Monitoring the effect of cat removal on reproductive success in Red-billed Tropicbird colonies on Saba, 2013-2014: first season of results

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Report number C103/15

IMARES Wageningen UR

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BO-11-011.05-029

Publication date: 9 October 2015

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Recommended format for purposes of citation: Terpstra, M., Van der Woude, E., Wulf, K., van Rijn, J., Debrot, A.O., (2015) Assessing the effect of cat removal on reproductive success in Red-billed Tropicbird colonies on Saba. IMARES Report C103/15.

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Summary

One of the most deleterious invasive introduced predators worldwide is the domestic cat which has been found responsible for many island extinctions worldwide. Cats can live off both natural prey and garbage and can be a particularly serious threat to ground-nesting bird populations. Saba is an important location for the Red-billed Tropicbird, *Phaethon aethereus* and feral cats are thought to be the main reason for the low breeding success in the southern coastal colonies of this bird.

To make proper decisions in invasive predator management, information is needed on the effects of cat removal on the tropicbird breeding success and the possible resulting increase in egg predation by rats in the case of any "mesopredator release effects". In this study we collected the first season of data needed to assess the effect of cat removal on the breeding success of the tropicbird on Saba. Two tropicbird nesting colonies (Great Level and Tent) were monitored in terms of egg and chick predation, under different net cat-removal intensities and the resulting survival was compared to survival prior to cat removal (as documented elsewhere).

In total, Saba Conservation Foundation removed 19 cats from the entire study area, of which eleven adult cats were removed from the Great Level colony and only six adult cats and two kittens were removed from the Tent colony. The gut contents of the 17 of these 19 feral cats consisted of natural prey (grasshoppers, rats, chickens, anoles and crickets), bait placed in the trap or even plant material. In the previous season 18 cats had already been removed (12 trapped, 6 shot) from the Great Level area.

During the period of September 2013 to May 2014, 46 occupied tropicbird nests were monitored, 27 at Tent, 15 at Great Level and 4 at Fort Bay. Fort Bay was not used in the data analysis. Egg-laying was documented in 34 of these nests. Observed egg failures were due to a variety of causes such as failure to hatch , broken eggs, including the breaking of an egg by an adult, and the disappearance of the whole nest due to heavy rainfall. Egg survival did not show a significant difference between the two colonies. In total 23 chicks were born, of which at least 15 died. Chick survival did show a significant difference between the two colonies, whereas prior to cat removal both had had zero chick survival. The breeding success of the tropicbirds and percentage of chicks fledged did appear to increase encouragingly in the breeding colony where cats had been more intensely culled (Great Level; 28 of initial 35 adult cats removed during two trapping seasons). The success on Great Level is notable, because in the breeding season of 2011/2012 the breeding success had been zero percent for several years.

Around the Tent colony only six adult cats were removed this season (total of 7 removed during two trapping seasons), which was insufficient to effectively increase breeding success in the tropicbird. A comparison of camera-trap densities showed that effective cat density at Tent by the end of trapping remained 4-5 times higher than at Great Level where 28 of the initial 35 adult cats had been removed. In total four black rats were observed on the camera traps but only appeared to be scavenging and no active egg predation was observed. These preliminary results suggest that cat removal seems to improve fledgling survival at no appreciable expense in terms of egg predation and that risks of any hypothetical "mesopredator release effects" are limited. Due to the low sample sizes in this first season, and natural fluctuations in breeding success which are normal in seabirds, clearly happenstance or other causative factors could equally explain the results obtained. Therefore, more definitive conclusions will depend on a more extensive and multi-year effort.

Key recommendations:

- **Continue with and expand feral cat removal from the main tropicbird nesting colonies**.
- **Simultaneously monitor nesting success and fledgling survival** to develop a more robust data set over a longer time-frame. With an expanded sample size, the benefits in terms of net fledgling survival and any risks of potential "mesopredator release effects" can be more firmly assessed.
- Many cats were documented to be wary of traps. Trapping was also very labour-intensive and entailed both trapping and handling stress. For these reasons additional, **more effective yet humane methods (such as predator baiting or shooting) should be used.** These methods have proven to be key to effective control of invasive predators worldwide.
- As long as legislation and control of cat importation, keeping and sterilization remain less than strictly implemented and failsafe solutions remain wanting, we recommend **to focus removal efforts towards key tropicbird nesting colonies shortly before or during the main nesting season** each year.

This research was funded as part of the Wageningen University BO research program (BO-11-011. 05-029) under project number 4308701028 (A Debrot, PI).

1. Introduction

1.1 Background

Saba is a small, 13 km^2 island in the Caribbean (Fig. 1) and part of the Dutch Caribbean. Not only is it home to 1864 residents (CBS, 2014) but also to one of the largest Red-billed Tropicbird (*Phaethon aethereus*) breeding colonies in the Caribbean. The Red-billed Tropicbird is circumtropic in distribution and found in the Caribbean, the Pacific and the Persian Gulf. Key populations occur on the Galapagos and the Cape Verde islands (Nelson, 2005).

The Red-billed tropicbird is the largest of the three species within the tropicbird family. The other two species, the White-tailed Tropicbird (*P. lepturus*) and the Red-tailed Tropicbird (*P. rubricauda*) do not occur on Saba. The White-tailed Tropicbird once did breed on the island, but recent breeding records remain wanting. It is suspected that this is a result of the competition with the Red-billed Tropicbird as these species are known to compete for breeding space (Lee and Walsh-McGehee, 2000). Saba is an important location for the Red-billed Tropicbird (here to after simply referred to as the "tropicbird"), because of its expansive amount of suitable breeding ground. The most reliable counts are those by Lee and Walsh-McGehee (2000) and McGehee (2000) who indicate that Saba accounts for 35% (750-1000 pairs) of the Caribbean population but more recent estimates based on field assessments by Boeken and delNevo are higher (1200-1500; Geelhoed et al. 2013). Almost the entire lower area of the island consists of low shrubby vegetation and steep rocky cliffs (Stoffers 1960). The coastal area of Saba is listed as an Important Bird Area (IBA) by Birdlife International (Collier & Brown 2008). There are four main colonies on Saba. The majority of these areas consist of steep and rocky slopes, ideal for tropicbirds. In recent years the tropicbirds on Saba have not been faring well, as their breeding success has plummeted to near zero as shown by research in previous years in several key colonies (Boeken, unpublished data).

Invasive species can be a serious threat for native wildlife in both island (Fitzgeraldi & Veitch 1985, Karl & Best 1982; Bonnaud *et al*. 2012) and mainland situations (Keitt *et al*. 2002). They can outcompete or predate on the native species and can potentially lead to a plague of or the extinction of native species. Island ecosystems like Saba are often more fragile for invasive species due to a higher "edge effect"; lower genetic diversity and a lack of natural predators (Frankham *et al*. 2003). Native species on islands can often not cope with the introduction of invasive predators (Whittaker 1998) and island biodiversity is among the most vulnerable to introduced exotics (Wittenberg and Cock 2001). On Saba invasive mammal species include the black rat (*Rattus rattus*), the house mouse (*Mus musculus*) and the domestic cat (*Felis domesticus*) (Jongman *et al*. 2010, van Buurt & Debrot 2012). Invasive species are second only to faulty site protection as a global threat to seabirds (Croxall *et al.* 2012). Among the various invasive alien species that impact seabirds, the cat is one of two most deleterious species worldwide (Croxall *et al.* 2012). Feral populations of the domestic cat are highly adaptable and have opportunistic food habits making it easy for them to live off both natural prey and garbage (Bradshaw *et al*. 2013). Consequently, cats have been found responsible for many island extinctions worldwide (Nogales et al. 2004, Campbell et al. 2011).

