



St. Eustatius Invasive Alien Green Iguana

Case Study of a Rapid Response Extermination Campaign (RREC)

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Summary

The Lesser Antillean Iguana, *Iguana delicatissima* is the largest extant native land vertebrate of St. Eustatius and was recently lost (~1990s) from the only other Dutch Caribbean island where it was native (St. Maarten). It is an IUCN Red List Critically Endangered (CR) species that has disappeared from most islands in the Lesser Antilles. A recognized principal cause for its endangerment throughout the islands is displacement by and hybridization with invasive alien Green Iguanas, *Iguana iguana* (IAGI) (Knapp et al. 2014). On 22nd February 2016 an adult female IAGI was caught in Princess Estates, St. Eustatius. The possibility that the animal had been present on the island for a longer period, that it may have laid one or more nests, or the possibility that there may have been other IAGIs on the island, represented an imminent danger to the continued existence of the Lesser Antillean Iguana.

We conducted a Rapid Response Extermination Campaign (RREC) with the goal of wiping out the IAGI at an early stage. Three thorough visual surveys were conducted during 2016-2017 in key risk areas in an attempt to detect and eliminate all IAGIs and their hybrids. In total 409.5 observer hours were spent during three dedicated surveys in and around areas where IAGIs or hybrids had been captured, seen or reported. Searches were conducted over a total of 40 days and covered a total of trajectory of 114.2 km. Only a single detection was realized during these directed surveys. This suggests that the RREC took place at an early stage of the invasion. Nevertheless, due to local publicity via newspapers and radio programs, several records were reported by the public. Thanks to these reports, and opportunistic encounters by park management staff, five captures of IAGIs or their hybrids were realized between February 2016 and January 2017. Since then eight additional captures have been realized, demonstrating that the RREC, even when augmented by public support and extra vigilance by park management staff, was insufficient to purge the island of the IAGI. Our study documents three distinct IAGI introductions between 2013 and 2020, one of which was likely intentional and two of which were incidental stowaways on container ships.

Our results show that, even though it is a relatively large animal, due to its relatively secretive nature, camouflage, and high fecundity, eliminating the IAGI from an island will require a more intensive and sustained effort than we provided, even by means of an RREC in the early stages of the invasion. Informing stakeholders and the public in an early stage of the campaign can clearly make a critical contribution towards an RREC. Even four years after the campaign, the numbers of the IAGI and its hybrids still appear to be limited and concentrated in and around inhabited areas, their likely main point of entry being the island's harbour. We conclude that it may not be too late to quell the invasion before the critically endangered, largest surviving island-endemic vertebrate is permanently lost from St. Eustatius. Additional IAGI extermination campaigns need to be launched as soon as possible.

The harbour of St. Maarten was identified as the source on the most recent 2020 introduction. As St. Maarten serves as a major inter-island trans-shipment hub in the Lesser Antilles, and the Lesser Antilles are rich in endemic iguanas vulnerable to the IAGI, it is essential that St. Maarten ports cull all Green Iguanas in and around their grounds to prevent the spread of this major pest to the islands with which they trade.

1 Introduction

The Lesser Antillean Iguana, *Iguana delicatissima*, is a rare and critically endangered (CR) Lesser-Antillean endemic species. Since the extinction of the endemic rice rat, *Pennatomys nivalis*, during the European colonial era, either due to introduction of invasive rodents/mammals or habitat destruction (Brace et al. 2015), the Lesser Antillean Iguana is now the largest surviving endemic land animal of St. Eustatius.

It is only recently that the native population of the Lesser Antillean Iguana of St. Eustatius has attracted research attention. Until the first decade of this millennium, the only two more-significant published assessments were those by Reichling (2000) and Fogarty et al. (2004). However, soon after the Kingdom of the Netherlands was restructured in 2010 and St. Eustatius became part of the Netherlands proper, the Netherlands Ministry of Agriculture, Nature and Fisheries commissioned a first formal status assessment for the Lesser Antillean Iguana (Debrot and Boman 2013, Debrot et al. 2013, Debrot and Boman 2014, Debrot et al. 2014). Since then, this large and emblematic land animal of St. Eustatius, endemic to the Lesser Antilles, has attracted a considerable amount of research effort, resulting in several additional theses (Docherty 2014, Brouwers 2015, Van Wagenveld 2015), semi-popular reports (Kluskens and van den Burg 2015, Debrot 2016, Van den Burg et al. 2018c), formal policy assessment (Van den Burg et al. 2018a, Debrot et al. 2018) and scientific contributions (Van den Burg et al. 2018b,d, Van Wagenveld and Van den Burg 2018), all of which contribute a variety of insights.

