 2016), a Bahamian island 206 km away from those reported here. The observations on North Bimini were similarly 202 km from prior observations from Port St. Lucie, Florida, so this represents a specific expansion of *L. lugubris* in the Caribbean. *Lepidodactylus lugubris* is likely already present on New Providence Island as its nearest point is approximately 400 m away from Paradise Island and the two islands are connected via two bridges. Additionally, the local nursery trade likely serves both islands. Reportedly, garden and tree plantings at Atlantis Bahamas were obtained from local nurseries, on Paradise Island or New Providence Island, involved in their landscaping (Atlantis Bahamas, *pers. comm.*).

Unlike all previous observations of *L. lugubris* from the Caribbean, when geckos were located on or near human structures (e.g., Gomès and Ibéné 2013; Krysko and MacKenzie-Krysko 2016; Bosch and Páez 2017), in the initial observation reported here, Individual #1 was originally perched on a red mangrove (*R. mangle*) overhanging the intertidal zone of a lagoon. Interestingly, in its native range, *L. lugubris* can be found on mangroves (Rösler 1995) and on rocks in the intertidal zone (Grismer 2011). Whether this observation of *L. lugubris* on *R. mangle* is an anomaly (as the observation was near anthropogenic habitats, approximately 20 m from a bridge and 35 m from a building), or if *L. lugubris* regularly perches on natural substrates in the Caribbean is unknown, but should be investigated further.

The recent introduction and subsequent spread of *L. lugubris* in the Caribbean over the last decade (Bosch and Páez 2017) continues with these recent observations on Paradise Island, The Bahamas and Grand Cayman, Cayman Islands. We note that both the currently reported iNaturalist observations in the Caribbean align with recent observations by trained herpetologists (Goetz and Burton 2018; this study). While the utility of iNaturalist or other citizen science herpetological databases has not yet been evaluated for reptiles, iNaturalist, like eBird, was found to be useful in examining avian occurrences despite lower numbers of observations than eBird (Jacobs and Zipf 2017). Due to the potential ecological effects of non-

native lizards (Kraus 2015), if citizen science reports of non-native reptile and amphibian species in novel locations in the Caribbean, such as those on iNaturalist.org, cannot be accepted outright as observations of range expansion, at the very least, they should be further investigated and verified by trained herpetologists. Such observations will help us better understand the spread of non-native herpetofauna in the Caribbean and other areas.

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