Surveying Potential Predators to Protect a Critically Endangered Bahamian Songbird

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Introduction:

The Bahama Oriole (*Icterus northropi*) is a critically endangered songbird species that is only present on the Andros Island complex in the Bahamas (Birdlife International, 2016). This species was formerly also present on the island of Abaco until the 1990s, when it was extirpated from Abaco (Price et al. 2011). We still do not know the exact cause of the Bahama Oriole's extirpation or continued decline, but one possible cause may be predation. Invasive mammals, including black rats (*Rattus rattus*), brown rats (*Rattus norvegicus*), and house cats (*Felis catus*), live on Andros and are known songbird predators (Buden, 1974; Buden, 1986). house cats have been credited with the extinction of over thirty island bird species, and rats are known nest predators of island songbirds (Marra and Santella, 2016). Notably, Allcorn et al. (2012) documented black rat nest predation of the Montserrat Oriole (*Icterus oberi*), a species closely related to the Bahama Oriole. The threat that mammalian predators pose to Caribbean songbirds suggests that they may be important factors in the Bahama Oriole's decline.

In January of 2017 and May of 2018, the Omland Lab from the University of Maryland Baltimore County traveled to Andros for ten days as part of the Bahama Oriole Project, a cooperative research effort between the University of Maryland, Baltimore County (UMBC) and the Bahamas National Trust (BNT) to study the Bahama Oriole's decline. We studied populations of rats and cats on the island in order to determine if predation by these species is a potential threat to Bahama Oriole. During the 2017 expedition, we examined the presence of house cats using trail cameras. During the 2018 expedition, we utilized wax baits to survey the population of rat species. By studying the populations of house cats and black rats on Andros, we sought to gather pilot data that would allow us to gauge the potential threat these predators pose to the remaining Bahama Oriole population.

Trail Camera Survey Methods:

Around the world, domestic and feral house cats are apex predators that frequently kill songbirds. As a result, cats have been credited with the extinction of over 30 island songbird species and the death of billions of songbirds in the United States and Canada annually (Marra and Santella, 2016). Therefore, if there is a feral house cat population present on the island of Andros that overlaps with the Bahama Oriole population, this predator may pose a significant threat to the Bahama Oriole's survival. By using baited trail cameras in different regions of Andros, we sought to determine whether feral cats are present in forests close to, and distant from, human settlements.

We utilized six motion activated Reconyx and Bushnell trail cameras with infrared flash for our cat survey. These cameras were deployed for two nights at fourteen sites for a total of 619 camera hours. Since we were only present on Andros for ten days, we chose to spread our camera locations across a variety of accessible locations where Bahama Orioles have nested previously. Sites 1-8 were located near Uncle Charlie's Blue Hole, a sinkhole less than 1km from the nearest human settlement along Queen's Highway in San Andros. Sites 9-11 were located in a remote pine forest off Owens Town Road, three kilometers south of the Bahamas Agriculture and Marine Science Institute (BAMSI) campus along Owens Town Road. Finally, sites 12-14 were located within the residential area of Nicholls Town (Figure 1) (Table 1). The Nicholls Town cameras were located within or adjacent to a developed area, whereas the Uncle Charlie's Blue Hole cameras were located less than one kilometer from an occupied settlement, and the remote pine forest cameras were located over three kilometers from the nearest developed areas. We specifically chose to examine the forest off Owens Town Road because we had documented Bahama Oriole nests in this area previously, and Bahama Orioles are known to be present in the pine forests of Andros (Stonko et al., 2018). Each camera was set

approximately 0.25 meters off the ground and had a small tin of cat food placed in front of it to attract nearby cats (Figure 2).

Trail Camera Survey Results:

We photographed 2 different cats that passed cameras 1, 2, 3, 5, and 8 near Uncle Charlie's Blue Hole, as well as 1 cat that passed cameras 9 and 11 in the pine forest off Owens Town Road (Figure 3). Cats were distinguished from one another based on the color patterns of their fur. The sites near Uncle Charlie's Blue Hole were approximately 1km from the nearest human settlement. Sites 9 and 11, on the other hand, were in the remote pine forest over 3km from the nearest human settlement. Such results indicate that some of the cats we spotted are likely feral and not being cared for by any human.

