

**POPULATION AND HABITAT OF THE ST. LUCIA WHIPTAIL LIZARD (*CNEMIDOPHORUS VANZOI*) ON PRASLIN ISLAND, ST. LUCIA (WEST INDIES)**

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**ABSTRACT:** The St. Lucia whiptail lizard (*Cnemidophorus vanzoi*) is an endemic saurian in the Lesser Antilles. The most recent population estimation suggests a total of 906 individuals. The whiptail has had a historically restricted range of two small offshore islands to the south of St. Lucia, Maria Major and Maria Minor. In an effort to conserve the species, a translocation of 39 individuals to Praslin Island was undertaken in 1995. Because of the proximity of the island to the mainland, the translocated population has faced several challenges from the time of establishment. My research focused on the structure of the current population including male to female and adult to juvenile ratios; gender-related biometric data; habitat use by gender and maturity; and the threat to the population posed by rats (*Rattus rattus*). Permanent marking techniques with a line transect method allowed for population estimation. A total of 34 whiptails was captured, measured, marked and released. Data collected on trapped whiptails included station of capture, weight, ear-snout measurement, snout-vent measurement and tail length. Trapped individuals included 22 males and 12 females. Juveniles composed 23% of the captured stock. To determine population estimates, two surveys were conducted by line transects on the island. The first yielded 24 observations of lizards and the second gave a total of 35 individuals. The first survey resulted in 9 males, 12 females, and 3 juveniles observed. The second survey gave 18 males, 13 females, and 4 juveniles. The results indicate that from a founding stock of 14 whiptail lizards, there is an estimated 207 individuals on the island. While the founding stock consisted of adult pairs, our survey revealed all stages of development and healthy growth among the population. The various individuals occupied respective habitats similar to those encountered in the Maria Islands (i.e. adults utilized the open understory of the woodlands where as juveniles utilized the grasses and edge habitat for cover. The translocation effort has been successful, however, there remains the constant threat of pest species such as rats being destructive to the population and constant monitoring is required.

## INTRODUCTION

The *Cnemidophorus* lizards are a complex genus made up of both bisexual and parthenogenic species. Their geographic range spans from southern North American to central Argentina (Wright & Vitt 1993). Species within this genus were described as part of *Lacerta* and *Amevia* until 1952 when measurements and tests developed by Lowe and Zweifel defined the genus (Lowe in Wright & Vitt 1993). The 45+ species are divided into four bisexual species groups and 14 parthenogenetic lineages (Wright & Vitt 1993). The *Cnemidophorus lemniscatus* group, to which the St. Lucia whiptail, (*C. vanzoi*) belongs, is one of the least studied groups. This species group is also the most primitive (i.e., *Amevia*-like) and it has been suggested that all other North American groups may have been derived from this root (Wright & Vitt 1993).

*Cnemidophorus vanzoi* has a maximum SVL 121 mm in males, 95 mm in females; dorsal caudal scales keeled and straight; ventrals in 33-38 longitudinal rows and 10 transverse rows; fourth toe subdigital lamellae 79-96 (combined counts for both fourth toes); femoral pores 49-57 (combined counts for both series); fifteenth caudal verticil with 30-37 scales. Male dorsum full, greenish brown with obsolete, tannish stripes; lateral spots light bluish gray; head bluish gray to brownish; snout blue-gray; chin pale bluish; throat slaty black; venter brilliant sulfur-yellow to orange; undersides of hindlimbs yellow to blue-green; vent area and entire tail bright green to sea-blue patched with turquoise. Female paler and browner, becoming dark on sides; stripes dull ocher, but no yellow or blue; bluish-gray dots on sides; head distinctly brownish; belly and throat clear gray with rusty lateral wash; with or without faint, rusty wash on neck and throat; thigh spots white to pale buff. The mean weight of males on Maria Major was  $36.7 \pm 4.35$  (range 27-42) g, females and juveniles  $15.0 \pm 4.29$  (8-24) g. (Schwartz and Henderson 1991).

