A Survey and Discussion of the Geographical Range of

Anolis cristatellus

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Abstract

The invasive Puerto Rican crested anole, *Anolis cristatellus*, has been of concern in recent years because of its potential to outcompete the endemic Dominican anole, *Anolis oculatus*. After the introduction of the invasive species through Roseau *A. cristatellus* has been observed spreading to areas with high human impact such as Cabrits National Park and Castle Bruce. This projects was done in order to further monitor the spread of *A. cristatellus* and assess the presence of *A. oculatus* in heavily impacted areas. Data were collected using a simple survey method in accordance with habitat and mapped using Google Maps, which was then compared to past projects done by Texas A&M at Springfield Guest House. This project found that *A. cristatellus* has been spreading likely through roadways to Northern and Eastern parts of the island, with the first documented sightings at Sunset Bay, Batalie Beach, and within the Kalinago territory. Furthermore, evidence was found that the previous notion that *A. oculatus* would be completely eliminated by the presence of *A. cristatellus* may not be the case. Only one instance was recorded of only *A. cristatellus* being present with no sightings of *A. oculatus*, with all other sightings of *A. cristatellus* being accompanied by at least a single sighting of *A. oculatus*. The endemic anole was found to be cohabitating and even aggression on the invasive species on multiple occasions, demonstrating the possible likelihood of resilience in the endemic species.

Introduction

The Lesser Antilles is characterized by an incredibly high diversity of herpetofauna and Dominica is no exception, with reptiles forming a significant amount of this diversity and many being found only on the island (Malhotra et al., 1999). One of the five endemic reptile species to the island, *Anolis oculatus* or Zandoli as it is known to those who live on the island, is
currently considered to be under serious threat by invasion of the Puerto Rican Crested Anole, *Anolis cristatellus*. The invasive species was suspected to be first introduced in the port of Roseau through shipments coming from Puerto Rico. This anole is a well adapted generalist species that is suspected to be capable of outcompeting and displacing the native Dominican anole, *Anolis oculatus*, if left unchecked, causing possible concern for conservation (Malhotra et al., 2011). The species has already been seen to be a serious competitor of the green anole, *Anolis carolinensis*, in Florida after its introduction there in the 1975 (Florida Fish and Wildlife, 2003). The endemic Dominican anole is a very morphologically diverse species, previously thought to have 4 subspecies due to it’s incredible variation among different habitats (Malhotra et al., 2011). This endemic is easily distinguished from the invasive species, with the Dominican anole having a characteristic white spot at the base of its head that is never found in *A. cristatellus*. Large males are the easiest to tell apart, as *A. oculatus* can be found with large unique breeding spots along their side and *A. cristatellus* males with a distinguishable crest running from the head to the tail (Malhotra & Thorpe, 1999).

This project is a follow up of several past Texas A&M projects that have monitored the spread and impact of *A. cristatellus* on the Dominican anole. In 2010 it was originally seen that the impact of the invasive was contained within and around the Roseau area and actively outcompeting the endemic species (Reinhart, 2010). A followup report in 2015 found that the Puerto Rican anole had spread to areas outside of Roseau such as Cabrits National Park, Castle Bruce, and Emerald Pool (McGrew, 2015). The last published scientific work assessing the status of the spread of *A. cristatellus* was done in 2011 and found the lizard was spreading only through the Canefield/Roseau area up Imperial road to an elevation of 150m. This paper also
outlined the ecological restrictions of the Puerto Rican invasive, noting the preference of *A. cristatellus* to open woodland as opposed to the dense forest currently inhabited by *A. oculatus* (Malhotra et al., 2011).