So far it is only known that cats eat young tropicbirds, but not what their actual impact is on breeding success (Debrot *et al*. 2014). Boeken (unpubl.) took photos, using camera traps, of cats entering nests and taking tropicbird chicks from their nests. As a suggested solution to this problem, feral cats were trapped, neutered and released (TNR) near the coastal island dump in an attempt to limit their reproduction and numbers. Work done in 2012, showed that the cats released near the island dump as part of the TNR program were in poor health. This is known to be common amongst unmanaged feral cat populations due to the lack of proper food, care and vaccination (Jessup 2004). It was suspected that the large concentration of cats was responsible for the dramatic downturn of chick survival in the important nesting tropicbird colonies near the island dump (Debrot *et al.* 2014).

Based on the initial assessment, the Saba Foundation for Prevention of Cruelty to Animals (SFPCA) decided that henceforth cats that are caught or brought in and are unwanted, will be euthanized instead of being neutered and released. Surveys held under inhabitants of the island had shown public support for this change in policy (Debrot *et al.* 2014).

Endarwin (2013) showed that diet and distribution of cats on Saba differ per habitat. Higher cat densities were found around the dump site compared to the forest. Scat analysis showed that the diet in the forest numerically consisted mainly of birds (50%) while at the dumpsite diet consisted mainly of garbage (42%). Tropicbirds are known to breed all year round, but are most active from December until March (Nellis 2001). The data on diet available for Saba had been collected from 11 October 2012 to 6 January 2013 (Endarwin 2013), which straddles but does not cover the breeding season of the tropicbird. The diet of feral cats is often opportunistic and differs with the season (Courchamp *et al*. 2003), seabirds can be a greater part of their diet during the birds' breeding season whereas mammals (often rats) or other prey can sustain them when the birds are not breeding (Marshall 1961). This is also the case with the Yelkouan Shearwater (*Puffinus yelkouan*) on the island Le Levant, where rats support the cat population outside the birds' breeding season (Bonnaud *et al*. 2012). A similar change in diet from rats towards tropicbird chicks depending on the season could also be the case on Saba and may account for the high mortality rates found in the tropicbird colonies in recent years.

Cat control is carried out by the Saba Conservation Foundation (SCF). This kind of control has the potential to cause a lot of controversy, also in the Netherlands (ANP 2013). This has become especially pertinent since 2010 when Saba, St. Eustatius and Bonaire formally acceded to the Netherlands. Often trapping-neutering-releasing programs are offered as an alternative for euthanizing. On Saba this method was used based on expat pressure, in which according to (Collier and Brown 2008) at least 200 cats were neutered and released during a five year period, but in which the total number of cats released up to 2014 is likely to have been more than one thousand individuals (E. Peterson, pers. comm.; Debrot *et al*. 2014). When trying to restore the ecological imbalance brought about by years of TNR practice and starting to remove feral cats, the question arises on how rats may impact the breeding success of birds as removal of cats may lead to an increase in rat abundance and impact.

1.2 Objectives

The assignment has two main objectives:

- To collect data on the diet of the cats by examining the composition of their stomach content.
- To determine the impact of feral cats on the breeding success of the Red-billed Tropicbird on Saba. To this end, two Red-billed Tropicbird colonies on Saba were monitored: Great Level and Tent. The following questions were posed:
    - what is the difference in egg survival between the two colonies?
    - what is the difference in chick survival between the two colonies? The effect of the removal of cats on breeding success was determined by comparing the chick and egg predation on Great Level (with cat removal) with those on Tent (without cat removal).
    - what is the difference in laying date between the two colonies?
    - what is the effect of cats observed on camera on chick survival?

These results will contribute to a better insight in effect of feral cats on the breeding success of the tropicbird on Saba, insights into the likelihood of mesopredator relationships between cats and rats, and may ultimately be useful for invasive predator management. Invasive species are a major problem and threat to biodiversity in the Caribbean Netherlands and mitigation of their negative effects on indigenous species has been highlighted as a key priority area in the current 5-year nature policy plan (MinEZ 2013).

Fig. 1. Position of Saba in the northern Lesser Antilles.

1.3 Acknowledgements

The project could not have been possible without the support of the Saba Conservation foundation (SCF) and its crew. A special thanks goes to James Johnson for supporting our work in the field and his nice stories. Adrian Delnevo taught MT and EW practical field skills. At Van Hall-Larenstein, Arjen Strijkstra served as tutor while Steve Geelhoed of IMARES also provided many useful suggestions, field guidance and a valuable review of an earlier version of this report. Evette Peterson and the SFPCA provided SCF the use of their traps to catch the cats. Maria and Michel from the Ecolodge provided support during our stay at the Ecolodge. We are very grateful to the Netherlands Ministry of Economic Affairs, and in particular Drs. Paul Hoetjes for the finances that made this work possible. Jan-Tjalling van der Wal made our map. Finally, Dr. Mardik Leopold provided a critical review that made a major difference towards the effective analysis and presentation of our results.

This research formed part of the Wageningen University BO research program (BO-11-011. 05-029) under project number 4308701028 (A.O. Debrot, PI). Author contributions: Conceived and designed the study: AOD, KW. Conducted the fieldwork: MT, EW, JR. Analysed the data: MT, EW. Coordinated the project: AOD, KW. Wrote the report: AOD, MT, EW.

2. Materials and Methods

2.1 Location

In this project, only the breeding colonies Tent and Great Level were studied (Fig. 2), because these two location were the easiest to access and because prior information was available on several years of zero survival at both sites (Del Nevo and Boeken, pers. comm.). The colonies are steep and full of large boulders and rocks, cacti and vines and about 1 km apart. Trees are rare on both sites and the Tent colony is steeper than the Great Level colony. Initial cat population density was previously estimated to be highest at Great Level (285/km^2) and lowest at Tent (166/km^2) (Endarwin 2013). During their studies, Endarwin and de Ruijter (Debrot et al. 2014) trapped and removed 7 out of 22 individual cats detected on camera at the Great Level site (De Ruijter, pers. comm.). As a total of 11 (adult) cats (and 2 kittens) had been removed from this site by them (5 of which had not been recorded on camera) this gives a rough initial population estimate for the Great level cat colony of 35 cats. To test for the (possible) effects of cat removal, we used a basic Before-After-Control-Impact (BACI) approach as commonly used to monitor for environmental impacts. In this the Tent colony can be considered as a "control" site because all else being equal (eg. similar site disturbance), the low catches at this site meant a negligible decrease in cat population density and predation, and an expected negligible increase in fledging success. Trapping locations referred to in the text as "St. Johns", "Dump", Fort Bay and "Great Level" all formed part of the trapping effort spent at the Great Level colony. The trapping locations "Tent", "Garage" and "Paris Hill" were trapping sites for the Tent colony.