St. Eustatius is one of the last three major islands (together with La Desirade and Dominica) where the species was (until recently) still free from hybridization with the Invasive Alien Green Iguana (IAGI), *I. iguana*. It is an IUCN Red List Critically Endangered (CR) species that has disappeared from most islands in the Lesser Antilles. Today, a recognized principal cause for the endangerment of the Lesser Antillean Iguana throughout the islands is displacement by and hybridization with the IAGI (Knapp et al. 2014). However, this awareness developed only gradually. For a long time the IAGI was regarded as a merely compatible coexisting species. For instance, Wijffels (1976) opined that the Lesser Antillean Iguana was “absolutely not being supplanted by the Green Iguana advancing from South America as has been assumed for many decades”. Three decades later, in their review on the conservation state of reptiles of the Lesser Antilles, Powell and Henderson (2005) only indicated the possibility of hybridization as among the many threats to the species but gave it no further priority or urgency. In the Lesser Antillean Iguana Species Profile by Pasichnick et al. (2006) hybridization is mentioned, however, only in passing and is not highlighted as a principal threat. Likewise, in his review paper on the ecology and conservation of the Lesser Antillean Iguana, Knapp (2007) did mention that documented hybridization with the IAGI threatens the genetic integrity of the species, but offered little to prioritize it as a principal threat. By the early 2010s, however, the views began to shift. For instance, in 2012, the IAGI was emphasized as a “potentially disastrous” future threat to the Lesser Antillean Iguana on St. Eustatius by Van Buurt and Debrot (2012) and Vuillaume et al. (2015). In 2013, Debrot and Boman (2013) and Debrot et al. (2013) listed the introduction of the IAGI as one of the top four threats to the native iguana population on St. Eustatius. Finally, today, the newest IUCN Species Action Plan for *I. delicatissima* recognizes “displacement through competition and hybridization with *I. iguana*” as a key factor in the loss of the Lesser Antillean Iguana from many islands (Knapp et al. 2014).

With exception of a few small satellite islands, the Lesser Antillean Iguana has disappeared from seven of the 14 (larger) islands where it formerly occurred as a result of hybridization and other factors. On five of the seven islands where it still exists (including St. Eustatius), it is currently being threatened by the establishment of the IAGI. As a consequence, its status was recently upgraded from Vulnerable (VU) to Critically Endangered (CR) by the IUCN (van den Burg et al. 2018). In the Dutch Caribbean, the species formerly existed on St. Maarten but also disappeared from there, possibly during the 1990s prior to the introduction of the IAGI (Yokoyama 2012). According to information provided to us by Tadzio Bervoets (St. Maarten Nature Foundation) in May 2019, five years earlier the American

Museum of Natural History searched the island for any surviving *I. delicatissima* but none were found. Genetic analysis by the AMNH further indicated that none of the IAGI sampled indicated signs of hybridization with *I. delicatissima* (T. Bervoets, pers. comm).

The Lesser Antillean Iguana population on St. Eustatius was estimated at approximately 300 animals in 1992, less than 300 animals in 2000, and about 425 (275-650) individuals in 2004 (Fogarty et al. 2004). During the most recent population survey, Debrot and Boman (2013a,b) concluded that notwithstanding stated protective measures, the status of the native iguana had not improved significantly in the eight years since the 2004 assessment. The situation worsened dramatically, when on 22nd February 2016, the local park management authority (STENAPA) reported the capture of a gravid adult female IAGI in Princess Estates. Our joint team recognized the gravity of the threat and agreed that a RREC was called for. The Ministry of Economic Affairs, at that time mandated with the agriculture, fisheries and nature portfolio, immediately agreed to fund a limited RREC to address this well-documented, emergent threat to the island's emblematic reptile, and by April we initiated the first of three eradication surveys.

2 Materials and Methods

Iguanas are generally shy and successfully use their grey, brownish and greenish coloration to avoid detection. This meant that our planned search missions had to be carried out by trained iguana spotters. Two researchers, well-experienced with iguanas (Hannah Madden and Tim van Wagensveld) were recruited to conduct three visual surveys spread out during the course of a year. Occasionally assistance was provided by a third iguana spotter (Thijs van den Burg). The distances covered during these surveys were recorded, and mapped, as was the time each person spent searching. The effective total visual widths of the transects varied greatly depending on the vegetation density or visual obstruction by buildings and differed from roughly 10-50 m, and was not recorded. Searches were conducted from 7.30 am to 1 pm. The first survey targeted an area of 200 m radius around the exact location where the first 2016 IAGI was captured, as well as the harbour area. All subsequent searches included these areas, as well as additional areas when new sightings or captures were made.

During the searches for IAGIs, Lesser Antillean Iguanas were often spotted and many of these were caught and tagged in support of additional scientific work on this endangered species. The time spent in tagging was reported separately from the time spent searching. The search areas were selected based on known or suspected presence of the targeted iguanas and were different but partially overlapping for each of the three search missions conducted. Prior to starting this campaign, the public was informed of the need for the RREC and asked to cooperate by reporting any suspicious-looking iguanas to the park management authority (Appendix 1).

Contacts were established and arrangements made with several foreign research institutes (Laboratoire Genindexe, France; University of Puerto Rico, USA; Department of Ecological Science, Free University of Amsterdam; Agroisolab GmbH, Germany) for assessment of reproductive state, isotope analysis of food sources and to investigate various aspects of the genetics of the IAGIs and hybrids caught. Unfortunately, notwithstanding the fact that the required export permits applied for were granted by the corresponding authorities, the various efforts made to actually get tissue samples sent away failed.