*C. vanzoi* is a ground-dwelling, diurnal, and primarily insectivorous macroteiid. The total estimated population for Maria Islands is 906 (Anthony 1993). The species prefers open areas. They occur at the grassy lower margin of woods and edge of rocky zone at peak of Maria Major and on lower edge of tree growth among bushes, cacti, and rocks. The lizard may roam through the woods and grassy areas. In the woods, *C. vanzoi* climbs thick stems of vines to lower boughs of trees and lies along them. The lizard can

be found foraging on the beaches. Its foraging behavior includes scratching soil surface and in leaf litter where it feeds on termites (but not ants), scorpions, amphipods, carrion (dead bird), and fruit of *Ficus citrifolia* (Schwartz & Henderson 1991).

The St. Lucian Government recently declared the two islets where the lizard is found protected areas because of the whiptails unique taxonomic status and its restricted range. Because of the perceived threats related to the island's proximity to the mainland (e.g., introduced predators) and the inability to establish an ex-situ population, the need for a translocation was a priority. Praslin Island, a 1.1 ha uninhabited island on the east coast of St. Lucia, was determined as suitable for translocation. The introduced fauna such as goats and rats were eradicated by 1993, and a biophysical examination was conducted in 1994 (Brice and Bloxam 1994, Johnston 1994). A total of 39 whiptail lizards was translocated from Maria Major to Praslin Island; a 1.1 ha uninhabited island in 1995 by the Jersey Wildlife Preservation Trust and the St. Lucia Ministry of Agriculture, Lands, Fisheries and Forestry. A small Indian mongoose (*Herpestes auropunctatus*) which was on the island destroyed the first translocation of 25 mature whiptails. After the removal of the mongoose, seven pairs of adult whiptails were subsequently translocated to Praslin Island. These 14 lizards formed the founder stock for the present population ( D. Anthony pers. commun.).

The translocated population has faced pressures from passing storms, predator invasion and incidental chemical poisoning from rodenticides since its establishment. This research was carried out to assess the overall success of the translocation. This was done by surveying the population, studying the structure of the surviving whiptails (i.e., male-females, adults-neonates), collecting biometric data and observing the habitat use by individuals.

## **OBJECTIVE**

This study was undertaken to assess the population of the translocated whiptails on Praslin Island.

Determine if the translocation effort was successful and if any threats exist to the survival of the population.

## STUDY AREA

St. Lucia is a mountainous island primarily of volcanic origin in the Windward Islands of the Lesser Antilles. St. Lucia (lat. 13°42' and 14°06' N, long. 61°05' and 61°52' W) lies between Martinique, 28.3 km to the north and St. Vincent, 31.2 km to the south (Fig. 1). The island is 44.7 km long and 21.5 km at its widest point. The total surface area is 616.4 km<sup>2</sup>. The island's mountains are predominantly in the south-central portion of the island. The highest elevation is 950 m above sea level.

The Maria Islands are located 13° 43.8' N, 60° 56.3' W, and lie approximately one km off the southeast coast of St. Lucia. The island grouping consists of the two small islets of Maria Major 10.2 ha, Maria Minor 2.2 ha and a single emergent rock of 0.04 ha. The average temperature is 28°C and the relative humidity is 70%. The Maria Islands receive approximately 153 cm of rainfall per year (Anthony 1993).

Praslin Island is off the eastern coast of St. Lucia at 13°52.2' North, and 60°53.1' West. It is in the mouth of the sheltered Praslin Bay and is only 220 m from the mainland. The highest elevation is 21.6 m above sea level. Praslin Island is approximately 21 km north of the Maria Islands. As with Maria Major, Praslin Island possesses a mosaic of vegetation types and features that made it a suitable alternative site for *Cnemidophorus vanzoi*. The island has woodland area, scrub vegetation, areas of long grass, leaf litter, and a soil type within which lizards are able to forage, dig and also lay their eggs. A small beach is on the western side of the island. Only two other lizard species are currently present: *Anolis luciae* and *Gymnophthalmus pleii*; both are native species. Praslin Island has been a private estate of the Dennehy family of Praslin. An agreement was reached between the Government and the family allowing the use of the island for the conservation of the St. Lucia whiptail.

