



Breeding Success of Red-billed Tropicbirds at Pilot Hill, St. Eustatius – a follow-up study (2013-2014)

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Abstract

We assessed the breeding success of Red-billed Tropicbirds (*Phaethon aethereus*) at the Pilot Hill site on St. Eustatius, particularly in relation to predation at the nest. We conducted weekly surveys during 2013-2014 and measured chick and adult morphometrics. Overall apparent hatching success was 64.6%, while apparent fledging success was 75.6%. We used cameras to document the presence of predators at nest sites and wax bait blocks to estimate rat density. Camera traps documented rats opportunistically scavenging eggs that were left unattended for even short periods of time. In total we documented nine predation events of eggs by rats at eight individual nesting cavities.

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1. Introduction

The Red-billed Tropicbird (*Phaethon aethereus*) is the largest of the three species of tropicbirds that occur in the tropical Atlantic, eastern Pacific and Indian Oceans. It breeds on tropical islands, laying a single egg inside a naturally-occurring cavity between boulders or in cliffs. Incubation time for RBTR is approximately 43 days and chicks typically fledge around 80 days (Chan, 2013). Tropicbirds are classified as a species of least concern by the IUCN at the global scale (Birdlife International, 2012). Within the Caribbean, however, the species' status appears to vary among islands. The global population for Red-billed Tropicbirds is estimated at between 5,000 and 20,000 individuals, with the current trend described as decreasing (Croxall et al., 2012). Thus the St. Eustatius breeding population of 300-500 pairs represents around 6-25% of the global population.

2. Project and Field Site Overview

Following our initial study at five nesting sites in 2012-2013, we concentrated this season's study at the largest site, Pilot Hill, on the north-eastern coast. We split the site into two smaller sites, namely Pilot Hill A and Pilot Hill B, in order to compare nesting success at the two areas (figure 1). Pilot Hill B is located closer to the oil storage facility, owned and managed by NuStar Terminals NV. The Pilot Hill study site covers an area of approximately 6,800m², with accessible nests at elevations between 13 and 37m. Following last year's study many nests had already been marked with numbered tags. Due to the topography of sites used for tropicbird nesting it is not possible to visit all nests.

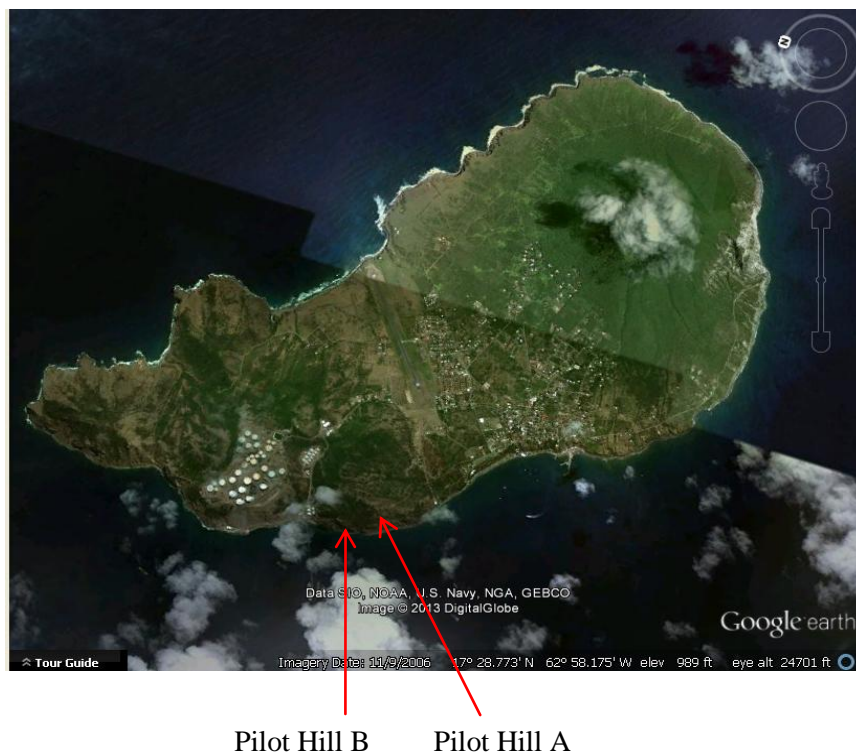


Figure 1: Map of St. Eustatius showing Pilot Hill A and B nesting sites (Google Earth)