3 Results

The three surveys were conducted, respectively, in April 2016, Augustus-September 2016 and January 2017 (Table 1, Annex 2). The exact search areas covered greatly overlapped but were also adjusted depending on actual or suspected sightings of IAGIs or their hybrids (Fig. 1). In general the search areas were clustered around inhabited areas, just landwards from the port of Oranjestad, the suspected main point of entry of the IAGIs. In total 409.5 observer hours were spent during three dedicated surveys in and around areas where IAGIs or hybrids had been captured, seen or reported. Searches were conducted over a total of 40 days and covered a total of trajectory of 114.2 km. Only a single detection was realized during these directed surveys (Table 1).

Table 1. Effort and results details on the three directed surveys executed during 2016 and 2017 in an effort to find, capture and destroy invasive Green Iguanas.

Search #	Period	Days searched (n)	Person-hours spent	Distance covered (km)	GI/hybrids detected (n)
1	April 2016	7	72	23.8	0
2	Aug-Sept 2016	21	154.5	40	0
3	Jan 2017	12	183	50.4	1
	Totals:	40	409.5	114.2	1

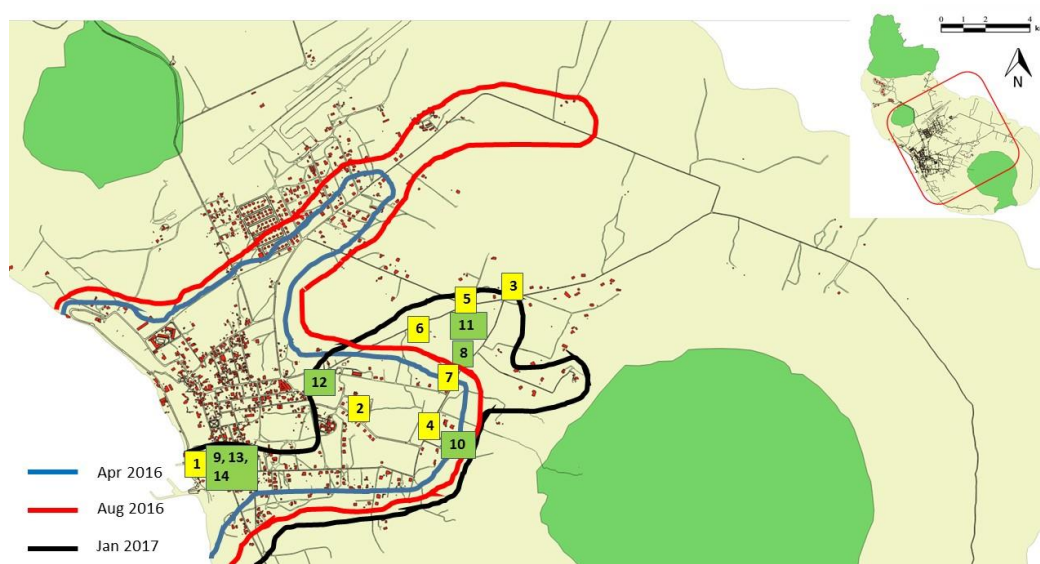


Figure 1. Map outlining the three Rapid Response Extermination Campaign (RREC) search areas (colored lines) and showing the locations of all Green iguanas and hybrids captured and killed before and up to the third search effort in 2017 (yellow boxes) and since then, up to 2020 (green boxes).

While the directed surveys yielded only one sighting and no captures, following the 2013 and initial 2016 captures (specimens 1-2), a total of 13 additional captures were realized based on incidental efforts by STENAPA staff and personnel and thanks to tips received from the public, during (specimens

3-7) and after the directed campaign period (specimens 8-15) (Table 2). The captured hybrids were largely adults, two of which were gravid. Information and photographs provided by R. Hensen, former head of the St. Eustatius LVV (Agriculture and Fisheries Service of St. Eustatius), indicated that he had captured and killed a juvenile IAGI from the harbour area in 2013 (Figure 2). The specimen had been stored in LVV's freezer but was ultimately lost and could not be recovered by us. Thus our work documents three separate introduction events: accidental in 2013, possibly intentional somewhere prior to 2016, and accidental in 2020 (Table 2).



Figure 2. Juvenile iguana caught at the St. Eustatius harbor and killed by R. Hensen in 2013. (Photo: R. Hensen). Photo taken at the office of the Agricultural Service.

Table 2. Overview of St. Eustatius IAGI and hybrid iguana records. NA: not available; SVL: snout to vent length; VT: vent to tail tip length; TL: total length.