The presence of one or more cats far from developed areas indicates that house cats are present deep in the pine forests of Andros. This evidence of a cat population is further supported by more recent observations, in which two additional cats were spotted at other remote locations. One of these cats was spotted in 2018, in pine forest more than 2 km east of developed areas along Queen's Highway (24°59'49.20"N, 78° 0'21.60"W). The second cat was photographed in 2019 (Figure 4) at a location more than 10km from the BAMSI campus (24°51'0.00"N, 78° 5'38.40"W) (Table 1).

The presence of cats in the remote pine forest near previous Bahama Oriole nest sites demonstrates that cat home ranges overlap with known habitats of the Bahama Oriole (Stonko et al., 2018). However, without more data, we are unable to determine the size of the cat population or where this population is most concentrated. Cat populations on Andros very likely pose a threat, not just to the Bahama Oriole, but to other endangered songbirds on Andros as well, such as the Bahama Swallow (*Tachycineta cyaneoviridis*). Therefore, feral house cats are likely a threat to the Bahama Oriole population, although more information is necessary to understand the impact of this threat and how it should be countered.

Wax Bait Survey Methods:

The main goal of the wax bait survey was to learn more about potential rat predation on the Bahama Orioles. Specifically, our intention was to study the presence of invasive rat species on Andros, as they are known nest predators of other Caribbean orioles (Allcorn et al., 2012). To accomplish this, we conducted a population survey of rats in the pine forests and developed areas of northern Andros. By comparing rat populations in these two habitats, we sought to assess whether rats are more or less likely to inhabit areas where Bahama Orioles nest.

The rat survey on Andros was conducted using peanut butter WaxTags manufactured by Pest Control Research LP in New Zealand (Figure 5). WaxTags are a survey tool designed for nonlethal possum and rodent monitoring (Russel et al. 2009). Each WaxTag consists of an orange plastic tag with a piece of peanut butter-scented wax on the end. The peanut butter scent encourages rats to bite the wax, leaving their characteristic tooth marks behind. The unpalatable taste of the wax then encourages the rat to leave it alone afterwards.

WaxTags were deployed at two sets of paired study sites. Each pair consisted of one developed site and one pine forest site. Nicholls Town and Pineville were the two developed sites chosen for the survey, while the undeveloped areas immediately south of Nichols Town and immediately south of Pineville were chosen as the pine forest sites (Figure 1). These site pairs were chosen due to their ease of access and their proximity to previous Bahama Oriole nesting sites. The Nichols Town site bordered the northeast coast of Andros and consisted of private homes with coppice habitat in between properties. The Pineville site was located further inland, with wetland and pine habitat near houses. Both pine forest sites had signs of human activity in the form of long abandoned logging roads; they were generally similar in terms of vegetation.

We placed 18 WaxTags in transects at each of our four study plots, for a total of 72 tags. Six transects were laid per plot at randomly chosen locations along roads and trails using QGIS. Each transect consisted of three WaxTags laid on the ground near tree roots, with each tag

placed ten meters away from the last. Each tag was left out for 6 days before being collected for analysis. Due to the ten day time limit of our expedition, this was the maximum number of transects and maximum deployment time for each transect we were able to achieve.

Wax Bait Survey Results:

We found no evidence of rat bite marks on any of our baits. While eleven of the seventy-two tags did have marks, it was unlikely that these marks came from rats, as their size and shape did not correspond to the distinct two-toothed mark characteristic of rats and other rodents. In order to accurately identify the marks on the baits, we consulted with Dr. Michael Cove, a rat expert at North Carolina State University. After discussing the tags with him, we concluded that the "bite" marks were most likely claw marks from land crabs (*Cardisoma guandhumi*) (Figure 6). In addition, one supplemental WaxTag from Nicholls Town that was not a part of the wax bait survey did show a bite mark from a house mouse (*Mus musculus*).