From 1 March 1993 a rat eradication program was carried out on Praslin Island using "Klerat" (Imperial Chemical Industries), a potent anti-coagulant with brodifacoum (Anthony 1993). This was a particularly useful compound for an eradication program (Moors 1995) because its anticoagulant mode of action had the advantage of killing rats after only a very small (single) dose. It does not induce a learned avoidance response in the rats since the gradual action precludes an association with eating a particular bait type. Rat

eradication was confirmed by the appearance of vigorous ground vegetation and the absence of rat “runways” subsequent to control efforts, there were numerous untouched seeds and seedling regeneration and ground-nesting seabirds found the island attractive thereafter (Johnston 1994). No effects were noted on non-target species by researchers (D. Anthony pers.commun.). Rats continue to be a frequently occurring predator on the island despite vigilant efforts to fend them off. An effort was made to remove any that were on the island during this research in July 1999.

## **METHODS**

This research was conducted from 19 July – 17 August 1999. The process of capture-mark-release was conducted during the first week. Whiptails were caught with a noose made of a length of 10 lb. fishing line attached to a light and flexible wooden pole, approximately 1.5 m in length. A loop was made with a slipknot or running bowline. The loop was lowered over the head of the whiptail and then jerked tight (Simons 1987). Once caught, each whiptail was individually marked using acrylic color paint combinations (yellow, red, and orange) on the dorsal surface of the head, the midsection and hindlegs. The markings were retained for approximately one week after application and were observed peeling off within the third week. This short duration of being marked reduces the likelihood of severe predatory pressure. Snout-vent length and snout-ear were measured with 15-cm calipers, whereas tail length was measured by folding rule to the nearest millimeter. The whiptail was placed in a cotton bag and weighed with a hand-held 100-g spring balance. Individual tail loss and gravid females were noted.

For the purpose of the whiptail survey, a total of nine lines was placed 20 m apart across the island extending from the west to the eastern tip of the island. The total length of the transect lines was 376.8 m. The shortest line established was 18.3 m. and the greatest length was 64.05 m. Lines were run at 360 degrees, in a northeast to southwest arrangement, perpendicular to habitat changes. Red and white flagging was placed at 3.05 m. intervals along each line.

Two surveys were conducted during the second week. Transect lines were walked between 09:00 and 14:00 hr. The observer first scanned up the line before following the line in a deliberate manner. When a lizard

was sighted, I recorded its sex and age, then its exact location with flagging tape. Pairs found together were recorded at the same location if they were within 20 cm of each other. Sex was determined by the color, length of tail, and behavior. If I was unsure if the individual had been counted previously, the sighting was not recorded.

The results of the surveys were analyzed using a modified version of the Lincoln-Petersen model for population estimation. The Chapman model of Lincoln-Petersen was chosen for analysis since it gives less bias to the result (Chapman 1960). The application of this population estimator is particularly suitable given a small island and a short time period of capture-release and survey (Lancia et al. 1996, Pollock et al. 1990). The total population estimate for the island is determined by dividing the estimated population from the survey sample by the total sampled area, 0.68 ha. The result is then multiplied by the total area of suitable habitat. An estimated 10% of the total island area is unsuitable habitat for the whiptails, as it is comprised of the cliff faces to the northeast, northwest, and southeast.

For the rat eradication effort, an alternative live small mammal trap was used instead of the Havahart model. This box shaped walk-in model was made from chicken wire with a funnel which terminated in sharp prongs. This allowed entry but the sharpened prong tips prevented the animal from exiting. The trap was baited with ripe bananas and set out overnight.