Specimen #	Name	Date	Period irt campaign	Stage/sex	Location	Latitude	Longitude	SVL (cm)	VT (cm)	Weight (kg)	Comment
1	Green 1	2013	prior	Juvenile, NA	Harbor	17.47766	-62.98716	NA	NA	NA	specimen lost
2	Green 2	2/17/2016	prior	Adult female	Princess	17.481471	-62.97829	40.7	79.9	2.18	Imported as pet. 29 eggs when killed
3	Hybrid 1	7/27/2016	during	Sub-adult male	Big Stone	17.4865	-62.9719	19.3	15.6*	0.33	half of tail missing - in CNSI freezer
4	Hybrid 2	8/30/2016	during	Adult female	Lodi	17.4855	-62.97500	26.5	63.7	0.63	roadkill (not in CNSI freezer)
5	Hybrid 3	10-10-2016	during	Adult female	Lampeweg	17.48664	-62.97477	NA	NA	NA	Flattened into road, unable to collect
6	Hybrid 4	10/19/2016	during	Adult male	Lampeweg	17.4822	-62.97450	26.9	67.0	1.40	roadkill - in CNSI freezer
7	Hybrid 5	1/24/2017	during	Adult female	Top of Princess	17.4827	-62.97744	32.5	79.6**	1.89	end of tail missing - in CNSI freezer
8	Hybrid 6	3/23/2017	after	Adult male	Round Hill	17.48337	-62.97217	33.1	68.8**	2.30	specimen lost
9	Green 3	3/30/2017	after	Juvenile, NA	Harbor	17.47766	-62.98716	NA	NA	NA	From ship arriving from SXM.
10	Hybrid 7	4/21/2017	after	Adult female	Old Quill road	17.48338	-62.97219	27.3	62.2	2.30	in CNSI freezer
11	Hybrid 8	4/18/2018	after	Adult female	Lodi road	17.48473	-62.97614	33.0	99.1	1.92	In CNSI freezer
12	Hybrid 9	3/31/2020	after	Adult female	Jewish cemetery	17.481565	-62.980698	26.0	29.9*	NA	end of tail missing / 21 eggs, CNSI freezer
13	Green 4	10/28/2020	after	Subadult male	Harbor	17.477511	-62.985822	17.0	40.5	NA	in CNSI freezer
14	Green 5	12-12-2020	after	Subadult female	Harbor	17.477511	-62.985822	31.0	49.0	NA	in CNSI freezer
15	Hybrid 10	NA	after	Sub-adult, NA	NA	NA	NA	24.4	33.7	NA	in CNSI freezer
* half of tail missing											
** tip of tail missing											

4 Discussion and conclusions

Biological invasions are a major global concern and have significant consequences on biodiversity, the environment, agriculture, livelihoods, health and culture in affected regions (Pysek et al. 2020). These effects tend to be much stronger on islands than on continents (Russell et al. 2017). In recent years, the Green Iguana has developed into a species of high conservation concern. From its origins in South America, it has spread extensively throughout the Caribbean (Falcón et al. 2012) and is now rapidly spreading throughout tropical and subtropical regions of the world, including Asia (Falcón et al. 2013, Van den Burg et al. 2020). Rapid response campaigns can greatly lower the cost of invasive species removal (Alvarez & Solís, 2018), and not surprisingly there is much recent literature available on decision models and governance frameworks for implementing such systems for early detection and rapid response (e.g. Kraus and Duffy 2010; Reaser et al. 2020; Burgos-Rodríguez and Burgiel 2020, Martinez et al. 2018). Even so, actual case studies of implemented RREC are few. Also for IAGI, Knapp et al. (2020) recently emphasized the need for action, but point out that these have typically come very late and that, in most cases, all that remains possible is culling and control (e.g. Lopez-Torres et al 2012, Rivera-Milán and Haakonsson 2020). In the case of the IAGI on St. Eustatius, a fortuitous early detection in the early stage of the invasion presented a unique opportunity, making eradication potentially feasible. In this effort we describe our attempt to execute a targeted eradication effort and assess the results for lessons learned.

Contrary to several recent reports and publications (Van Wagensveld and Van den Burg 2018, Van den Burg et al. 2018), the first documented record of the IAGI on St. Eustatius dates from 2013, not 2016. The animal was caught and killed in 2013, having been discovered in the harbour area, and was evidently a juvenile. It could represent an animal hatched from a nest laid on St. Eustatius (by an adult female previously introduced to the island) but may also have been introduced as a juvenile. At the time of its capture, LVV was of the opinion that it was a single specimen, and that killing it would eliminate the threat of invasion. Therefore, aside from a brief search in the harbour area, no further attention was given to the incident. The first IAGI caught in 2016, around which our response was coordinated, was a large, gravid adult female IAGI with 29 eggs, caught at Princess Estates, approximately 1km from the harbour on the outskirts of Oranjestad. Based on local inquiries, it is thought that the animal in question had been introduced as a pet.

Our results show that, even though it is a relatively large animal, due to its relatively secretive habits, camouflage, and high fecundity, eliminating the IAGI from an island will require a more intensive and sustained effort than we provided, even by means of an RREC in the early stages of the invasion. In their draft Joint Invasive Alien Species Strategy, Smith et al. (2014) stress the need to involve the public in IAS campaigns at an early stage. Our results corroborate that doing so can clearly make a critical contribution towards an RREC. Even four years after the campaign, the numbers of the IAGI and its hybrids still appear to be limited and concentrated in and around inhabited areas, and their likely main point of entry is the island harbour.