3. Methods

We visited each primary nest on average once per week (SE 7 +/-0.69 days). At each nest we noted the number of adults and whether each nest contained an egg or chick. We measured standard morphometrics for each bird (adult and chick). Culmen length (± 0.1 mm) was measured as the distance from the end of the upper mandible to the point where the feathering begins on the head. The length of the head plus bill (± 0.1 mm) was measured as the distance from the end of upper mandible to the back of the skull. Bill depth (± 0.1 mm) was measured at the gonydeal expansion. Each bird was also weighed using a spring scale and previously weighed bag (± 5 or ± 10 g depending upon whether the mass was > 600 g).

Birds were banded using numbered aluminium bands, manufactured specifically for St. Eustatius, funded by the Dutch Caribbean Nature Alliance (DCNA). These purple bands have the prefix EUX followed by four digits. Adults were only measured when first encountered to minimise disruption to their natural behaviour (Le Maho et al, 1992). Chicks were removed from the nest and measured on each visit, although occasionally the size or shape of the nest and the chick's location within it prohibited access to the chick. Measurements were taken using the smallest amount of handling and shortest possible time out of the nest to minimize stress. Where possible we estimated the age of the chicks based on known or estimated hatch dates so that we could monitor and compare growth.

In order to try to gauge rat density in the area, 16 wax blocks consisting of one part peanut butter/eight parts wax were tied at 20m intervals across Pilot Hill A and B every three weeks from 23 January to 31 March 2014. The blocks were set out before sunset and retrieved the following morning.

We deployed ten Reconyx HC500 cameras to monitor activity within nests containing an egg. The cameras were set up to take one photo every five minutes 24 hours a day and also to take three photos, one second apart, every time a variance in temperature was detected. The main focus of the cameras for this project was to capture photos of introduced predators, namely cats (*Felis catus*) and rats (*Rattus norvegicus*).

4. Reproductive Success

Red-billed Tropicbirds lay one egg per nest. We report apparent hatching success (AHS), apparent fledging success (AFS) and apparent breeding success (ABS) for each nesting area.

- AHS is the percentage of eggs that hatched per eggs found

$$\frac{n_h}{n_l} \times 100 = AHS$$

- AFS is the percentage of apparently fledged chicks per number of hatched eggs

$$\frac{n_f}{n_h} \times 100 = AFS$$

- ABS is the percentage of fledged chicks per number of laid eggs

$$\frac{n_f}{n_l} \times 100 = ABS$$

(n_h = number hatched; n_l = number laid; n_f = number fledged)

Each of these measurements was calculated based on our weekly observations from October 2013 to May 2014.

5. Results

Apparent hatching success (AHS) was 70.2% at Pilot Hill A and 52% at Pilot Hill B, with an average of 64.6% across both areas.

Apparent fledging success (AFS) was 75% at Pilot Hill A and 77.8% at Pilot Hill B, with an average of 75.6% across both areas.

Apparent breeding success (ABS) was 42.1% at Pilot Hill A and 28% at Pilot Hill B, with an average of 38.8% across both areas.

Figure 2 shows apparent hatching and fledging success, egg loss, chick loss, fate unknown and breeding success of the Pilot Hill nesting site, showing the difference in success between Pilot Hill A and B.