While our wax bait results were unexpected, as we did not anticipate land crabs attacking the tags, the lack of rat bites could indicate a few possible conclusions. First, it is possible that, although peanut butter WaxTags have worked for assessing rats in other studies (Russell et al., 2009; Samaniego-Herrera et al., 2013), they do not adequately attract rats on Andros. However, these baits have been used in studies of rats and other invasive mammals in other parts of the world, so this possibility does not seem likely (Russell et al., 2009; Samaniego-Herrera et al., 2013). Second, the rat population density on North Andros may be so low that the few rats present simply did not notice the tags deployed at our four sites. However, we do know that at least some rats are present on Andros; for example, we found one road-killed Brown Rat in 2017. Low rat density on Andros would be beneficial for the Bahama Oriole, as it would rule out one potentially dangerous predator as a major threat to the population. However, a longer and more extensive rat survey is necessary to verify this conclusion.

Future Directions:

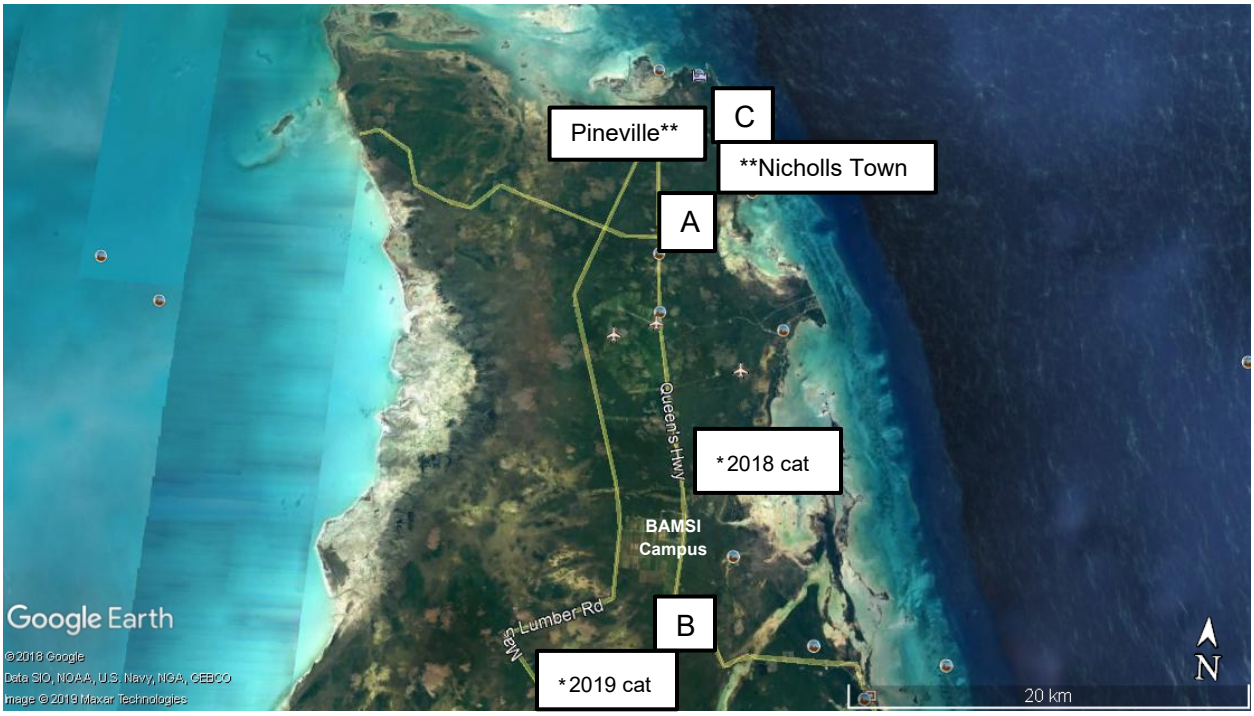
A lack of rat bites in the WaxTag survey suggests that the rat population density was very low throughout each study site. However, a more extensive survey is necessary to confirm this. In multiple studies, WaxTags have been an effective method of determining rat population density, even when compared with more traditional methods such as kill traps (Russell et al., 2009; Samaniego-Herrera et al., 2013). However, it is possible that the rat populations in these studies may have different preferences than the rat population on Andros. In order to ensure that the lack of bites was not due to the WaxTags themselves, a more extensive study using different survey methods should be conducted.