Pluess et al. (2012a, b) examined the effect of various factors typically considered critical to eradication success stress on eradication outcomes in 136 eradication campaigns and 75 species. They found that factors such as reaction time, the level of knowledge and insularity were all unrelated to eradication success. Only the spatial extent of the infestation was significantly related to the eradication outcome. In the case of the St. Eustatius IAGI, our work shows that spatial extent of its distribution is still quite limited. Our organizations conduct extensive research and nature management activities around the island and confirm that no IAGI have been detected outside Oranjestad or its immediate surroundings. Therefore, we conclude that it may not be too late to quell the invasion before the critically endangered, largest surviving island-endemic vertebrate is permanently lost from St. Eustatius. However, additional extermination campaigns need to be initiated as soon as possible.

In total, from 2013 to 2020, we document three separate IAGI introduction events, two of which were accidental and one of which was likely intentional. To safeguard the existence of the Lesser Antillean Iguana on St. Eustatius for posterity under such high and continuing threat levels will require additional structural measures. However, St. Eustatius institutions have been found to be grossly in need of additional financing, staffing and general capacity in order to be able to effectively address nature management in general (Beek et al. 2015) and the Invasive Alien Species issue in specific (Smith et al. 2014). Of utmost priority will be to install a minimum of legislation and train and equip border officials to prevent potential entry of the mongoose (*Herpestes javanicus*) and repeated entry of the IAGI from neighbouring islands (Debrot & Boman 2013a,b; Debrot et al 2018). No amount of research will be able to save the Lesser Antillean Iguana. Only a combination of structural measures and effective implementation will ultimately help prevent the extinction of this last largest endemic land vertebrate of St. Eustatius.

Not only do IAGI introductions pose a major danger to *I. delicatissima* in the Lesser Antilles, but also to several other endemic iguana species and or subspecies, several of which have only recently been described, such as *Iguana melanoderma*, from the Dutch Island of Saba (Breuil et al. 2019, 2020). In order to give these last large endemic island vertebrates a chance to survive, it will be essential to keep their islands free of the IAGI. The largest and most persistent source of IAGI in the Lesser Antilles is likely the harbor of St. Maarten that serves as a major inter-island shipping hub. To reduce the threat of accidental stowaway or hitchhiking iguanas from St. Maarten, we recommend the port of St. Maarten to carry out regular iguana eradications on port grounds in order to reduce the chance of spreading invasive iguanas to the surrounding islands. Green Iguanas are a delicacy, and allowing intensive harvest for consumption purposes as practiced on Grand Cayman should also be explored (Rivera-Milán & Haakonsson 2020).

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5 Quality Assurance

Wageningen Marine Research utilises an ISO 9001:2015 certified quality management system. This certificate is valid until 15 December 2021. The organisation has been certified since 27 February 2001. The certification was issued by DNV GL.

Furthermore, the chemical laboratory at IJmuiden has EN-ISO/IEC 17025:2017 accreditation for test laboratories with number L097. This accreditation is valid until 1th of April 2021 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation. The chemical laboratory at IJmuiden has thus demonstrated its ability to provide valid results according a technically competent manner and to work according to the ISO 17025 standard. The scope (L097) of de accredited analytical methods can be found at the website of the Council for Accreditation (www.rva.nl).

On the basis of this accreditation, the quality characteristic Q is awarded to the results of those components which are incorporated in the scope, provided they comply with all quality requirements. The quality characteristic Q is stated in the tables with the results. If, the quality characteristic Q is not mentioned, the reason why is explained.

The quality of the test methods is ensured in various ways. The accuracy of the analysis is regularly assessed by participation in inter-laboratory performance studies including those organized by QUASIMEME. If no inter-laboratory study is available, a second-level control is performed. In addition, a first-level control is performed for each series of measurements.

In addition to the line controls the following general quality controls are carried out:

- Blank research.
- Recovery.
- Internal standard
- Injection standard.
- Sensitivity.

The above controls are described in Wageningen Marine Research working instruction ISW 2.10.2.105. If desired, information regarding the performance characteristics of the analytical methods is available at the chemical laboratory at IJmuiden.

If the quality cannot be guaranteed, appropriate measures are taken.

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Justification

Report C033/21

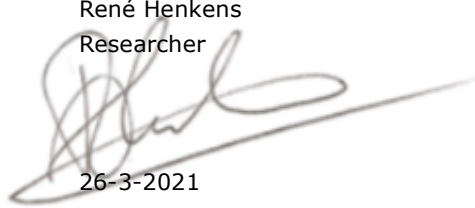
Project Number: 4318100053

The scientific quality of this report has been peer reviewed by a colleague scientist and a member of the Management Team of Wageningen Marine Research

Approved: René Henkens
Researcher

Signature:

Date: 26-3-2021



Approved: Jakob Asjes
Manager Integration

Signature:

Date: 31-3-2021





Figure A1: Local Newspaper attention to Green Iguana campaign, April 2016.