## **RESULTS**

A total of 34 whiptails was captured on Praslin Island over a period of four consecutive days. The trapped individuals included 22 males (64.7%), and 12 females (35%). Juveniles accounted for 23% of the trapped lizards.

The adult males had mean weight of  $29.59 \pm 12.65$  g. ( $r = 13-56$  g.,  $n = 17$ ) (Table 1). In comparison, the mean weight for juvenile males was of  $19.0 \pm 8.51$ g. ( $r = 7-30$  g.,  $n = 5$ ). The average snout to vent length for mature males was  $9.60 \pm 1.40$  cm ( $r = 7.10-12.37$  cm), in comparison to the juvenile males  $7.64$  cm  $\pm$   $2.00$  cm ( $r = 4.51-9.74$  cm).

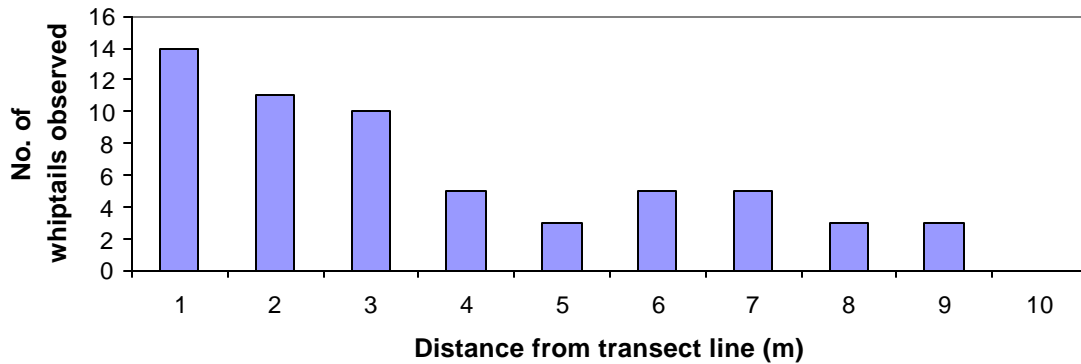
**Table 1. Biometric data from captured adult and juvenile St. Lucia whiptails on Praslin Island, St. Lucia during July 1999**

<b>Gender/Maturity</b>	<b>Weight (gm)</b>	<b>Ear-Snout (cm)</b>	<b>Snout-vent (cm)</b>	<b>Tail (cm)</b>
<b>Adult male</b>				
Average	29.59	2.30	9.60	16.91
Minimum	13.00	1.57	7.10	8.00
Maximum	56.00	2.92	12.37	27.00
Std. Dev.	12.65	0.40	1.40	5.06
<b>Juvenile male</b>				
Average	19.00	1.88	7.64	16.50
Minimum	7.00	1.30	4.51	12.00
Maximum	30.00	2.27	9.74	22.00
Std. Dev.	8.51	0.38	2.00	4.27
<b>Adult female</b>				
Average	31.78	2.44	10.37	21.40
Minimum	26.00	2.10	9.20	16.00
Maximum	38.00	2.76	12.45	27.00
Std. Dev.	4.15	0.23	1.13	3.72
<b>Juvenile female</b>				
Average	20.00	1.91	8.41	18.10
Minimum	19.00	1.87	7.81	17.50
Maximum	22.00	1.95	9.03	19.00
Std. Dev.	1.73	0.04	0.61	0.80

The adult females had mean a weight of  $31.78 \pm 4.15$  ( $r = 26-38$  g.,  $n = 9$ ) (Table 1). In comparison, the mean weight for juvenile females was of  $20.00 \pm 1.73$  ( $r = 19-22$  g.,  $n = 3$ ). The average snout to vent length for mature females was  $10.37 \pm 1.13$  cm ( $r = 9.20-12.45$  cm), in comparison to the juvenile females  $8.41 \text{ cm} \pm 0.61 \text{ cm}$  ( $r = 7.81-9.03$  cm).