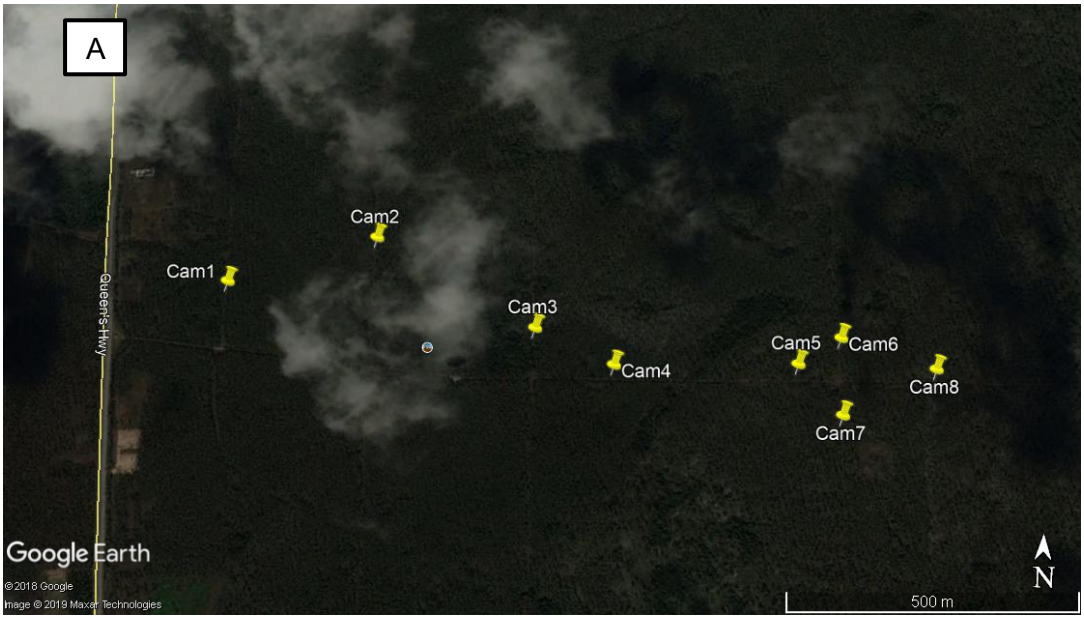
While peanut butter WaxTags did not document any rat bites in our study, the response they elicited from land crabs suggest that they may be useful in future land crab surveys. If the land crab response to WaxTags is consistent between populations on different islands, the peanut butter WaxTag could be used to monitor the land crab population. These wax baits would provide a survey method that can be used in a wide range of habitats. Such surveys would be beneficial to ensure sustainable crab harvests in the long term.

If the cats we found in our trail camera survey are indicative of a feral cat population on Andros, then feline predation may be a significant threat to the Bahama Oriole's survival. Like the black rat and brown rat, the house cat is a globally invasive predator that potentially poses a crucial threat to the Bahama Oriole, as well as other songbirds throughout Andros. The pilot data we have gathered indicates that house cats are present in areas far from human development that are inhabited by Bahama Orioles. Therefore, to gain an accurate understanding of what species may predate Bahama Orioles, a more extensive population survey of house cats on Andros will be necessary. Additional surveys are being conducted by UMBC students working with Dr. Kevin Omland and Dr. Colin Studds, who are deploying 20 unbaited cameras in the same general area as cameras 9-11 in the pine forests of Andros. Based on the lack of rats found in our rat survey and the multiple cats found in our cat survey,

we believe that the majority of future research concerning Bahama Oriole invasive predators should focus on house cats.