2.2 Data collection

2.2.1 Feral cats

2.2.1.1 <u>Cat removal</u>

Feral cats were caught using nine Havahart Single Door Traps, 32x12x10 (inch) or 81x30x25(cm)) with bait. Canned tuna (with oil) or Japanese fishing bait (Sardines used as fishing bait by the local fisherman) served as attractant and was placed inside the traps and in some cases around the traps to lure feral cats. Four traps were placed at the outer edges of the Red-billed Tropicbird colony on Great Level and five at Tent (Fig. 2). They were set once a day in the afternoon, four days a week from 23th of September until the 19th of December 2014 and were checked the next morning to see if any cats had been trapped. If there was nothing caught on a location for two days the trap was relocated in a range of 50-100 meters. Setting and controlling for catches was

Fig. 2. Map showing the location of the Red-billed Tropicbird colonies at Great Level and Tent (green) in relation to the only main paved road of the island. Locations of 5 live trapping locations (yellow) surrounding the two colony sites. Yellow scale bar is 1 km.

relatively labour intensive. The total of 52 nights x 9 (traps) = 468 trap-nights. Each night cost roughly 2.5 (persons) x 4 (hrs) = 10 person-hours per night for a total effort of 520 person-hours expended on the 468 trap-nights.

2.2.1.2 Camera traps

A trap camera (Reconyx HC500) was placed at 21 nests to see which effect the invasive predators had on the egg and chick predation. The trapcam setup was medium-high sensitivity, 3 pictures 1 sec interval, 15sec quiet period, every 5 min a picture following Chan (2013) and Boeken (unpubl.).

2.2.1.3 Cat diet

Once a feral cat was caught is was taken to a secure location (Tent Bay) where it was dispatched by a SCF park ranger. Dispatching was carried out by rifle to secure a fast and painless death. Of the 19 cats caught only 17 cats (10 Great Level, 7 Tent) were studied with respect to food habits. The intestines were removed and thoroughly examined for the presence of food items and fragments.

2.2.2 Red-billed Tropicbird

In order to determine the impact of feral cats on Red-billed Tropicbird breeding success it was necessary to determine Red-billed Tropicbird nest locations and to monitor their colonies. The Red-billed Tropicbird lays one egg on which it breeds for approximately 43 days, when the chick hatches it will be fed for approximately 85 days until it is fledged (fully-developed) (Delnevo 2012).

2.2.2.1 Nest locations

Two methods were used to locate nests.
- By watching the colony and observing birds flying into their nest. If this was the case, the location of the nest was documented on a printed picture of the area, after which the area was later searched.
- A second method required walking through the colony and searching for birds below rocks and bushes. When walking past a nest the bird would sometimes vocalise, revealing its location. Once a nest was found it was marked with a little metal plate with a number on it by gluing it onto the rock with 2 component rock glue. This was done to mark them permanently for future research. Earlier workers had also used marks but these were often washed away The nests were mapped using GPS (Garmin 62) and the locations (of most…) were entered into the SCF nest site database (Appendix A).

2.2.2.2 Nest monitoring

2.2.2.2.1 Adult measurements

Adults breeding for a week were caught and measured and marked as this forms standard part of seabird nest monitoring protocol (Delnevo, 2012). The culmen, head-bill length and nostril-bill tip were measured to the nearest millimetre using callipers (Fig. 3). Bird weight was measured to the nearest gram with a cotton/burlap sack and a spring balance (Pesola, 100g or 1000g, depending on the total weight). In addition, the birds were checked for rings. All birds not having a ring were ringed. The rings were specially made for this study and started with the alphanumeric series SAB002 etc. The aluminum rings are known to wear and tear faster than standard birding rings because adult birds climb and abrade the ring over the rocks. Therefore, the rings were attached to the tibia instead of the tarsus. The use of aluminum rings should be discontinued in preference for stainless steel birding rings from an official bird ringing organization.

Fig. 5. Left photo: Measuring of the culmen. Right photo: Measuring the nostril to bill-tip.

2.2.2.2.2 <u>Egg and chick measurements</u>

To determine an approximate hatching date of the eggs the flotation test was used. This method involves placing the eggs in a container with fresh water. Based on its position in the container and angle in the water an approximate hatching date can be determined using the Egg flotation table (Fig. 6). A geo-triangle was used to measure the angle of the egg in the water.

The average incubation period is 43 days (Delnevo 2012). This allowed us to estimate when hatching would take place. Two days before the estimated hatching day the nest was monitored daily until several days after hatching). As soon as the chick hatches its exact age can be followed. Chicks were weighed and measured every week to monitor growth. The measurements taken from chicks were almost the same as on the adults, only the nostril was not measured with the chicks as this was not useful for estimating age. The measurements were used to back-calculate the age of the chicks of which the exact hatching date was unknown.

Egg position	Stage	Angle to Horizontal	Position	Approximate Age (days)	Approximate days to hatching
	1	0 - 90	on bottom	0 - 6	37 - 43
	2	10 - 44	on bottom	7 - 13	30 - 36
	3	45 - 79	on bottom	14 - 20	23 - 29
	4	80 - 90	on bottom	21 - 27	16 - 22
	5	90	at surface	28 - 34	9 - 15
	6	60 - 90	above surface	35 - 41	2 - 8
	7	< 60	above surface	42 +	1 - 4 Call the nurse

Fig. 6. Egg flotation table (Delnevo 2012)

2.3 Data analysis

2.3.1 Red-billed Tropicbird

The breeding success was assessed and compared using the Mayfield method (Mayfield, 1975). The Mayfield method rejects the conventional breeding success measurement, which only measures the surviving chicks as a percentage. The Mayfield method also uses the survival duration/period of both the chick and the egg. Therefore it not only gives a measure of breeding success, but also of failure risk, the latter of which could be due a number of causes such as e.g. also predation or death of adults (Beintema 1992). This method can be used for the whole breeding cycle including nest building, egg laying, incubation and fledging (when the chick was ready to fly). During the present research, focus was on the incubation and fledging period and used these measures to compare between the colonies.

The Daily survival probability (SD) was calculated with the following formula:

SD = (exposure days – failed nests) ÷ exposure days

“Exposure days” are defined as: the number of days from the estimated laying date or hatching date until the last day the egg failed or the chick died. The number of days for egg exposure was taken from the first time an egg was found or from the estimated laying date according to the float measurement, until the last date the egg was seen in the weekly check or when the failure of the egg was documented on camera. If an egg was first found cold in a nest it was considered as failed from that moment. The number of days for chick exposure was calculated from the day the chick was found or fully hatched (on camera), until the last day the chick was seen. If an egg had hatched or a chick had fledged, the exposure days used were 43 or 85 days, respectively, as average values reported by Delnevo (2012). Hence the average “total breeding period‟ for the tropicbird is 128 days (Delnevo 2012).

Survival probability (ST) for the entire nesting cycle (laying, incubating, nestling) was calculated from daily survival by raising the daily survival probability (SD) to a power equal to the number of days in the nesting period (P).

$$ST = SD^{P}$$

The egg and chick survival were calculated separately and together. SPSS was used to test if the potential differences in the data were significant. To test for potential differences in the timing of egg laying between the two colonies, a Mann-Whitney test was used. To estimate the difference in egg laying date the independent sample T-test was used. For the comparison of chick and egg survival between colonies and between nests, showing and not showing cat activity, a Fischer Exact Test was used. Finally, for the comparison of exposure time of eggs and chicks between the two colonies the Mann-Whitney U test was used.