The surveys gave an average distance of 3.23 m for whiptail observations on either side of the transect line. The number of observations decreased with increasing distance from the transect line (Fig.2).

**Fig. 1 Whiptail detection and distance from transect lines on Praslin Island**



The maximum range of observations was just over 8 m away from the transect line. This gave a maximum observation width of 18 m to the transect area. The surveys covered 0.678 ha. (61.6%) of the total area. The first survey yielded 24 observations and the second gave a total of 35 individuals (Table 2).

**Table 2. Results of whiptail surveys conducted on Praslin Island, St. Lucia, during July 1999**

<b>Census No. 1</b>			<b>Census No. 2</b>		
Males	9	38%	Males	18	51%
Females	12	50%	Females	13	37%
Juveniles <sup>1</sup>	3	13%	Juveniles <sup>1</sup>	4	11%
<b>Total</b>	<b>24</b>	<b>100%</b>	<b>Total</b>	<b>35</b>	<b>100%</b>

Juveniles<sup>1</sup> were individuals too young to determine gender

A total of 34 whiptails was captured, marked and released over a four-day period in the first week of the exercise. My first survey resulted in 24 whiptails recorded, of which 5 were marked. When Chapman's model is applied, a population estimate of 144.8 is obtained. On applying an approximate 95% CI, (normality is assumed), the result is  $144.8 \pm 85.95$ .

A second survey was conducted on the 12 July. This was conducted during the same time period as the first survey. Results of this survey were 35 whiptails encountered, of which eight were marked. In this instance

when Chapman's model is applied, a population estimate results in  $139 \pm 64.93$  is obtained. The highest number of whiptails recorded came from lines C (Shrub) and E (Woodland) vegetative zones (Table 3).

**Table 3. Survey results of whiptails by vegetative zones on Praslin island, St. Lucia, July 1999**

Transect	Length (m)	Zone	No. of Whiptails found
A	18.3	Woodland	0
B	42.7	Woodland/Shrubs	5
C	57.95	Shrub/Woodland	12
D	64.05	Shrub/Woodland	5
E	61	Woodland/Shrub	15
F	57.95	Woodland/Grasses	6
G	51.85	Woodland/Grasses	6
H	39.65	Woodland/Shrub	5
I	21.35	Shrub/Grasses	5

The total island size is 1.1 ha of which 0.99 ha is suitable whiptail habitat. The results of the first survey provide a total whiptail population estimate of  $211.4 \pm 5.98$ . The results of the second survey indicate a range of approximately  $202.96 \pm 5.98$  individuals for the island. A mean of both surveys estimates results in  $207 \pm 5.98$  whiptail lizards for the island.

A total of 8 juveniles was captured, marked and released. The first survey resulted in seven juveniles recorded of which one was marked. This gave an estimated juvenile population of  $35 \pm 31.19$ . The second survey resulted in 10 juveniles recorded of which none were marked. This gave a juvenile population estimate of  $98 \pm 123.65$ . Juveniles were encountered at the extreme ends of the transect lines in the grasses, and a few were found in the dense scrub along lines H and I.

My efforts at trapping the rats present on the island met with some success using the walk-in box funnel trap and two rats were destroyed on the 10-11 August.

## **DISCUSSION**

The St. Lucia whiptail (*Cnemidophorus vanzoi*) is an endemic saurian of the family Teiidae in St. Lucia. The species was brought to the attention of science in 1958 when it was discovered by G. Williams and E. Long (Long 1974). It remains one of the least studied species of the family and is a critically endangered species in the region. The translocation effort was viewed as an appropriate conservation strategy for the species. The program has not been evaluated since its implementation in 1995. This study sought to answer the questions of how the population is doing since the translocation in 1995.