Figures:





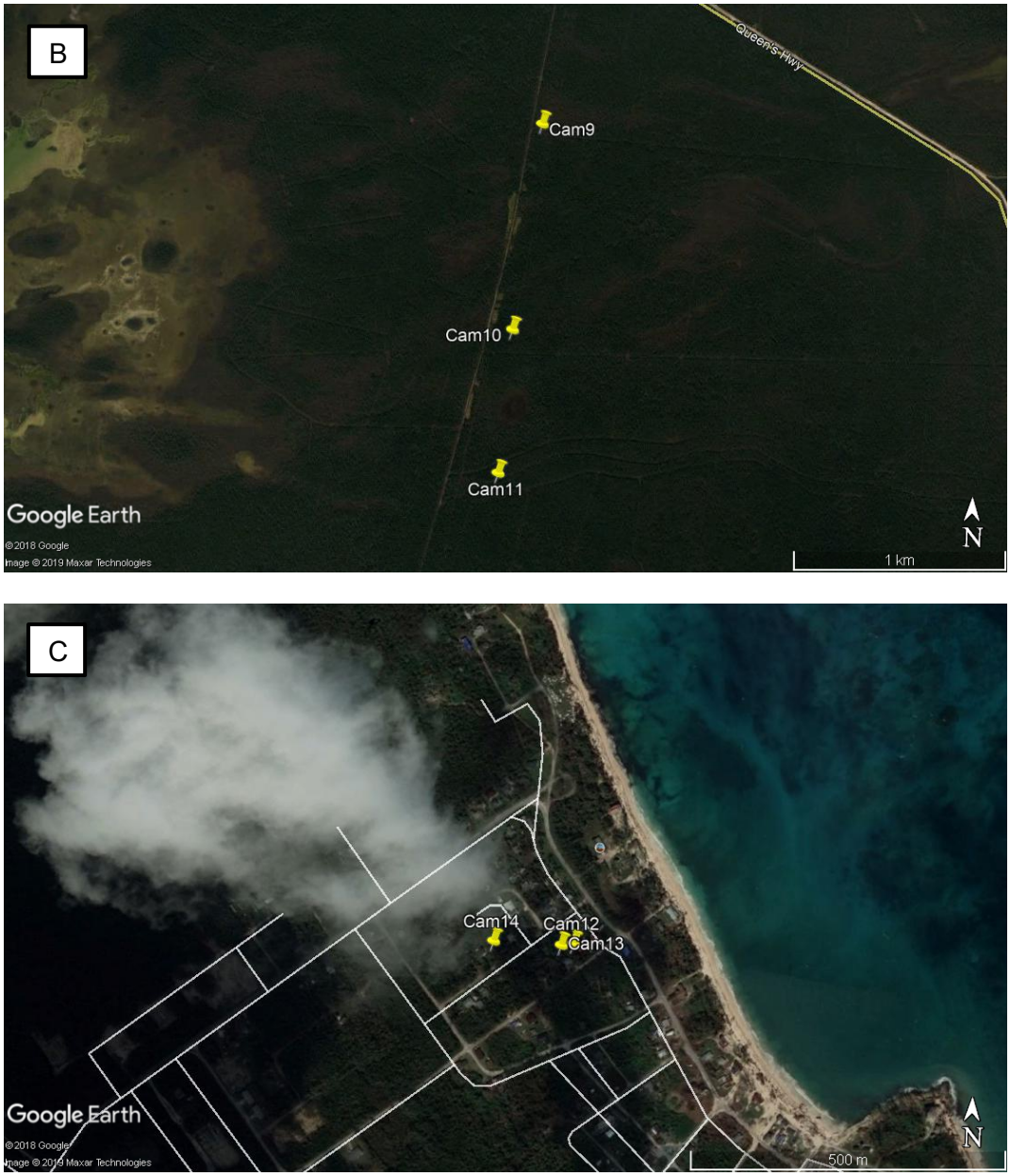


Figure 1: Map North Andros Study Site. Andros is approximately 200km southeast of Miami, in the southwestern part of the Bahamas. (A) Cameras 1-8 were placed near Uncle Charlie's Blue Hole, a sinkhole near Queen's Highway in North Andros. (B) Cameras 9-11 were placed off Owens Town Road. (C) Cameras 12-14 were placed in Nicholls Town, a developed town in North Andros. Cameras 1-8 were located within 1km of an occupied human settlement, while cameras 9-11 were located over 3 km from settled areas, and cameras 12-14 were located within a developed area. * = Locations of two cats observed opportunistically in 2018 and 2019. ** = Towns where two sets of rat WaxTag baits were deployed in 2017.

Location	Latitude	Longitude
Camera 1*	25° 6'44.72"N	78° 2'39.46"W
Camera 2*	25° 6'47.64"N	78° 2'30.09"W
Camera 3*	25° 6'42.65"N	78° 2'19.69"W
Camera 4	25° 6'40.69"N	78° 2'14.64"W
Camera 5*	25° 6'41.13"N	78° 2'3.01"W