2.4 Results

2.4.1 Cat removal

In total, 19 cats were removed from the study area based on the total effort of 468 trap nights and 520 person-hours (Appendix B). Cat removal using baited traps was clearly very labour intensive. Other methods, such as opportunistic shooting and the use of predator toxins are to be preferred. Twelve cats were male (63%) and seven were female (37%). Eleven were caught from the Great level colony (Dump, n=8); St. Johns, n=1; Great Level, n=2), and 8 from the Tent colony (Paris Hill, n=6, incl. 2 kittens); Garage, n=1; Tent, n=1). Four (two males and two females) cats had clipped ears, indicating they had been previously neutered. Two of the cats were kittens, both of which were caught on Paris Hill. The locations Great Level, St. Johns and Dump were all located close to the Great Level colony, whereas the locations Tent, Garage and Paris Hill were close to the Tent colony. Figure 7 shows the number of adult cats removed and the number of adult cats registered on camera per 1000 hours for both colonies. Five individual cat were identified on camera at Tent whereas only one at Great Level. So not only were less cats removed from the Tent colony but the camera trap data indicated a 4-5 time higher effective cat density remained at Tent by the end of trapping effort. At Tent, the cats appeared more weary of traps.

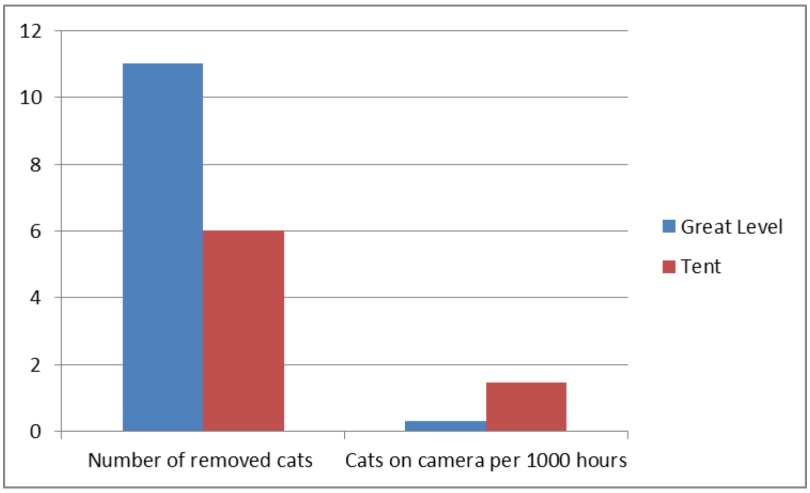

Fig. 7. Number of adult cats removed adult and number of individual adult cats on camera per 1000 camera hours at the two Red-billed Tropicbird colonies studied.

2.4.2 Cat stomach content

Prey remains were found in the stomach contents of 6 of the 17 cats dissected cats. Eight stomachs were empty, three had only bait or only some plant material. The prey items found were grasshopper (*Schistocerca sp.*; one specimen), black rat (*Rattus rattus*; two times a single specimen), chicken (*Gallus gallus domesticus*; a single chick), Saban anole (*Anolis sabanus*; once two anoles) and cave crickets (*Amphiacusta saba*; once two specimen). No human food items or garbage was found and no RBTB remains (see also Appendix C).

2.4.3 Camera trap data and other species

A total of 6349 hours at 21 nests was recorded with the camera traps at the nests, of which 3031 at Great Level and 3408 at Tent. Six cats were documented by trap cameras, five at Tent (the chicks in these five nests disappeared, figure 8) and one on Great Level (where the chick did not get eaten). Other animal species documented on camera were Goats (*Capra hircus*), rats (, Saban Anoles (*Anolis sabanus*), Geckos (*Gekkonidae sp.*), Green Iguanas (*Iguana iguana*), Red-bellied Racers (*Alsophis rufiventris*), Caribbean Hermit Crabs (*Coenobita clypeatusand*) and Mountain Crabs (*Gecarcinus ruricola*). The images did not incriminate any of these species in egg or chick disappearance. Goats, anoles, geckos, snakes and iguanas were visitors which did not target either eggs or chicks at all. However, crabs and rats were documented only after an egg had obviously failed or a chick had disappeared. In total, four rats were observed on camera, two at Tent, one at Great Level (Figure 8) and one at Fort Bay. No predation of eggs by rats was recorded, only scavenging. Cameras placed in front of a cat trap at the Tent site showed that numerous cats attracted to traps did ultimately not enter the traps (ie. they were "trap shy").

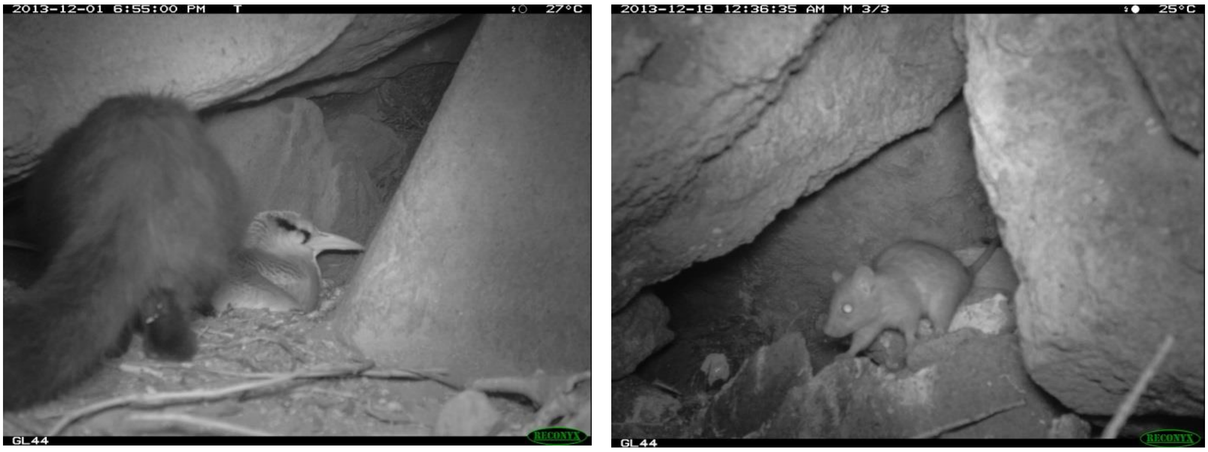

Fig. 8. Camera footage. Left: Cat taking chick with adult bird at nest at T57. Right: Black rat visiting nest after egg failure at GL116.

2.5 Red-billed Tropicbird

2.5.1 Nest activity

During the period of September to January 46 occupied nests were found, 27 at Tent, 15 at Great Level and 4 at Fort Bay. In 34 of the occupied nests, at least 1 egg was laid. Nine eggs failed. Of these 9 failed eggs, 6 failed due to natural causes (failed incubation or flushed away by rain; no predation), 2 eggs disappeared (one from Tent and one from Great Level) and in 1 nesting site, empty egg shells were found (Tent). Observed egg failures were likely due to several possible causes such as neglect of the eggs, possible infertile (incubation problems) eggs, broken eggs, the breaking of an egg by an adult (Fig. 9) and the disappearance of the whole nesting site due to heavy rainfall. At Great Level, four of the five failed eggs, were due to natural causes: one egg disappeared without any evidence of the cause (no camera placed). On Tent, the cause of failure of two out of the three first eggs remained unknown, the other was due to neglect as it was found cold in the nesting hole. Of one of the two, T128, it is unkown if the eggs failed or the chick hatched and got predated. Failed eggs and the remains of broken eggs were scavenged by land crabs or rats. Nine birds started a second lay, of which at least three failed in a similar way as in the first attempt. In total 23 chicks were born, of which 16 died (Table 1), 5 were fledged and two for which the fate remains unknown. These nests were not checked to the death or fledging of the chick, since these chicks were still alive at the end of the monitoring. The whole dataset can be found in Appendix D.