HAVE YOU SEEN THIS IGUANA?

INVASIVE GREEN IGUANA

NOT TO BE CONFUSED WITH THE ENDANGERED LESSER ANTILLEAN IGUANA. PLEASE SEE OVERLEAF FOR MORE INFORMATION.

IT IS LIKELY TO BE FOUND IN THE TOPS OF LEAFY TREES AND SHRUBBERY, BATHING IN THE MORNING SUN.

ONE HAS BEEN SPOTTED IN YOUR NEIGHBOURHOOD. IF SEEN **PLEASE CONTACT STENAPA ON 318 2884 OR EMAIL INFO@STATIAPARK.ORG** IMMEDIATELY SO IT CAN BE CAPTURED AND ANALYSED.

NOTED DIFFERENCES OF THE LESSER ANTILLEAN IGUANA

LESSER ANTILLEAN IGUANA

BEWARE

JUVENILE AND FEMALE LESSER ANTILLEAN IGUANAS ARE GREEN IN COLOUR, PLEASE DO NOT MISTAKE THESE FOR GREEN IGUANAS. TO ENSURE NO CONFUSION LOOK CAREFULLY FOR A LINE OF SMALL SCALES AROUND THE MOUTH AND FOR THE ABSENCE OF BANDS ON THE TAIL.

THIS SPECIES IS ENDANGERED AND IS UNIQUE TO STATIA. IT IS ILLEGAL TO HARM OR KILL A LESSER ANTILLEAN IGUANA, ANYONE CAUGHT DOING SO WILL BE PROSECUTED. **REPORT ANY INCIDENTS TO STENAPA ON 318 2884 OR EMAIL INFO@STATIAPARK.ORG**

Figure A2. Flyer for Green Iguana Rapid Action, August 2016.

6 Annex 2 Maps and details on areas covered during three surveys

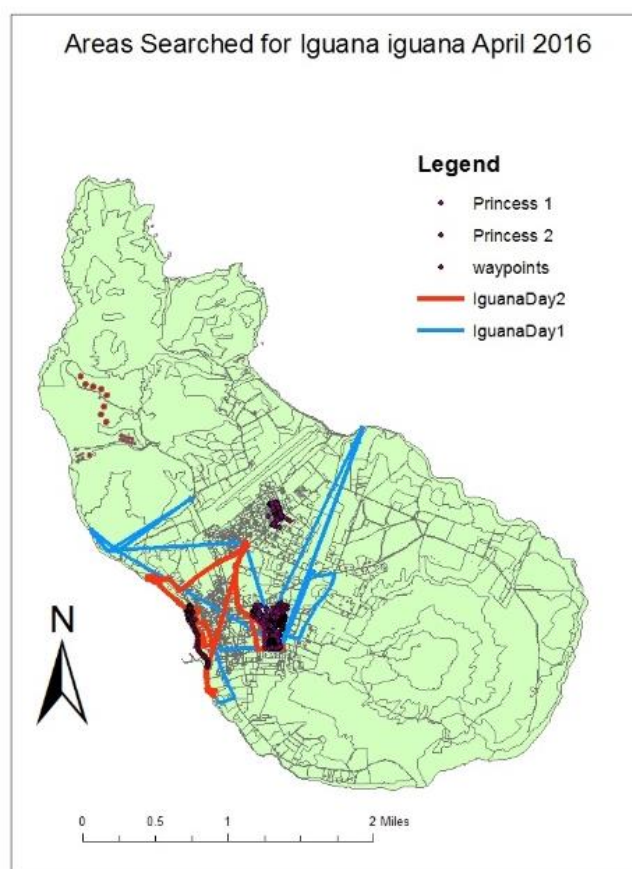


Figure B1. Map of areas and trajectories searched for Green Iguana and its hybrids in April 2016.

Table B1. Details on effort spent searching for Green Iguanas and hybrids in April 2016. "Beading" refers to marking iguanas by sewing coloured beads into their dorsal ridge to allow individual recognition in the field.

Date	Time		Hours	(Beading)	Persons	Total man hours
13-apr-16	7.30am-1.30pm	Princess Estates, Rosemary Lane fieldwork	6	1	2	10
	2-4pm	Visit LVV, draft press release	2			2
14-apr-16	7.30am-1.30pm	Harbor area, Crooks Castle, Oranje Bay, slave path, fort	6	1	2	10
	2-2.30pm	Email & photos Roberto Hensen	0.5			0.5
	5-6pm	Photos and morphometrics Green Iguana	1			1
15-apr-16	7.30am-1.30pm	Princess Estates, Rosemary Lane fieldwork	3		2	6
		Search Concordia area for green iguanas	3	2	2	6
	2.30-3.30pm	Press release, photos and morphometrics	1			1
16-apr-16	7.30-12pm	Harbor, slave path, Oranje Bay	4.5	0.25	2	8.5
17-apr-16	7.30-12pm	Fort, Princess Estates, Rosemary Lane, Concordia	4.5	0.25	4	17
18-apr-16	7.30-12pm	Princess Estates, Concordia	4.5		2	9
	1-2pm	Download GPS coordinates and create maps	1		2	2
19-apr-16	7.30-10am	Princess Estates	2.5		2	5
	11am-1pm	Princess Estates/Rosemary Lane	2			4
	2-3pm	GPS coordinates and GIS maps	1			1
		DISTANCE COVERED: 23.8 KM		4.5		
					TOTAL	83
					Search	72