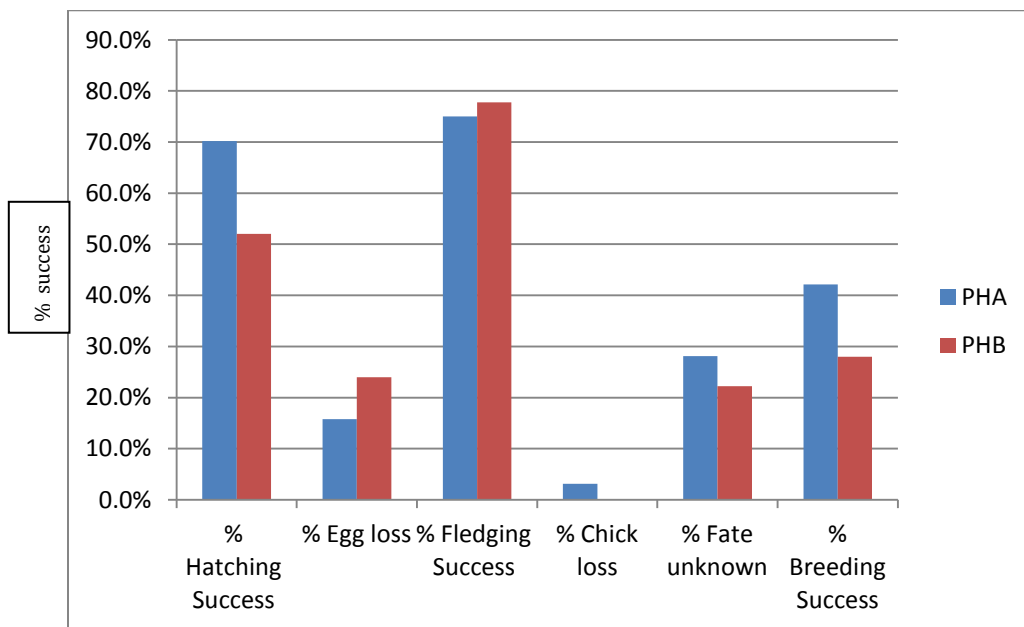


Figure 2: Reproductive success of Red-billed Tropicbirds at Pilot Hill A (PHA) and Pilot Hill B (PHB) in St. Eustatius, October 2013 – May 2014.

Table 1 gives a comparative overview of 2012-2013 and 2013-2014 data, showing number of eggs laid, number of eggs hatched, apparent hatching success (AHS), number of chicks apparently fledged, apparent fledging success (AFS) and apparent breeding success (ABS).

Site name / year	Eggs laid	Eggs hatched (still incubating)	AHS (%)	Chicks apparently fledged (still in nest)	AFS (%)	ABS (%)
Pilot Hill 2013 (n=38)	45	22 (4)	48.9%	15	68.2%	33.3%
Pilot Hill 2014 (n=63)	82	53 (2)	64.6%	31 (11)	75.6%	38.8%
Difference +/-			+15.7%		+7.4%	+5.5%

Table 1: Reproductive Success of Red Billed Tropicbirds at Pilot Hill in St. Eustatius, 2012–2013 and 2013-2014.

Definitions:

Eggs laid: All nests in which an egg is laid (or chick observed)

Eggs hatched: All hatched eggs + nests with chicks

AHS (%): Percentage of hatched eggs per number of eggs

Chicks apparently fledged: Percentage of fledged chicks per number of hatched eggs

AFS (%): All chicks probably fledged

ABS (%): Percentage of fledged chicks per number of laid eggs

Figure 3 offers a comparison of apparent hatching, fledging and breeding success between the 2012-2013 and 2013-2014 season at Pilot Hill nesting site.