Table 1 - Nest frequencies Tent, Great Level and Fort Bay

	Tent	Great Level	Fort Bay
Total nests	27	15	4
Number of 1st egg	20	12	2
Number of 2nd egg	7	2	0
Failed eggs (1st)	3	5	1
Failed egg (2nd)	1	2	0
Hatched chicks	16	6	1
Chicks died	14	1	1
Fledged chicks	0	5	0
Last time chick alive	2	0	0
Still on first egg	1	1	0
Still on second egg	6	0	0
Cat on camera	5	1	0
Rat on camera	2	1	1

Fig. 9 Adult breaking own egg at nest site GL116.

<u>Laying dates at the Tent and Great Level colonies.</u>

Figure 10 shows the number of eggs laid per month. There was no significant difference in laying month detected between the two colonies (Mann-Whitney: U = 72,5; Z = -0,425; p = 0,671; N = 26). A laying peak occurred in November and a second laying peak in January. The estimated egg laying date shows no significant difference between the two colonies (T-Test: t = 0,696; df = 24; P = 0,213; N = 26). The mean laying date for Tent was November the 5th, on Great Level this was November the 13th. Only 26 nests were used, as only nests with an estimated laying date could be taken into account.

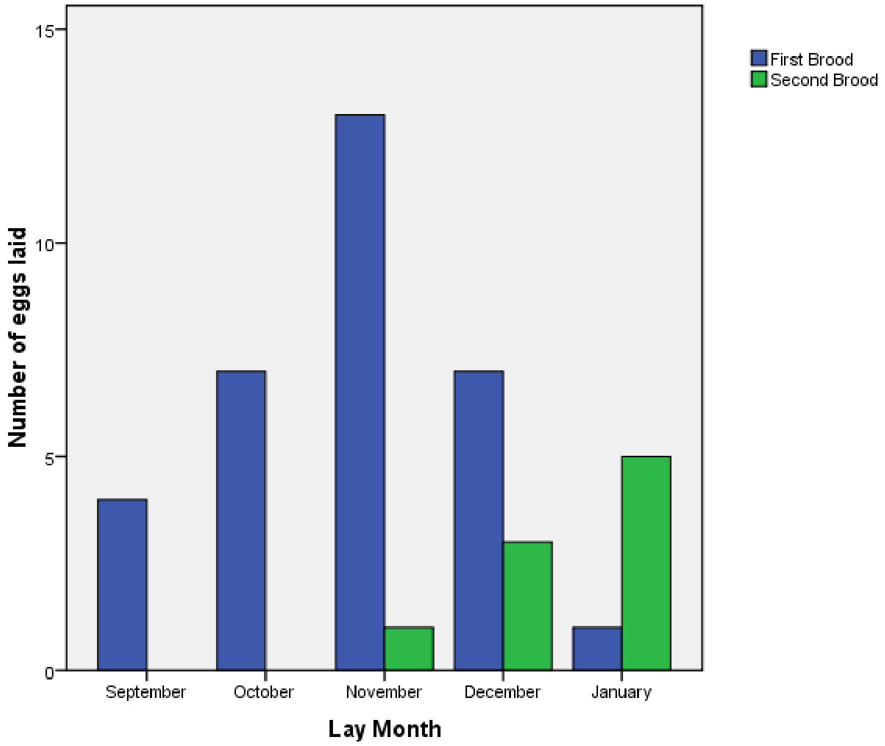

Fig. 10. Number of eggs laid per month divided into first or second brood for both sites combined.

Difference in survival between the colonies Tent and Great Level.

Egg survival
Hatching success of the first brood was 83% (N = 18) at Tent and 54% (N = 11) at Great Level but did not differ significantly (Fishers Exact Test: p = 0,917). The "still on first egg" and T128 were not taken into account. Mean egg exposure lengths for the Tent colony was 37 ± 14 days) and for the Great Level colony was 34 ± 16 days. There was no significant difference in mean egg exposure length between the two colonies (Mann-Whitney: U = 64,00; Z =-0,541; P = 0,589; N = 24). The daily survival probability of the eggs as calculated using the Mayfield method was 0,996 and 0,987 at Tent and Great Level, respectively. The corresponding survival chance for an egg to hatch were 84% at Tent and 56% at Great Level (Fig. 11). Since these are results from a formula, no statistics could be used to compare these percentages. Only the 29 nests with a total followed breeding cycle and estimated laying date were taken into account. Observed egg failure was always natural, but did not involve egg predation in any of the 29 eggs monitored.

Chick survival
Unlike egg survival, chick survival did show a significant difference between the two colonies (Fishers Exact Test: P = 0,00, N = 19). The mean chick exposure time at Tent was 3,09 ± 2,63 days and at Great Level was 85,00 ± 0,00 days (all chicks had the same and maximum exposure time at Great Level), a difference which was statistically significant (Mann-Whitney: U = 0,000; -3,369; P = 0,001; N = 17).

The daily survival probability of the chicks with the Mayfield Method was for Tent 0,676 and for Great Level 0,993. This brings the survival probability of the chicks to zero for Tent and 85% for Great Level (Fig. 23). The total integrated nest survival at Tent was 4% even though net survival was zero as ultimately all chicks died. This sounds paradoxical but is due to giving value to temporary survival at earlier ages, even if at last minute a chick may suddenly fail to fledge.

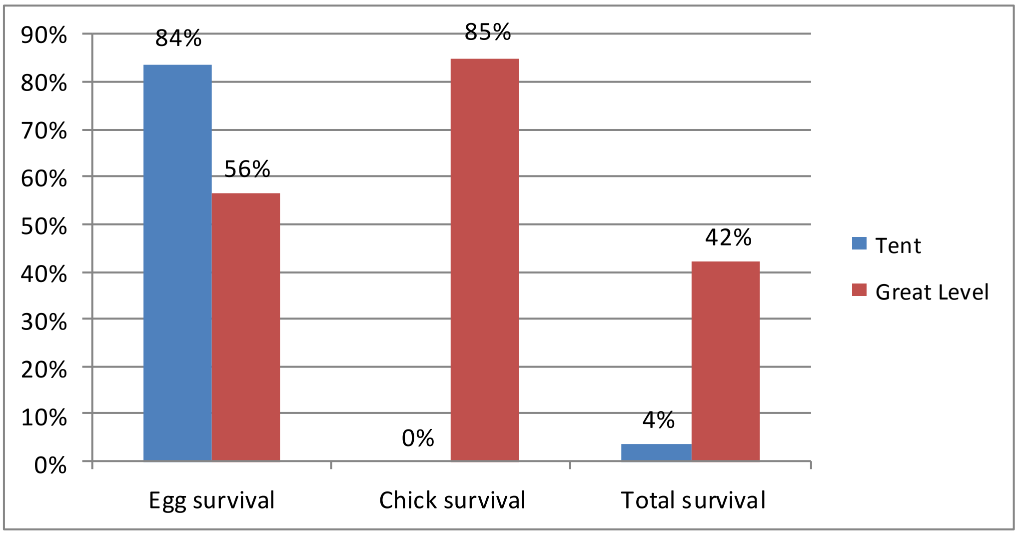

Fig 11. Difference in egg (N = 24), chick (N = 17) and integrated survival (N = 24) between the two colonies.

3. Discussion and recommendations

Cats and rats are both known to impact nesting seabirds worldwide and hence both are potential threats to tropicbird nesting on Saba. Both occur in large numbers on Saba and mutually coexist even though demonstrating strong apparent habitat segregation (Debrot *et al.* 2014). Cats are concentrated in the lower and drier coastal areas and dry-evergreen woodlands, where we presume that prey availability is greater to this ground-dwelling predator. In contrast, rats (specifically the black rat) are more concentrated in the higher areas of the island dominated by humid tropical forest (Debrot *et al.* 2014). This was presumably due to greater food abundance from abandoned fruit trees for the preferentially arboreal black rat (Debrot *et al.* 2014). Even so the effects of possible predator avoidance by rats or density dependent predation cannot be strictly excluded as potential factors in the habitat segregation.