The study ran from 19 July – 16 August 1999. The translocated population of whiptails has been facing survival issues over the years. Recent records indicate that the island had continually experienced rat invasions within recent months. The island warden, Stephen Lesmond, reported that between 7-29 August 1998, a total of 15 rats were captured and killed. He had been monitoring four stations, which were established as the initial release sites for lizards. His report indicated that lizards were no longer being recorded at two of the release sites.

On arrival for this season (July-August 1999), of research, Mr. Lesmond explained additional challenges were being faced in management of the rats on Praslin Island. Rats continued to be a decimating factor. Havahart traps had been used to capture rats, however, success rates were dropping. From March to May 1999, an attempt was made to poison the rats using a common agricultural rodenticide, Friodom. The application was laid out at dusk, 18:30hr, and removed at 06:00 hr, so as to prevent poisoning of non-target animals. This time period was supposed to exclude lizards and bird activity time. Lesmond reported success in killing some of the rats; however, there was impact on other non-target species such as St. Lucia anole (*Anolis luciae*), hermit crabs (*Eupagurus bernhardus*), whiptails (*C. vanzoi*), and Carib grackles (*Quiscalus lugubris*). Application of the rodenticide was stopped in the last week of May 1999. Whiptail activity had ceased at all four release sites. Observations of one mature male and two mature females, and several

juveniles were all found at an isolated point called “big boulder” at the eastern end of the island. Given this scenario, rat eradication had to be a component of the work to be done. However, this needed a less lethal approach. The walk-in box trap, which enabled us to capture two rats, may provide a suitable future alternative. Lesmond speculates that rats are able to swim to the island when conditions are favorable. The entire Praslin Bay is sheltered and fairly shallow. At low tide, a sand berm surfaced approximately 80m long. It was a hard, compact surface, which can be observed from the aerial photograph (Fig. 2). This situation highlights the need for constant vigilance for predators reaching the island.

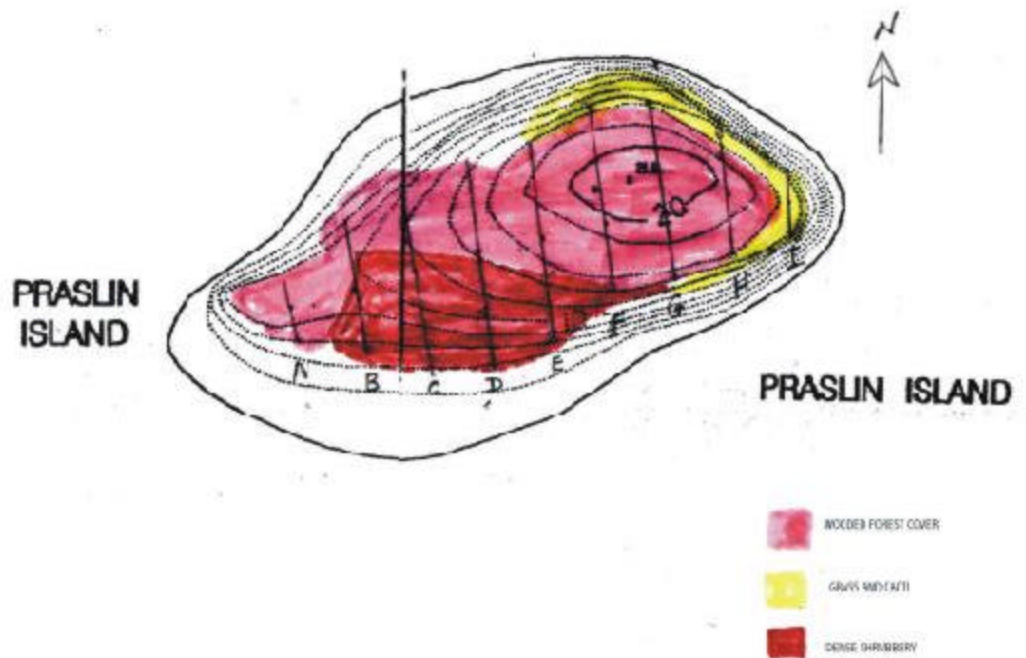
FIG. 2 PRASLIN ISLAND IN PRASLIN BAY

9/11/96



The whiptail surveys were conducted along transect lines which ran perpendicular to the habitat changes extending from the leeward to the windward coast in a southwest to northeast arrangement (Fig 3.).