Camera 6	25° 6'42.72"N	78° 2'0.29"W
Camera 7	25° 6'38.30"N	78° 2'0.25"W
Camera 8*	25° 6'41.12"N	78° 1'54.31"W
Camera 9*	24°55'3.46"N	78° 1'35.60"W
Camera 10	24°54'31.53"N	78° 1'39.39"W
Camera 11*	24°54'9.62"N	78° 1'40.94"W
Camera 12	25° 8'40.74"N	78° 0'20.53"W
Camera 13	25° 8'40.62"N	78° 0'21.22"W
Camera 14	25° 8'40.71"N	78° 0'25.06"W
Cat Sighting 2018*	24°59'49.20"N	78° 0'21.60"W
Cat Sighting 2019*	24°51'0.00"N	78° 5'38.40"W

Table 1: Camera placement locations for trail camera survey. * = cat spotted at this location

Figure 2: Deployed cat camera.


2017-01-16 4:45:18 PM M 10/10 76°F
BAHAMAS DEC. 2016
RECONYX


Bushnell
01-20-2017 17:31:48

Figure 3: Three feral cats spotted with trail camera at site 3 (top), site 8 (middle), and site 9 (bottom).

Figure 4: Feral cat photographed in 2018 in the pine forest of Andros, approximately 2 km from the nearest human settlement.

Figure 5: Peanut butter WaxTag deployed in the field.