The presence of *A. oculatus* was recorded in order to determine if it was being actively out competed in areas where *A. cristatellus* was found. All past reports cite that in areas where *A. cristatellus* are observed it is rare or impossible to find *A. oculatus* (Reinhart, 2010; Erin Mcgrew 2015; Malhotra et al. 2011), however this is not a predetermined outcome of an invasion by *A. cristatellus*. In the city of La Romana in the Dominican Republic *A. cristatellus* has been introduced in a similar manner to Dominica, but has not had the same impacts on the herpetofauna. Several anole species were impacted by the invasion of *A. cristatellus*. *Anolis cybotes* was pushed out of its normal range in La Romana due to having a longer generation time and suspected predation on its eggs by *A. cristatellus*. However *Anolis distichus* and *Anolis chlorocyanus* are two anole species who were either not impacted by the introduction of *A. cristatellus* or only being refined to trunks that are not inhabited by *A. cristatellus* (Fitch et al., 1989). Measuring both the presence of *A. oculatus* and *A. cristatellus* gave a better idea of whether this was a possible outcome of the Dominican invasion of the Puerto Rican anole.

**Materials and Methods**

Visual observations were made in all areas visited throughout the 3 week stay in Dominica. Data was taken at every opportunity off station, resulting in results from 11 different locations throughout the island. These locations include the Botanical Gardens, Batalie Beach, Cabrits National Park, Sunset Bay, Castle Bruce, Scott’s Head, the Kalinago territory, Emerald Pool, the city of Roseau, and Boeri Lake. Individuals were searched for using a simple survey
method and identified based on morphological characteristics. In areas where either anole was found GPS locations were taken and general habitat characteristics were taken note of including type of habitat (e.g. dry forest, wet forest, type of vegetation), proximity to human disturbance, proximity to other anole species. Data was mapped out for comparison using Google Maps.

**Results**

*Anolis oculatus* was seen at all sites visited except for within the city of Roseau. In areas where *Anolis cristatellus* was observed, *A. oculatus* numbers were generally seen in drastically lower amounts; however there are several cases where individuals were seen in equal or near equal amounts, such as the entrance to the Batalie Beach area, Sunset Bay, and the entrance to Cabrits National Park. Additionally in these areas the species were seen interacting, often on the same tree or building. Some of these interactions were negative (chasing, fighting) but some were neutral, with little attention being given to the heterospecific species.

<table>
<thead>
<tr>
<th>Location</th>
<th><em>A. oculatus</em> observed</th>
<th><em>A. cristatellus</em> observed</th>
<th>GPS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Springfield Station</td>
<td>34</td>
<td>0</td>
<td>N 15°20.812'W 61°22.129'</td>
</tr>
<tr>
<td>Botanical garden</td>
<td>2</td>
<td>42</td>
<td>N 15°17.924'W 61°22.977'</td>
</tr>
<tr>
<td>Cabrits Entrance &amp; Museum</td>
<td>9</td>
<td>12</td>
<td>N 15°34.949'W 61°28.369'</td>
</tr>
<tr>
<td>Cabrits Trail</td>
<td>41</td>
<td>0</td>
<td>N 15°35.310'W 61°28.388'</td>
</tr>
<tr>
<td>Batalie Beach</td>
<td>24</td>
<td>7</td>
<td>N 15°27.240'W 61°28.546'</td>
</tr>
<tr>
<td>Sunset Bay</td>
<td>18</td>
<td>26</td>
<td>N 15°45.136'W 61°44.687'</td>
</tr>
<tr>
<td>Castle Bruce</td>
<td>2</td>
<td>26</td>
<td>N 15°25.590'W 61°15.266'</td>
</tr>
<tr>
<td>Scott's Head</td>
<td>4</td>
<td>0</td>
<td>N 15°12.496'W 61°22.168'</td>
</tr>
<tr>
<td>Kalinago Territory</td>
<td>2</td>
<td>2</td>
<td>N 15°29.460'W 61°15.202'</td>
</tr>
<tr>
<td>Emerald Pool Visitor Center</td>
<td>1</td>
<td>5</td>
<td>N 15°23.433'W 61°18.383'</td>
</tr>
<tr>
<td>Emerald Pool Trail</td>
<td>15</td>
<td>0</td>
<td>N 15°23.840'W 61°18.729'</td>
</tr>
<tr>
<td>City of Roseau</td>
<td>0</td>
<td>4</td>
<td>N 15°18.128'W 61°23.201'</td>
</tr>
<tr>
<td>Boeri Lake</td>
<td>8</td>
<td>0</td>
<td>N 15°21.071'W 61°19.095'</td>
</tr>
</tbody>
</table>

*Anolis oculatus* were observed sparingly within heavily human impacted areas such as the Botanical Gardens, Cabrits National Park’s museum and welcome center, Sunset Bay, and the entrance to the Batalie Beach area. Larger numbers of *A. oculatus* were seen in heavily
forested areas even when nearby human impacted areas, such as was seen at Batalie Beach. In areas that were heavily forested with little human establishment, such as the Springfield station, *A. oculatus* was seen in extremely high numbers and *A. cristatellus* was not found in any amount.