FIG. 3. TRANSECTS ON PRASLIN



Transect line A ran through a wooded environment with sparse understory and sparse leaf litter. No whiptails were captured in this zone nor were any recorded during surveys. Line B was predominantly shrub with little tree cover. Line C had little tree cover but dense herbaceous shrub (Appendix 1) cover over much of the leeward slope. This reduced effective capture of whiptails. Lines D and E had shrubbery averaging 1-3 m in height with well developed leaf litter layers. Lines E through G ran through well developed wooded cover (3-4 m) with deep litter layer and little understory vegetation on the summit of the island. This enabled easy sighting and capturing of whiptails along with good visibility during censuses. Lines H and I were dense thicket at the summit extending into grasses on the windward slope. The adult whiptails and advanced juveniles were readily encountered in areas of open understory with deep litter

cover. The juveniles stayed in the cover of the grasses and dense thickets closer to the shorelines, thus gaining protection from possible predation by adult whiptails who have been documented as cannibalizing juvenile whiptails (S. Lesmond and D. Anthony pers. commun.).

Results obtained indicate a healthy adult whiptail population inhabits Praslin Island. However, these results are biased to adults due to their larger size and their propensity to occupy open understory. Most of our observations were from the woodland area but I recognized the use of thicket, grasses and shrub habitat for escape cover by juveniles. They were highly elusive under those conditions and were able to evade capture on most attempts. The amount of vegetative cover in the shrubby habitat reduced our ability to observe.

## **CONCLUSION**

The objective of the research was primarily to determine whether the translocated whiptails were thriving on Praslin Island. The results indicate that from a founding stock of 14 whiptail lizards, there is an estimated 207 individuals on the island. While the founding stock consisted of adult pairs, our survey revealed all stages of development and healthy growth among the population. The various individuals occupied respective habitats similar to those encountered in the Maria Islands (i.e. adults used the open understory of the woodlands, whereas juveniles used the grasses and edge habitat for cover. However, there remains the constant threat of pest species, such as rats, being destructive to the population and constant monitoring is required.

## **ACKNOWLEDGEMENTS**

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## APPENDIX (1)

### Botanical listing; Herbaceous species identified on Praslin Island.

*Evolvulus convolvuloides*

*Cynapijolia* spp.

*Solanum racemosum*

*Alysi carpus vaginalis*

*Emilia* spp.

*Erythsoxyum ovatum*

*Spermacoce verticillata*

*Rivina hamilis*

*Coinutia pepamidala*

*Enticostema verticillatum*

*Centrosema virginianum*

*Pithocellobium unquiscati*

*Indigofera sufficosa*

*Eupatorium odoratum*

*Lagascea mollis*

*Microtea debilis*

*Fabaceae* spp.

*Portulaca halimoides*

*Cyperus sphacelus*

*Emilia* spp.

*Fibristylis ovata*

*Ruellia enterosa*

*Croton flavens*

*Lantana camera*

*Ruolfia iridis*

*Spermacoce ernestii*

*Spermacoce verticillata*

*Synedrella hodiflora*

*Peperomi pellucia*

*Croton guildingiana*

*Cordia curassavica*

*Desdemonium incanum*

*Trichostigrea octandrum*

*Vernonia cinerea*

*Stachytarpheta sp.*

*Cissus verticillata*

### **Trees**

*Hippomane mancinella*

*Tabebuia heterophylla*

*Cornutia pyramidata*

*Ficus citrifolia*

*Pisonia fragrans*

*Bursera simaruba*

*Tabonea montana citrifolia*

*Cordia curassavica*

### **Cactids**

*Cephalocereus royenii*