

The use of paint marking to estimate population size of the St. Croix Ground Lizard (Ameiva polops) at Protestant Cay and Ruth Island

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The St. Croix Ground Lizard (*Ameiva polops*) is a highly endangered lizard that is endemic to St. Croix. At one time this lizard was found on the main island of St. Croix, but through predation by the introduced mongoose and habitat degradation, they are now limited to a few small offshore cays. Naturally occurring populations are found on Protestant Cay, under the jurisdiction of DPNR-DFW, and Green Cay. Green Cay has been protected by the US Fish and Wildlife Service as a refuge for these lizards and continues to be managed by USFWS. The *Ameiva* has also been introduced (or re-introduced, as the case may be) to Ruth Island on the south shore of St. Croix, managed by DFW, and Buck Island (BUIS), managed by the National Park Service (NPS).

Given the limited range of this species, it is necessary to periodically assess the population size and status. Each agency has agreed to do a population estimate on their respective island including DFW. In addition, Protestant Cay is about to undergo a habitat restoration project and it is of utmost importance to estimate the “before” population size and distribution in order to adequately assess the success of the restoration project. Geographic Consulting was contracted by DFW to conduct fieldwork for an updated population estimate of the *Ameiva polops* on Protestant Cay and Ruth Island in order to fulfill these goals.

In 2008, DFW repeated the population estimate conducted in 2003 (McNair and MacKay 2005) at Ruth Island (DFW 2008). Results of this survey indicated a 10-fold increase in population size between 2003 and 2008. These results were encouraging, however the increase in *Ameiva* population size also made the methodology used for these surveys somewhat obsolete. Each survey consists of a minimum of three passes over the same transect, introducing the possibility of counting the same lizard twice or even three times. When lizards were scarce, this method was used to increase the probability of detection of lizards along each transect and individual lizards were easy to keep track of. Now that the population has grown, as many as eight lizards have been seen on a single transect. It is difficult to keep track of each individual lizard and avoid over counting. In addition, new information on the activity patterns of *Ameiva* has come to light, further emphasizing the need for a different method for estimating population size. A project conducted in association with the translocation of *Ameiva* to BUIS found that the probability that individuals were active on the surface during standard survey hours was 0.094 to 0.251 (Treglia 2010). For these reasons, new methodology is being developed to reliably estimate the population size throughout its range.

Researchers from Texas A&M University (TAMU) were initially contracted to develop methodology for long-term monitoring at BUIS by NPS and then to produce population estimates at Ruth Island and Protestant Cay by USFWS. It was generally agreed upon that some manner of mark recapture/resight would be ideal. The primary advantage of the mark



recapture/resight methodology is that it can provide an accurate population estimate without detecting every individual in the survey area.

Initially TAMU pilot tested the use of unique combinations of glass beads permanently affixed to the lizards to mark individual lizards. Unfortunately, none of the bead marked lizards were resighted. It is unknown if the beads came off of the lizards, made them more susceptible to predation or other mortal events, or if there simply were not enough of them marked to ensure that a percentage were resighted. The TAMU group then proposed a paint marking system that employed methods used to conduct population estimation for anoles. This method has the added benefit that the *Ameiva* do not have to actually be captured to be marked. Many more lizards can be marked and with less disturbance. This method was preliminarily tested in a limited area on Green Cay in June 2009 with a fair amount of success and they then recommended it for long term use in monitoring populations of *Ameiva polops* in St. Croix. This paint marking technique was used in late 2010- early 2011 to conduct a population estimate on Ruth Island and Protestant Cay. In addition, McNair's original surveys were repeated again to compare population estimates.

Methods

Ideally, both the paint marking and McNair methods would be conducted within a very close time frame to eliminate any seasonal effects on population size. However, due to an extremely rainy season and logistical issues, surveys on Protestant Cay were conducted several months apart.

For this particular study, the surveys using McNair's methods were conducted on Protestant Cay, each section was surveyed three times on different days on the dates of September 9, 10, 14, 17, 2010 (see results table for specifics). The paint marking surveys were conducted on February 14, 15 and 16. The transects on Ruth Island were surveyed using the McNair methods on November 30, December 6 and December 11, 2010. The paint marking surveys on Ruth Island took place on December 20, 21 and 23. All surveys occurred between the hours of 10:00 and 15:30, the peak activity times for these lizards.

McNair methods

We conducted initial surveys based on methodology employed by McNair to estimate *Ameiva* populations on Ruth Island (McNair and MacKay 2005) and Protestant Cay (McNair



2003). The following is a very brief summary of these methods; for specifics see the above mentioned publications.