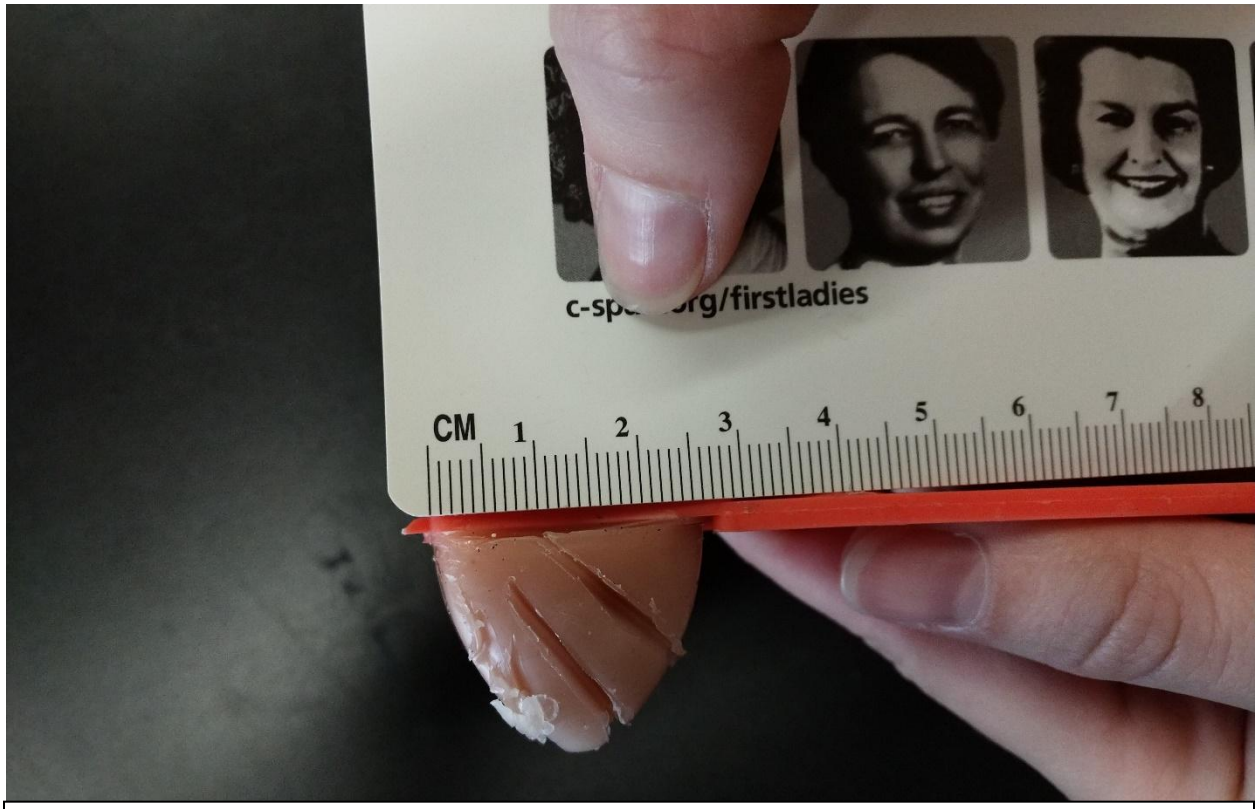


Figure 6: An example of the markings we saw on our WaxTags, which tended to resemble a slash rather than a two-toothed rodent bitemark. Upon consulting with Dr. Michael Cove, we realized that the marks on the tags were likely made by land crabs rather than rats.

Works Cited

Allcorn, R. I., G. M. Hilton, C. Fenton, P. W. Atkinson, C. G. R. Bowden, G. A. L. Gray, M. Hulme, J. Madden, E. K. Mackley, and S. Oppel. 2012. Demography and breeding ecology of the critically endangered Montserrat Oriole. Condor **114**:227-235.

BirdLife International. 2016. *Icterus northropi*. *The IUCN Red List of Threatened Species* 2016: e.T22736369A95132045. http://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T22736369A95132045.en.

Buden, D. W. (1974). *Prey Remains of Barn Owls in the Southern Bahama* Islands Wilson Bulletin **86:** 36-343

Buden, D. W. (1986). Distribution of mammals of the Bahamas. *Florida Field Naturalist*, **14**: 53–84.

Price, M. R., V. A. Lee, and W. K. Hayes. 2011. Population status, habitat dependence, and reproductive ecology of Bahama Orioles: A critically endangered synanthropic species. Journal of Field Ornithology **82**:366-378.

Marra, P. P., and C. Santella. 2016. Cat Wars: The Devastating Consequences of a Cuddly Killer. Princeton University Press, Princeton, New Jersey.

Russell, James C., J. Abdelkrim, R.M. Fewster. 2009. Early colonization population structure of a Norway rat island invasion. Biological Invasions. **11**: 1557-1567.

Samaniego-Herrera, Araceli, D. P. Anderson, J.P. Parkes, A. Aguirre-Muñoz. 2013. Rapid Assessment of rat eradication after aerial baiting. Journal of Applied Ecology. **50**: 1415-1421.

Stonko, D.C., L.E. Rolle, L.S. Smith, A.L. Scarselletta, J.L. Christhilf, M.G. Rowley, S.S. Yates, S. Cant-Woodside, L. Brace, S.B. Johnson, and K.E. Omland. 2018. *New documentation of pine forest nesting by the Critically Endangered Bahama Oriole (Icterus northropi)*. Journal of Caribbean Ornithology **31**:1–5.