We detected native food in the intestines of only 6 of the 17 cats examined. While several native prey species were recorded, no tropicbird remains were detected. In a more extensive sample involving 94 scats and 11 stomach analyses of Saba cats, Debrot *et al.* (2014) found 15% of food items to be birds, of which about one quarter was the tropicbird. Clearly, the link between prey consumption and impact is difficult to establish based on consumed prey. Many studies do not attempt to establish the link directly but base all management interventions on indirect evidence and assumptions that this link actually exists (e.g. Sarmento *et al.* 2014). Stable isotope analysis today is often useful to assess long-term diet composition that may be difficult or impossible to accurately measure by conventional means through gut contents (Stapp 2002). Notwithstanding lack of strict causal proof of the negative impacts of cats based on diet, a review of cat eradications worldwide shows that all in all post eradication effects are almost always positive (Nogales et al. 2004. Campbell *et al.* 2011).

To make proper decisions on invasive predator management, information is needed on the effects of cat removal on the tropicbird breeding success and the possible resulting increase in egg predation by rats in the case of possible mesopredator release effects (Courchamp *et al.* 1999). An extreme example of this phenomenon is provided by Rayner *et al.* (2007) who describe how removal of cats from an island in New Zealand actually resulted in reduced breeding success of the endangered Cook's Petrel (i.e. contrary to expectations) until rats were also eradicated. In this study we present the second season of measured data in a multi-year project designed to assess the effect of cat removal on tropicbird breeding success in Saba. The data for the first season is not yet fully available apart from summary communications (Boeken, in prep.). We used a basic Before-After-Control-Impact (BACI) approach as commonly used to monitor for environmental impacts to test for the (possible) effects of cat removal. Two tropicbird colonies on Saba were monitored in terms of egg and chick predation. Of 46 occupied nest, 34 produced one or more eggs during this study for a total of 43 eggs and 23 resulting chicks, all of which were followed until full fledging results during the 2013/2014 nesting season.

In the breeding season of 2011/2012 the breeding success in the Great Level colony was zero. All hatched chicks disappeared there within one week. Also at Tent the chicks disappeared within several days, while trap cameras confirmed predation by cats but not by any other of the various species frequenting the nest areas (Boeken, unpubl.). Following two seasons of trapping and removal, our results show that the overall breeding success of the tropicbird (as measured in terms of total survival to fledging) increased from 0 to 40% compared to previously in the Great Level nesting colony where 28 of the original estimated population of 35 (adult cats) were removed (Eleven cats from the present effort, plus 6 by J. Johnson in 2013 (J. Johnson, pers. comm, 2014) and 11 by Endarwin and de Ruijter (Debrot *et al.* 2014) amount to a removal of 28 from the Great level colony). In contrast much fewer where removed from the Tent colony (eight in this effort (of which 2 kittens) (plus one previously by Endarwin and de Ruijter (Debrot *et al*. 2014) and, breeding success only increased inappreciably from 0 to 4%.

While exact numbers present remain unknown, camera traps showed that by the end of two seasons of trapping effective cat density at Tent remained 4-5 times higher than at Great level.

Madden (2015) provides useful comparative results from the neighbouring island of St. Eustatius, where cats are a minor problem compared to Saba. Based on data from three recent breeding seasons at a single site where cats are at low densities, final breeding success (classical survival: ie. not using the Mayfield method) was between 30% and 40% in all the monitored seasons (Madden 2015). This compares favourably with Saba with very high cat densities and very low breeding success in the Saba tropicbird colonies studied, prior to cat culling activities started in October 2012 by SCF (Debrot *et al.* 2014). Egg survival remained unaffected by cat removal even though an increase might have been expected if rat abundance and rat predation would have increased due to cat removal. Several studies from the region suggest that the tropicbird may be less vulnerable to rats than cats and our results seem to corroborate those suggestions. The reduced vulnerability of tropicbirds to rats has been suggested to stem from their larger size and aggressiveness at the nest (Campbell 1991, van Halewijn and Norton 1984) compared to many other smaller ground-nesting seabirds which can be extremely vulnerable to rats (Dewey and Nellis 1980). Madden (2015) found rat "predation" on Tropicbird chicks and removal of eggs to only take place in nests unoccupied by an adult, whereas from our trap camera recordings cats were seen removing chicks in the presence of adult tropicbirds.

Aside from survival data, our camera-trap recordings document actual predation by cats on tropicbird nestlings but no predation by rats on either eggs or nestlings. Cats had also already been unequivocally implicated in the depredation of tropicbird nests on Saba (unpublished data, Michiel Boeken). This suggests that feral cats may pose a larger threat to nesting tropicbirds on Saba than rats. This is also suggested by the fact that the tropicbird has coexisted with rats (and controlled numbers of cats) for centuries, whereas cats have only recently become a problem on Saba (since about 2000) when the TNR practice was introduced. In this, large numbers of unwanted (largely feral) cats were neutered and returned to the wild, instead of being (humanely) put down as before introduction of TNR. Nevertheless, cats and rats on the island may to a certain degree coexist in a mesopredator balance. Under such circumstances, the full removal of cats might result in the ecological release of rats as mesopredators which could theoretically worsen conditions for the tropicbird (Courchamp *et al.* 1999, Allen *et al.* 2014). Based on our results so far, this does not appear to be the case but more data is needed for a better evaluation.

Removal of cats by means of trapping as conducted by the SCF and as studied here was found to be quite labour intensive. Trapping 19 cats while deploying 9 different traps during 60 days cost about 600 person-hours of field effort. Considering the high density (285 cats per km^2 in the Great Level colony based on scat density prior to cat removal, Debrot et al. 2014) and corresponding likely large numbers of feral cats on Saba (Debrot *et al.* 2014), means that alternative more labour-effective methods are dearly needed. Worldwide, all effective cat eradications except one utilized primary poisoning as the main method of eradication (Campbell *et al*. 2011). Of the 87 successful campaigns, on average each campaign used an average of 2.7 methods. These included leg-hold traps (68%), shooting (59%), poisoning (31%), cage traps (29%) and hunting dogs (24%). Hence, preferentially even a combination of methods will be needed to control cat numbers in the seabird breeding colonies. In the past, the predator toxin Temic-10 (Aldicarb) was used successfully at the Saba trash dump and provided overnight kills of more than 50 animals with minimal effort (J. M. LeSueur, pers. comm.). An additional advantage of the use of potent predator toxins like Aldicarb is that death takes place within minutes after consumption to the effect that these feral cats do not have to suffer overnight trapping stress or handling stress. Inhabitants were previously interviewed on their perceptions regarding the acceptability of various control methods. The results showed that for both native and expat Saban residents, this method is fully acceptable as a method to protect the tropicbird from local extirpation (Debrot *et al.* 2014). Other studies also report that cage traps can be very inefficient (e.g. Twyford *et al.* 2000; Bester *et al.* 2002). Cage traps have some special use on inhabited islands where capture of domestic cats is a priority, where domestic cats are non-targets or where other methods may be controversial. Neither local public sentiment nor risks to domestic pet cats should be a complication on Saba and the current circumstances seem favourable to make the step to more effective and efficient cat control methods.

