



# Using Citizen Science to Rapidly Determine the Distribution of Exploited Green Iguanas (*Iguana iguana*) across Urban Areas in Trinidad and Tobago

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Because, among other constraints, a lack of funding has limited the effectiveness of biodiversity conservation efforts (McCarthy et al. 2012), citizen science has emerged as an important and relatively inexpensive option (Tiago et al. 2017). For example, observations from a large community of volunteers across wide spatial scales can help alleviate costs and provide a large number of records in a relatively short space of time. Further, the advancement in technologies used in citizen science plays a part in alleviating costs and encourages involvement (Miller-Rushing et al. 2012). Social media and online applications are technological tools that can engage persons to contribute biodiversity records as well as strengthen public awareness of wildlife conservation and biodiversity monitoring (Chandler et al. 2017; Fanovich et al. 2017; Wu et al. 2018).

Green Iguanas (*Iguana iguana*) (Fig. 1) are the largest lizards in Trinidad and Tobago. Primarily herbivorous, they are potential seed dispersers and thus provide an ecologically important role in ecosystems (Valido and Olsen 2019). They are considered widespread in Trinidad and Tobago, found across forests but also known from urban areas usually in or near trees (Murphy et al. 2018). Urban landscapes have become important areas for wildlife as human populations increase and development expands. However, urbanization leads to an increasing likelihood of exploitation. Green Iguanas can be legally hunted with a permit from 1 October to 31 December across Trinidad and Tobago except in Prohibited Areas and the capital, Port of Spain (Conservation of Wildlife Act, Trinidad and Tobago). Indeed, restricting hunting year round in the capital was implemented as of 11 September 2019, but perhaps other towns with high numbers of Green Iguanas (including juveniles) should also be included in order to help sustain healthy local populations across the island. This can have conservation implications especially where the number of hunted Green Iguanas is not regularly reported, and a

once relatively common species may become vulnerable locally without sufficient baseline data and monitoring.

In order to determine in which towns and urban regions across Trinidad Green Iguanas are most frequently observed, my aim was to collect records of Green Iguana sightings using citizen-science tools readily and freely available and map their distribution. I also wanted to illustrate how an inexpensive approach in a limited time can be used to monitor the distribution of an exploited reptile and help determine which urban areas are potentially important for Green Iguanas based on numbers of individuals reported. This information can be used to determine whether these areas also require stricter forms of protection in order to better manage and conserve local Green Iguana populations for future generations.



Fig. 1. A Green Iguana (*Iguana iguana*) from Arima, Trinidad and Tobago. Photograph by the author.

**Methods**

Trinidad and Tobago is located between the Atlantic Ocean and the Caribbean Sea northeast of Venezuela. On Trinidad, large expanses of urban development lie mainly along the western side of the island and across the northeastern corridor paralleling the foothills of the Northern Range.

I solicited observations of Green Iguanas across urban areas on 11 April 2020 using various outlets. Initially, I sent an email to members (over 300 at the time) of the Trinidad and Tobago Field Naturalists’ Club (ttfnc.org). Secondly, I used social media outlets (Instagram, Twitter, Facebook, WhatsApp) to engage members of the general public. I compiled records from those sources that were submitted from 11 to 30 April 2020. Finally, I used the online citizen-science application iNaturalist (iNaturalist.org) to collect records from urban areas in Trinidad submitted during the previous two years (15 April 2018–30 April 2020).

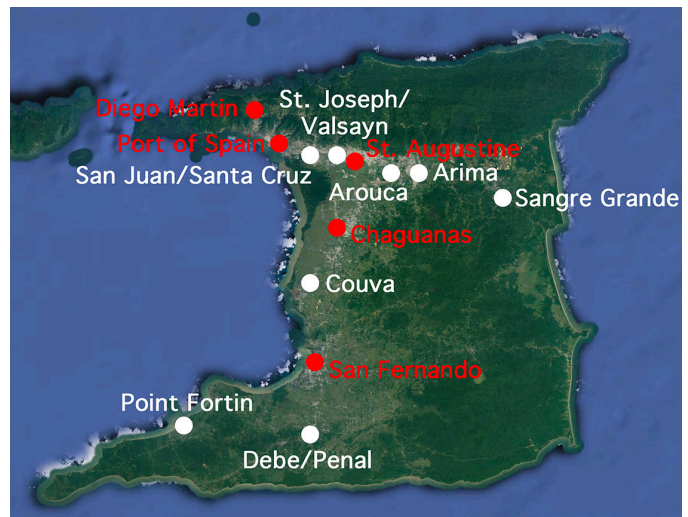
I mapped all records in urban areas on a Google Earth Pro (version 7.3.2.5776) image and used Microsoft Excel to quantify the percentages and illustrate trends using a bar graph.

**Results**

Of the 130 reported sightings compiled in this rapid assessment, the towns of Chaguanas and San Fernando had the most observations (approx. 17% each) followed by St. Augustine (13%) (Fig. 2). Other areas with 10% or more of sightings were Port of Spain and Diego Martin Regional Corporation (= Diego Martin) (Figs. 2–3).