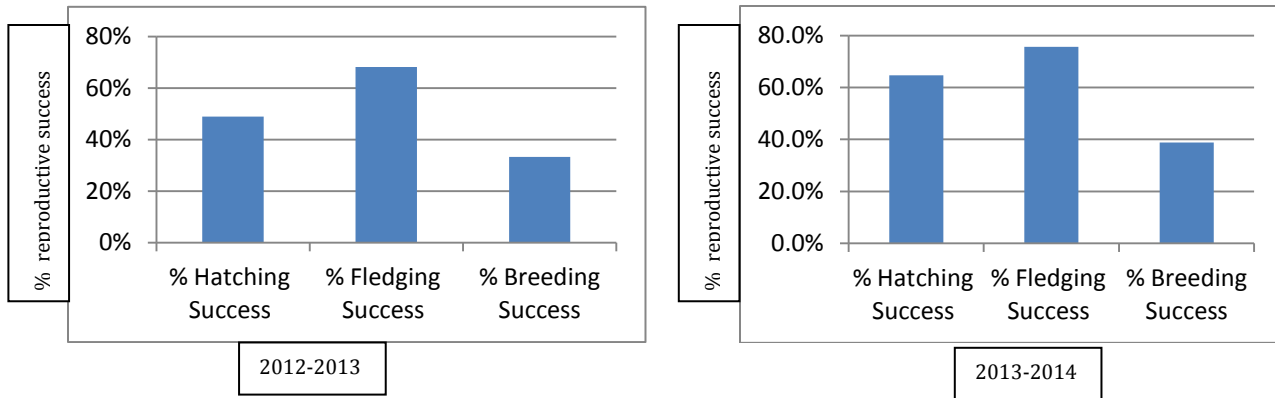


Figure 3: Apparent hatching, fledging and breeding success comparison of Red-billed Tropicbirds at Pilot Hill in St. Eustatius, 2012-2013 and 2013–2014.

Photographs were taken by ten cameras at Pilot Hill between November 2013 and May 2014. Overall, ca. 929,000 photos were taken and there were 25 incidents of rats totalling 970 photos (Table 2).

Nest number	Photos taken	Photos containing Rat	Photos containing Rat %
70	15,347	0	0.0
71	28,148	0	0.0
73	23,498	4	0.017
75	5,693	6	0.105
78	22,764	0	0.0
79	18,504	95	0.513
81	41,291	0	0.0
82	14,534	183	1.259
86	13,074	1	0.008
93	17,088	0	0.0
99	27,057	10	0.037
805	2,761	71	2.572
806	7,368	4	0.054
811	19,126	28	0.146
816	11,755	0	0.0
820	2,231	36	1.614
821	15,464	39	0.252
823	48,760	0	0.0
824	25,421	200	0.787
848	12,815	15	0.117
851	61,191	0	0.0
852	69,275	26	0.038
854	45,462	22	0.048
857	22,467	0	0.0
858	33,030	3	0.013
865	8,429	0	0.0
866	35,186	9	0.026
867	34,420	9	0.026
872	14,993	12	0.080
873	7,642	42	0.549
875	50,899	59	0.116
877	35,332	15	0.042
878	32,892	21	0.064
880	17,227	29	0.168
881	66,399	31	0.047
886	7,822	0	0.0
890	14,366	0	0.0
Total	929,731	970	0.104%

Table 2 – Results of Reconyx cameras at Pilot Hill, November 2013 – May 2014.

On 10 February 2014 we discovered an unattended egg at nest PH18 at 9.35am and left a camera to observe the cavity. Within 50 minutes of departing, the camera captured photos of a rat entering the nest and removing the egg. On 11 February 2014 at nest PH61, we captured images of a rat entering the nest at 1.47am, biting a hole in the egg and eating some of its contents. Approximately one hour later our camera documented a land crab eating the remains of the egg, indicating that land crabs do scavenge eggs but there is no direct evidence that crabs are responsible for predation.

At nests PH34 and PH104 there were two cases of adults incubating eggs longer than average (nine weeks compared with the usual six), with neither egg resulting in a hatching success. The first egg exploded when we extracted the adult to inspect its leg band; the second was abandoned after an incubation period of nine weeks, and after being left in the cavity for four days the egg was scavenged by a rat.

There were also two incidents of an adult bird destroying or removing an egg from the nest. While we cannot confirm the exact cause, the first incident might have been a prospective male looking for a suitable female/nesting cavity. However, the second incident seemed to be a case of self-predation, where the bird had been apparently incubating the egg for approximately five days and suddenly destroyed it (figure 4).