The simple discontinuation of the TNR practice on Saba and euthanasia of unwanted pet and stray cats brought in by the public, may largely suffice to solve the problem of cat predation in the coastal tropicbird colonies of Saba. TNR, once hailed as a major solution to control feral predators like cats, has many problems (Jessup 2004, Hildreth *et al.* 2010) and rarely solves the feral predator issue according to the recent review by Longcore *et al.* 2009). In addition, its main claim that it helps reduce animal suffering (ALLEY CAT ALLIES, 2011) remains totally unsubstantiated. Debrot et al (2014) suggest that the opposite is true. However this may be, without rigorous legislation and control on importing, keeping and sterilizing cats, the feral cat problem will likely continue into the foreseeable future. Therefore, ongoing periodic control will likely be needed to limit cat predation damage. To use limited funds and manpower more effectively, we recommend that more efficient control methods be used and that control effort be concentrated in the vicinity of the main tropicbird colonies prior to, or at the onset of, the main nesting season.

Of the three principal threats to island biodiversity (climate change, urbanization and invasive species), the only one that typically falls under the mandate of nature management is the invasive species issue. In the case of Saba, the Saba Conservation Foundation has not yet been explicitly mandated this responsibility by any legislation or written agreement with government. The SCF after all these years, still has no mandate to assume any nature management tasks aside from the Saba Marine Park and the Saba Bank (K. Wulf, pers. comm.). It is important that the Island Government recognizes the need for controlling cats on Saba, and formally equips the SCF or a government department or service to this important task.

A related but equally important matter regarding the implementation of cat control, is that the SCF still remains under-equipped to address other invasive species (Buurt and Debrot 2012)! The recent review of nature management priorities and finances (van Beek *et al.* 2015) namely concluded that the SCF is grossly underfunded for the work it minimally needs to do.

As follow up to these result the following recommendations can be made:

- Based on these encouraging interim results, we advise to continue with and expand feral cat removal from the main tropicbird nesting colonies as a way to reduce tropicbird chick mortalities and the risk of local breeding extirpation of this flagship species.
- Nesting success and fledgling survival should be simultaneously monitored to develop a more robust data set over a longer time-frame. With an expanded sample size, the benefits in terms of net fledgling survival and any risks of potential "mesopredator release effects" can be more firmly assessed.
- Notwithstanding various lines of indirect evidence suggesting rats may be less of a threat to tropicbird nesting on Saba, this may fully depend on different factors affecting rat survival and availability of other food sources for rats. Therefore baseline data is needed to be able to detect any possible shift from cat to rat predation at an early stage.
- Removal of cats by means of trapping as conducted by the SCF and as studied here was found to be quite labour intensive and entailed both trapping and handling stress for the animals. In addition, observed animals observed often did not enter traps. Considering the comparatively high density (Debrot et al. 2014, e.g. relative to St. Eustatius) and corresponding extrapolated

high numbers of feral cats on Saba, this means that alternative methods and preferentially even a combination of methods will be needed to control cat numbers in the seabird breeding colonies. The use of predator-control toxins is the main and most important tool used in the control of invasive predators worldwide. It has previously been successfully used in Saba and is a method acceptable to both expat and native Saban residents.

- Without rigorous legislation and control on importing, keeping and sterilizing cats, full eradication is not possible and periodic control will be essential. To use limited funds and manpower effectively, we recommend to use a more efficient method than cage capture and that control effort be limited to the vicinity of the main tropicbird colonies prior to, or at the onset of, the main nesting season.
- The SCF after all these years, still has no mandate to assume any nature management tasks aside from the Saba Marine Park and the Saba Bank. It is very important that the Island Government recognizes the need for controlling feral cats (and other invasive species) on Saba, and formally equips the SCF or other government department to fulfil this task. Many invasive species are a principal biodiversity threat (e.g. feral cats) while others may form major economic (e.g. the feral goat, plant pests) or health constraints (invasive mosquitoes) to the Caribbean Netherlands. Consequently the issue of invasive species has been identified as a priority issue in the current 5-year nature policy plan (MinEZ 2013).

Quality Assurance

IMARES utilises an ISO 9001:2008 certified quality management system (certificate number: 124296-2012-AQ-NLD-RvA). This certificate is valid until 15 December 2015. The organisation has been certified since 27 February 2001. The certification was issued by DNV Certification B.V. Furthermore, the chemical laboratory of the Fish Division has NEN-EN-ISO/IEC 17025:2005 accreditation for test laboratories with number L097. This accreditation is valid until 1th of April 2017 and was first issued on 27 March 1997. Accreditation was granted by the Council for Accreditation.

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Justification

Report : C103/15
Project number : 4308701028

The scientific quality of this report has been peer reviewed by the a colleague scientist and the head of the department of IMARES.

Approved: Dr. M. F. Leopold
Researcher

Signature:

Date: 9 October 2015

Approved: Drs. F.C. Groenendijk
Head of Maritime Department

Signature:

Date: 9 October 2015

Appendix A. GPS locations of (most) monitored and marked nests

Name	Latitude	Longitude
FB103	17,616,037	-63,248,581
FB48	17,616,893	-63,251,130
GL101	17,615,527	-63,245,266
GL106	17,616,006	-63,244,579
GL107	17,616,189	-63,244,300
GL108	17,616,153	-63,243,960
GL117	17,616,429	-63,244,840
GL123	17,616,244	-63,244,849
GL124	17,616,196	-63,244,474
GL126	17,616,486	-63,244,666
GL127	17,616,419	-63,244,660
GL157	17,616,410	-63,244,654
GL49	17,617,242	-63,324,514
GL111	no data	no data
GL116	no data	no data
GL118	no data	no data
GL119	no data	no data

Name	Latitude	Longitude
T102	17,619,202	-63,255,550
T104&5	17,619,246	-63,255,510
T109	17,619,439	-63,255,389
T110	17,619,288	-63,255,435
T112	17,619,536	-63,255,571
T120	17,619,339	-63,255,421
T121	17,619,163	-63,255,580
T122	17,619,384	-63,255,400
T128	17,619,574	-63,255,614
T129	17,619,539	-63,255,620
T130	17,619,541	-63,255,611
T51	17,619,213	-63,255,490
T52	17.619.560.	-63,255,600
T53	17.619.560.	-63,255,560
T54	17,619,242	-63,255,493
T55	17,619,250	-63,255,500
T56G	17,619,250	-63,255,520
T57	17,619,550	-63,255,610
T58	17,619,530	-63,255,610
TE46	17,619,232	-63,325,555
TE47	17,619,254	-63,255,535
T113	no data	no data
T114	no data	no data
T114	no data	no data
T115	no data	no data