**Discussion**

Limitations of using citizen science include spatial bias and misidentification of species (Chandler et al. 2013). However, these limitations were mitigated for this assessment in the following ways. First, spatial bias toward urban areas occurs in many citizen science projects. This project, however, specifically asked persons to note Green Iguanas only in urban areas as the focus of the exercise. Still, a possibility of spatial bias exists whereby certain towns from which Green Iguanas were reported less frequently than others may represent false negatives (Chandler et al. 2013). However, this project did not



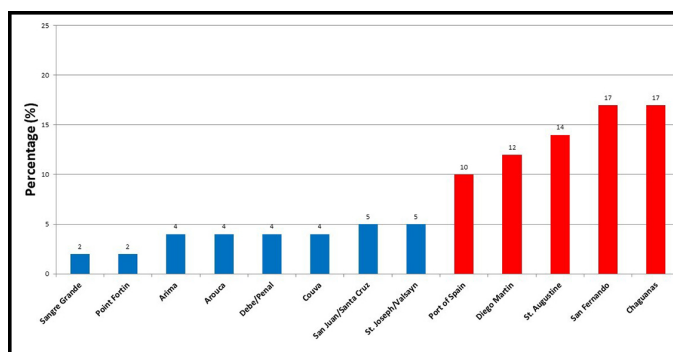
**Fig. 3.** Distribution of Green Iguanas (*Iguana iguana*) in urban areas in Trinidad compiled from citizen-science observations. Towns/regions marked in red on the Google Earth® image are those with the most records (see Fig. 2).

aim to assess presence and absence, but merely to note the presence and frequency of sightings during a relatively short time to establish a baseline for future assessments in the same or other areas.

Secondly, Green Iguanas, as a consequence of ubiquity, large size, mostly bright green coloration, and the fact that they are hunted, are readily identifiable and familiar to most people in Trinidad (Murphy et al. 2018). Further, most records were accompanied with a photograph for verification. Although not all records had photographs, sightings in urban areas would almost certainly be Green Iguanas. Perhaps the only other lizards that could be confused with juvenile Green Iguanas are Multicolored Tree Lizards (*Polychrus audoboni*). However that species is more frequently encountered in forests and along forest edges than in urban areas in Trinidad (Murphy et al. 2018).

The social media outlet that reached more persons and generated the most records (approx. 50%) was Facebook. This suggests that Facebook could be the main social media outlet for similar types of citizen science conservation projects in Trinidad and Tobago. However, I recommend using as many online outlets as possible to enlarge the dataset. iNaturalist records accompanied by photographs and GPS locations verified by naturalists were particularly valuable.

These results no doubt underestimate the Green Iguana populations in Trinidad, as the data were collected in a short period of time from a small sample of the local population. However, these results were intended to illustrate the ease and lack of financial resources required to map the distribution of an exploited reptile. The fact that observations accompanied by photographs included both adults and juveniles suggests that at least those urban areas with the most sightings are sustaining breeding populations.



**Fig. 2.** Records of Green Iguanas (*Iguana iguana*) in urban areas in Trinidad compiled from citizen-science observations.

Monitoring all urban areas across Trinidad for illegal hunting of Green Iguanas is difficult, especially given the limited human and fiscal resources. However, even these preliminary data suggest that the areas with the most sightings (i.e., San Fernando, Chaguanas, St. Augustine, and Diego Martin) are targets for more focused patrols, increased conservation management strategies, and permit follow-ups by game wardens and other law-enforcement officers. In addition, future efforts to monitor Green Iguana populations should include abundance estimates to better advise government officials on the status of Green Iguanas across the nation. I hope these suggestions will facilitate the survival of sustainable Green Iguana populations and reduce or ban exploitation in urban areas.

### Acknowledgements

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### Literature Cited

- Chandler, M., L. See, K. Copas, A.M.Z. Bonde, B.C. Lopez, F. Danielson, J.K. Legind, S. Masinde, A.J. Miller-Rushing, G. Newman, A. Rosemartin, and E. Turak. 2017. Contribution of citizen science towards international biodiversity conservation. *Biological Conservation* 213: 280–294.
- Fanovich, L., N.D. Cook, R.S. Mohammed, and A. Wothke. 2017. Citizen-based observations on shark and morbid species in Tobago, West Indies. *Living World, Journal of the Trinidad and Tobago Field Naturalists' Club* 2017: 26–31.
- McCarthy D.P., P.F. Donald, J.P.W. Scharlemann, G.M. Buchanan, A. Balmford, J.M.H. Green, L.A. Bennun, N.D. Burgess, L.D.C. Fishpool, S.T. Garnett, D.L. Leonard, R.F. Maloney, P. Morling, H.M. Schaefer, A. Symes, D.A. Wiedenfeld, and S.H.M. Butchart. 2012. Financial costs of meeting global biodiversity conservation targets: Current spending and unmet needs. *Science* 338: 946–949.
- Miller-Rushing, A., R. Primack, and R. Bonney. 2012. The history of public participation in ecological research. *Frontiers in Ecology and the Environment* 10: 285–290.
- Murphy, J.C., J.R. Downie, J.M. Smith, S.M. Livingstone, R.S. Mohammed, R.M. Lehtinen, M. Eyre, J.-A.N. Sewlal, N. Noriega, G.S. Casper, T. Anton, M.G. Rutherford, A.L. Braswell, and M.J. Jowers. 2018. *A Field Guide to the Amphibians and Reptiles of Trinidad and Tobago*. Trinidad and Tobago Field Naturalists' Club, Port of Spain, Trinidad and Tobago.
- Tiago, P., A. Ceia-Hasse, T.A. Marques, C. Capinha, and H.M. Pereria. 2017. Spatial distribution of citizen science casuistic observations for different taxonomic groups. *Scientific Reports* 7: 12832.
- Valido, A. and J.M. Oelsen. 2019. Frugivory and seed dispersal by lizards: A global review. *Frontiers in Ecology and Evolution* 7:49.
- Wu, Y., L. Xie, S.-L. Huang, P. Li, Z. Yuan, and W. Liu. 2018. Using social media to strengthen public awareness of wildlife conservation. *Ocean and Coastal Management* 153: 76–83.