On Ruth Island, 20 transects were established at random throughout the island. Each transect was 4m X 25m. To survey the transects, the observer slowly walks from one end to the other three times, recording all Ameiva seen within the transect boundaries. The observer must keep track of each individual Ameiva to avoid counting the same individual on multiple passes. The density of lizards in the transects is derived and then extrapolated to the area of habitat on the island.

Protestant Cay was divided into 23 sections based on existing landmarks such as pathways, buildings or hillsides. Each section is thoroughly searched and all Ameiva observed are recorded. This is repeated several times on different days. The high counts within each section are summed to produce the population estimate.

Paint Marking

Paint marking methods were conducted based on methodology in Heckel and Roughgarden 1979 with some adjustments made for local conditions.

Some studies have conducted paint marking surveys along transects. However, this violates one of the basic assumptions of mark recapture models: that a population is closed. The marked lizards can disperse outside of the transect making them unable to be detected in future sampling. The borders of each Ameiva polops population are finite (the edges of each offshore cay) and the area of each island is not prohibitively large so the survey area consisted of all available habitat on each island. We initially surveyed the islands by walking from end of the island to the other with each surveyor walking several meters apart but found that it is more productive and efficient to divide the island into sections and assign each person a section to cover.

Latex paint diluted with water at a ratio of 1:1 was used for marking. The literature differs as to what the proper level of dilution should be (Heckel and Roughgarden 1979, Diaz et al 2005). We initially started out by diluting the paint with two parts water for one part paint, but found that the paint quickly rubbed off the lizards and was often undetectable the following day. We switched to the 1:1 formula and found this to work much better.

All lizards detected were sprayed with paint. The Idico® Duz-All tree marking gun was used for this project and we found it to be ideal for marking lizards. With a little practice, lizards can be marked with minimal excess spray as far as about 3 meters. Paint marking proved to be somewhat difficult on Ruth Island because many lizards prefer to stay under the low-lying shrubs



such as cocoplum. We did find that having multiple people surrounding the shrubs proved effective in driving the lizards into open enough area for marking.

Paint marking was conducted on each island on three consecutive days, with one exception. On Ruth Island, the third sampling day had to be put off for 24 hours due to overcast weather. Ameiva are very sensitive to temperature and will not be active on overcast or rainy days. Sampling days should be as close to consecutive as possible to minimize loss of marks and changes in population from death or birth.

A different color of paint is used to mark lizards each day. Every lizard detected was marked with paint to the best of our abilities. If a lizard was marked from a previous day's survey, it was marked again with the current day's paint color. The number of adult and juvenile lizards marked was tallied each day and the number of resights and from which day, was recorded.

Geographic Consulting was contracted to determine methods and carry out field data, but not to analyze results. To analyze results of paint marking, we recommend using maximum likelihood techniques in an analysis program such as MARK.

Results

Please see accompanying results spreadsheet for full results.

Discussion of Methodology

As with many long term monitoring programs, the first surveys are most useful for refining technique rather than determining a fully accurate population estimate. This was the case with the paint marking work conducted on Ruth Island. We learned many lessons while carrying out these surveys detailed in the description of methods above and further described below.

We found these surveys to be more labor intensive than initially expected, especially on the larger Ruth Island. The effort required to completely survey the island within the peak hours of lizard activity is considerable. Although we had four people conducting surveys each day on Ruth Island, it would require at least two more to fully cover the island each day. Three people surveyed lizards on Protestant Cay on the first and third survey days and four people surveyed lizards on the second day. Three people proved to be sufficient coverage for this island. We did find that it is more productive to divide the island into sections and assign each person a section to cover rather than to all attempt to walk the entire island together several meters apart.



Due to the limited budget of this project, we had to rely heavily on volunteers. In total we had 6 volunteers, most of which participated on multiple days, donating a total of 66 hours of work, not including travel time to and from the site. In addition, USFWS, NPS and a private individual loaned us kayaks to access Ruth Island.

We found that it is important to choose the paint colors carefully as some colors will be very difficult to resight. Generally the more distinct the colors are from the environment, the better. Greens and yellows should be avoided, unless they are used on the final day of paint marking. Pinks and oranges were very obvious and stood out well against the background. Blue also worked well but only a light, bright blue. Dark blues, browns and blacks will not work. Additionally, the darkest color paint should be used on the first day and progressively lighter colors should be used each day.

In conducting these surveys, we coordinated with Biologists from both USFWS and NPS, who manage the other populations of *Ameiva polops* on Green Cay Wildlife Refuge and Buck Island National Monument respectively. The intention is for every agency to use the same methods to estimate *Ameiva* populations so the individual populations can be compared. This interagency cooperation is what has made the translocation of *Ameiva* to BUIS successful.



Literature Cited

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