Appendix B: Overview of the feral cat data

Cat removal data

Cat ID	Trap Loc.	Sub location	Date	Weight (Kg)	Snout-anus length (cm)	Tail length (cm)	Total length (cm)	M (0) / F (1)	Neutered (0 no, 1 yes)	Damages (0 no, 1 yes)	Damages
1		Dump	24-9-2013	3,11	46	28	74	0	0	0	
2		Dump	25-9-2013	3,11	49	28	77	0	0	0	
3		Dump	25-9-2013	3,33	49	27	76	0	0	1	Nose damaged (because of cage?)
4		Dump	26-9-2013	2,8	43	26	69	0	0	1	Paw was weird (see pictures)
5	38	St. Johns	8-10-2013	2,88	41	25	66	1	0	1	Missing right ear
6	31	Dump	8-10-2013	3,06	41	26	67	1	1	0	
7	33	Paris Hill	9-10-2013	1,43	39	19	58	1	0	0	
8	31	Dump	9-10-2013	2,94	44	27	71	0	0	0	
9	313	Paris Hill	13-10-2013	1,89	42	23	65	1	0	0	
10	314	Paris Hill	13-10-2013	not weighed	28	19	47	1	0	0	
11	314	Paris Hill	17-10-2013	1,8	29	18	47	1	0	1	Right ear piece of, left ear damaged
12	314	Paris Hill	18-10-2013	4,09	50	28	78	0	0	0	
13		Great Level	23-10-2013	2,35	46	24	70	1	1	0	
14		Dump	24-10-2013	3,71	44	29	73	0	1	0	
15		Paris Hill	13-11-2013	3,38	50	24	74	0	0	0	
16		Dump	19-11-2013	3,73	47	24	71	0	0	0	
17		Tent	26-11-2013	3,14	48	28	76	0	0	0	
18		Great Level		3,03	48	27	75	0	0	0	
19		Garage	20-12-2013	3,99	52	26	78	0	1	0	

Appendix C. Cat stomach contents


a. Two crickets found in a cat stomach.


b. Grasshopper found in a cat stomach.


c. Chicken claw


d. Chicken remains


e. Rat tail and bones.


f. Remains of two Saban anoles.

Appendix D. Overview of the nest data

Colony: colony location; *Nest nr.*: Nest number; *Egg found*: date egg was found; *FirstSecond Brood*: egg was result of a first or second brood; *Estimated lay date*; *Lay month*: month egg was layed; *Apr. Date Egg failed*: Approximated date of egg failure; *Exp. Days egg*: Exposure days of egg; *Egg hatched*: if egg hatch or not; *Chick found*: date a chick was found; *Apr. Hatch date*: Approximated hatch date; *Date Chick died*: date chick died; *Cause of death*: cause of chick death; *Chick survived*: if chick survived or not; *Exp. Days chick*: Exposure days chick; *Cat onCam*: Cat on camera; *Rat onCam*: Rat on camera.

Colony	Nest Nr.	Egg found	First Second Brood	Estimated Lay date	Lay Month	Apr. Date Egg Failed	Exp. Days egg	Egg Hatched	Chick found	Apr. Hatch date	Date Chick died	Cause Of Death	Chick Survived	Exp. Days chick	Cat OnCam	Rat OnCam
Tent	T105															
Tent	T109															
Tent	T110	18-12-13	First		Dec			Yes				Unkn.	No		No	
Tent	T114		First					No								
Tent	T121	17-12-13	First		Dec	17-12-13	1	No								
Tent	T122															
Tent	T128		First									Unkn.	No		No	
Tent	T130	20-01-14	First	20-01-14	Jan			Yes								
Tent	T51	11-12-13	First	11-12-13	Dec			Yes								
Tent	T52															
Tent	T54															
Tent	T55	29-10-13	First	25-09-13	Sept		43	Yes	11-11-13	10-11-13	14-11-13	Cat	No	5	Yes	No
Tent	T46	30-09-13	First	30-09-13	Sept	08-10-13	9	No								Yes
Tent	T53	21-10-13	First	02-10-13	Oct		43	Yes	13-11-13	13-11-13	13-11-13	Unkn.	No	1	No	No
Tent	T57	22-10-13	First	16-10-13	Oct		43	Yes		01-12-13	01-12-13	Cat	No	1	Yes	No
Tent	T56	29-10-13	First	23-10-13	Oct		43	Yes		05-12-13	06-12-13	Unkn.	No	2	No	No
Tent	T102	05-11-13	First	01-11-13	Nov		43	Yes	17-12-13	15-12-13	23-12-13	Unknown	No	9	No	Yes
Tent	T47	05-11-13	First	05-11-13	Nov		43	Yes	17-12-13	17-12-13	21-12-13	Cat	No	5	Yes	No
Tent	T113	20-11-13	First	08-11-13	Nov		43	Yes	17-12-13	16-12-13	20-12-13	Cat	No	5	Yes	No
Tent	T115	04-12-13	First	26-11-13	Nov		43	Yes		13-01-14	13-01-14	Cat	No	1	Yes	No
Tent	T120	04-12-13	First	27-11-13	Nov		43	Yes		09-01-14	09-01-14	Unkn.	No	1	No	No
Tent	T129	11-12-13	First	27-11-13	Nov		43	Yes		09-01-14	09-01-14	Unkn.	No	1	No	No
Tent	T58	04-12-13	First	28-11-13	Nov		43	Yes	15-01-14	13-01-14	15-01-14	Unkn.	No	3	No	No

Colony	Nest Nr.	Egg found	First Second Brood	Estimated Lay date	Lay Month	Apr. Date Egg Failed	Exp. Days Egg	Egg Hatched	Chick found	Apr. Hatch date	Date Chick died	Cause Of Death	Chick Survived	Exp. Days chick	Cat OnCam	Rat OnCam
Tent	T104	11-12-13	First	03-12-13	Dec			Yes	20-01-14	17-11-13						
Tent	T112	30-12-13	First	24-12-13	Dec											
Tent	T46	18-11-13	Second	18-11-13	Nov	11-12-13	25	No								
Tent	T55	17-12-13	Second	17-12-13	Dec											
Tent	T53	07-01-14	Second	07-01-14	Jan											
Tent	T102	15-01-14	Second	15-01-14	Jan											
Tent	T114	20-01-14	Second	20-01-14	Jan											
Tent	T128	20-01-14	Second	20-01-14	Jan											
Tent	T57	30-12-13	Second	30-12-14	Dec											
Great Level	GL101	24-10-13	First		Oct	24-10-13	1	No								
Great Level	GL106	16-12-13	First		Dec	19-12-13	4	No								
Great Level	GL108															
Great Level	GL119															
Great Level	GL157															
Great Level	GL107		First	24-09-13	Sept		43	Yes	13-12-13	08-11-13			Yes	85	No	No
Great Level	GL127		First	07-10-13	Oct		43	Yes	16-12-13	21-11-13			Yes	85	No	No
Great Level	GL123		First	25-10-13	Oct		43	Yes	13-12-13	09-12-13			Yes	67	No	No
Great Level	GL116	26-11-13	First	01-11-13	Nov	18-12-13	48	No								
Great Level	GL117	26-11-13	First	02-11-13	Nov		43	Yes	16-12-13	16-12-13			Yes	60	No	No
Great Level	GL111	19-11-13	First	09-11-13	Nov	19-12-13	31	No								No
Great Level	GL49	16-12-13	First	19-11-13	Nov	23-12-13	35	No								
Great Level	GL126	23-12-13	First	22-11-13	Nov		43	Yes	08-01-13	07-01-14			Yes	49	Yes	No
Great Level	GL124	13-12-13	First	22-11-13	Nov		43	Yes	16-01-14	11-01-14			Yes	45	No	
Great Level	GL118	13-12-13	First	13-12-13	Dec											
Great Level	GL101	31-12-13	Second	20-12-13	Dec	21-01-14	33	No								
Great Level	GL116	16-01-14	Second	16-01-14	Jan	21-01-14	6	No								Yes
Fort Bay	FB125															
Fort Bay	FB50															
Fort Bay	FB48	10-10-13	First	25-09-13	Sept		43	Yes	06-11-13	05-11-13	05-12-13	Unkn.	No	31	No	
Fort Bay	FB103	24-10-13	First	18-10-13	Oct	07-11-13	21	No								