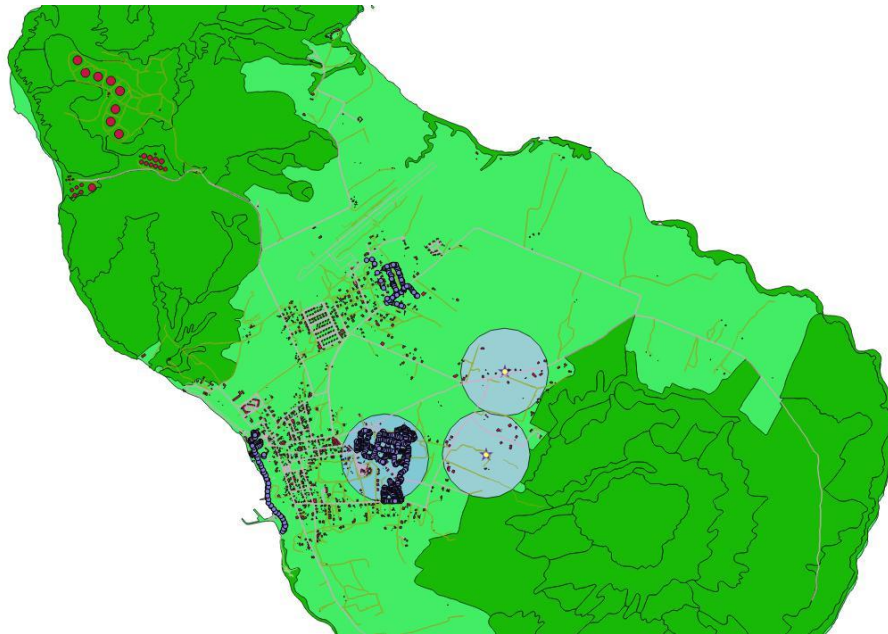


Figure B2. Map of areas and trajectories searched for Green Iguana and its hybrids in August and September 2016.

Table B2. Details on effort spent searching for Green Iguanas and hybrids in August and September 2016.

Date	Time		Hours	(Beading)	Persons	Total man hours
16-aug-16	8.00am-1.00pm	Fieldwork at Big Stone and road to White Wall (cliff above Crooks Castle)	5	0.25	2	9.5
	2-4.30pm	Iguana stakeholder meeting at CNSI; hybrid photos	2.5			2.5
17-aug-16	8.00am-1.00pm	Fieldwork in Princess, Upper Round Hill, Big Stone, Lynch Plantation	5		2	10
	1-2.30pm	Meeting with STENAPA	1.5			1.5
18-aug-16	8.00am-1.00pm	Fieldwork in Princess, Rosemary Lane, Oranje Bay, Crooks Castle	5	0.25	4	18.75
	6-6.30pm	CNSI presentation: Science Café "The Invasion of the Green Iguana"	0.5			0.5
19-aug-16	8.00am-1.00pm	Fieldwork in Lampeweg and Big Stone. Relocation of female delicatissima to Kingswell (potentially mated with hybrid)	5		2	10
20-25 Aug		(Tim in Anguilla)				
22-aug-16	10-11am	Meeting with STENAPA and LVV re: iguana enclosure				1
23-aug-16	8-10am	Search Big Stone area	2		1	2
24-aug-16	8-9am	Search top of Princess area (no further fieldwork possible due to tropical wave)	1		1	1
25-aug-16	9am-12pm	Search top of Princess area	3		1	3
26-aug-16	8-12pm	Princess area (rain forced early stop)	4		2	8
29-aug-16	8am-1pm	Search Big Stone area	5	0.75	2	8.5
30-aug-16	8am-12pm	Search Princess area	4	0.5	2	7
31-aug-16	8am-12pm	Search harbor/Tompi area and Cherry Tree/sugar mill	4	0.25	2	7.5
2-sep-16	4-5pm	Tip off re: hybrid at Princess	1		2	2
3-sep-16	8.30-11.30am	Search Patrick yard + immediate area	3		3	9
	1.30-2.30pm	Search Patrick yard + immediate area	1		1	1
6-sep-16	8.30am-1pm	Search Patrick yard + immediate area	4.5	0.25	4	17
7-sep-16	8.30-11.30am	Search hybrid 2 area	3	0.25	3	8.25
8-sep-16	8.30am-1pm	Search hybrid 2 area	4.5	1	4	14
9-sep-16	8.30-11.30am	Search hybrid 2 area	3		4	12
10-sep-16	9.30am-1pm	Search hybrid 2 area	3.5	0.5	2	6
11-sep-16	8.30am-12pm	Search hybrid 2 area	3.5	0.5	2	6
12-sep-16	8.30-11.30am	Search hybrid 2 area	3		5	15
		DISTANCE COVERED: ca. 40 KM				
					TOTAL	160
					FIELD	154.5