These results were compared to the previous findings of Erin McGrew in 2015 and when the two data were strictly compared based on mutual sites visited it was seen that it cannot be said that *A. cristatellus*’ range is increasing since sites that were shared between our projects

Figure 1: Maps comparing the presence of *Anolis cristatellus* (red) and *Anolis oculatus* (yellow)
yielded a similar result in regards to the presence of *A. cristatellus*. However several sites that were visited during this project had not previously been observed by past researchers. Sunset Bay, Batalie Beach, and the Kalinago territory contained confirmed sightings of *A. cristatellus* where there are no recorded sightings in literature.

![Map of Dominica with marked locations](image)

*Figure 2: Map comparing the presence of *Anolis oculatus* (yellow) and *Anolis cristatellus* (red) and when both are present in the same area (orange)*
Discussion

As independent data it can be stated that sightings of *A. cristatellus* have spread to new parts of the island where it had not previously documented. Something these places have in common is their shared levels of high human impact. While Dominica is a largely preserved ecological landscape, these areas all see high amounts of road traffic and are greatly altered for the benefit of human life. Sunset Beach is a dive resort and cafe that sees large amounts of human influx and Batalie beach is an area just off the road with small buildings and waste littering the entrance where *A. cristatellus* was found. As compared to Malhotra’s 2011 report, the spread of *A. cristatellus* has advanced at an alarming rate in 7 years, now being found on the north end of the island as well as parts of central and east Dominica.

![Figure 3: Maps comparing Erin McGrew’s sightings of *A. cristatellus* (left) and my own (right)](image-url)
A notable observation made during the project was the amount of cohabitation seen between *A. oculatus* and *A. cristatellus*. The reports done in the past on Dominican herpetofauna have seen *A. oculatus* be completely out competed by the invasive anole (Reinhart, 2010; Erin Mcgrew 2015; Malhotra et. al 2011). However, at 4 of the 13 recorded areas the two species of anoles were seen close together in the same habitats, often on the same wall or tree. Sunset Bay and Batalie Beach had the largest showing of this behavior with the area inhabited by *A. cristatellus* not found to have a reduced population of *A. oculatus*. The anoles were seen interacting competitively at Cabrits National Park, with *A. oculatus* individuals seen throughout the entrance area where it was suspected that they had been eradicated by the invasive anole. These competitive behaviors were even observed to be in favor of *A. oculatus* as it aggressed upon *A. cristatellus* individuals, chasing it off of trees and walls on multiple occasions. Additionally, only in the marketplace of Roseau was *A. cristatellus* seen in the complete absence of *A. oculatus*. At other sites where *A. cristatellus* individuals were observed, at least one *A. oculatus* was observed as well. While this was an unexpected result, it is not out of the realm of possibility that *A. oculatus* has rebounded in number and is capable of cohabitating with *A. cristatellus*. The possible parallel to this result would be the invasion of *A. cristatellus* in the port city of La Romana in the Dominican Republic. While one anole species, *Anolis cybotes*, did see serious displacement due to the invasion, two other species (*Anolis distichus* and *Anolis chlorocyanus*) did not see a change in geographic range and were capable of cohabitating with the introduced *A. cristatellus* (Fitch et al., 1989). This example coupled with the findings in this project gives rise to a possibility that *A. oculatus* could be capable of withstanding the spread of the invasive *A. cristatellus* and remaining the dominant anole throughout the entire island. This
situation should be monitored to determine if these findings are due to the invasion into these areas being so recent that the Dominican anole has yet to begin declining in number or if the endemic is in fact capable of competing with the Puerto Rican Crested anole.

Acknowledgements

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Citations


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