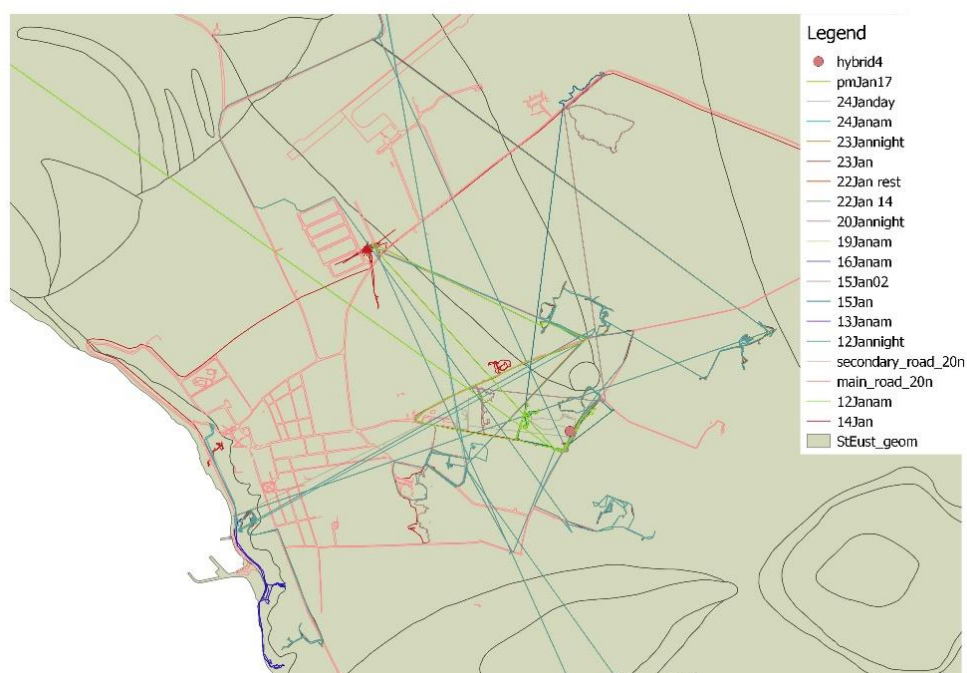


Figure B3. Map of areas and trajectories searched for the Green Iguana and its hybrids in January 2017.

Table B3. Details on effort spent searching for Green Iguanas and hybrids in January 2017.

Date	Time	Location	Hours	Persons	Beading	Total	Comments
12-1-2017	8am-12pm	Princess and Lampeweg	4	3	2.25	9.75	
12-1-2017	1-4pm	End Devon yard, Lampeweg	3	2		6	
13-1-2017	7-9pm	Big Stone road	2	8	4.00	12.00	
14-1-2017	2pm-5pm	Princess (Devon's outer yard) and Lampeweg	3	2	1.00	5	
14-1-2017	8pm-10.30pm	Princess (Devon's outer yard)	2.5	2		5	
15-1-2017	8.30am-12pm	Bush inbetween Dutch plumbing and Rosemary lane. Chucks house/Lodi	3.5	3	8.75	1.75	
16-1-2017	8am-12pm	Harbor and Crooks castle	4	4	1.00	15	
17-1-2017	8am-12pm	Princess	4	3		12	
18-1-2017	8am-12pm	Lodi, Upper Round Hill, French peoples garden by Glenn & Michelle	4	6	6.00	18	
19-1-2017	8am-12pm	Tom's yard, Big Stone	4	6		24	
19-1-2017	2pm-4:30pm	Big Stone and area	2.5	3		7.5	
19-1-2017	8pm-11:30pm	Princess	3.5	4		14	
20-1-2017	9am-12pm	Tompi hill, harbor, above bay road	3	11	2.75	30.25	
22-1-2017	3pm-5pm	Devon yard, Princess	2	3		6	
23-1-2017	9am-12pm	Dr. Bakker road, top of Princess	3	7	5.25	15.75	
23-1-2017	3.30pm-5.30pm	Road to white wall	2	3		6	
23-1-2017	9pm-11.30pm	Princess and Lampeweg	2.5	4		10	
24-1-2017	11am-12pm	STENAPA office and slave path	1	4		4	
24-1-2017	2pm-3pm	Lodi	1	3		3	
24-1-2017	4.30pm-5.30pm	Devon yard, Princess	1	6		6	Hybrid was found
24-1-2017	10pm-11pm	Harbor and STENAPA office	1	3		3	
					31.00		
		DISTANCE COVERED: 50.4 km		TOTAL	183.00	214	

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With knowledge, independent scientific research and advice, **Wageningen Marine Research** substantially contributes to more sustainable and more careful management, use and protection of natural riches in marine, coastal and freshwater areas.



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