Figure 4: Adult bird destroying egg

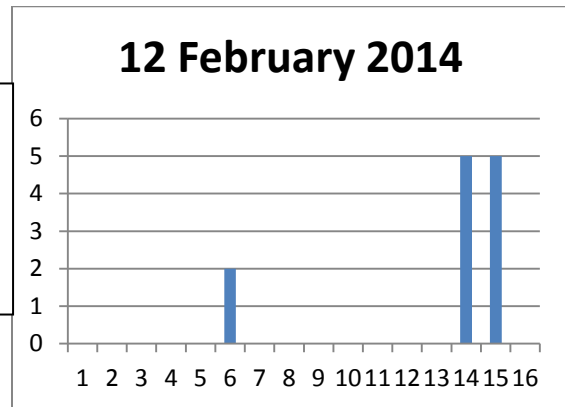
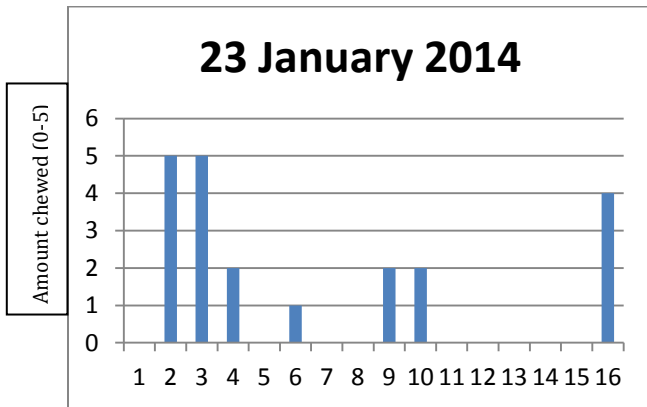
Because our study focused on egg loss, cameras were removed from active nests 1-2 weeks after chick hatching. On 11 occasions chicks disappeared from nests following removal of the camera. We were therefore unable to accurately determine the cause of disappearance. One large juvenile, weighing 570g on our previous visit one week earlier, was found dead inside the cavity; the exact cause of death is unknown but feathers scattered around the area indicated predation.

During fieldwork we also came across a total of five eggs that showed obvious signs of rat predation (figure 5). We were unable to link them specific nests, therefore they have not been included in the data, but it is clear that rats are taking eggs.

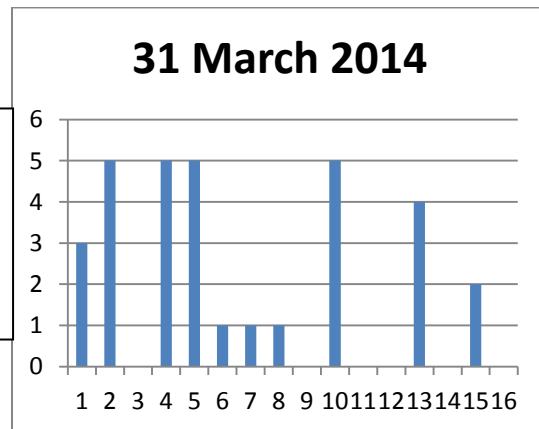
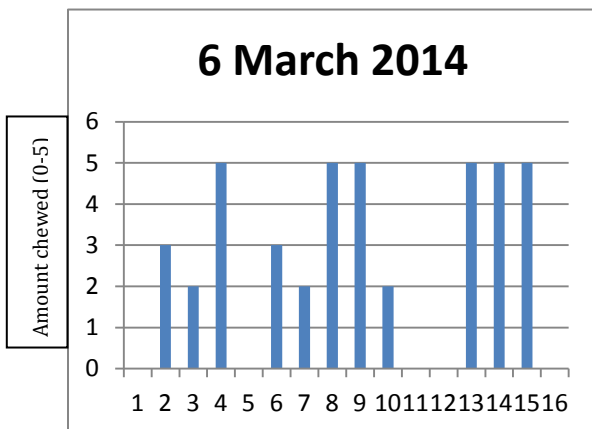


Figure 5: Tropicbird egg showing signs of rat predation, Pilot Hill

The results of the wax blocks were inconclusive, with activity varying over the four dates. The graphs below give an overview of the results per date (Figures 6-9):



(Figures 6 and 7: results of wax blocks showing rodent activity – date indicates when set out. 0 = no bite marks, 5 = completely chewed or block removed)



(Figures 8 and 9: results of wax blocks showing rodent activity – date indicates when set out. 0 = no bite marks, 5 = completely chewed or block taken)

It should also be noted that while the wax blocks primarily showed evidence of rodent bites, there were also indications that land crabs and ants attempted to eat the bait.

6. Nest fidelity

While not officially part of the study, it is interesting to note that there were 17 confirmed incidents of nest fidelity at Pilot Hill. Fidelity can be described as the same nesting cavity being used by one or more adult birds with the same band number. Five nesting cavities were used by the same birds in both 2012-2013 and 2013-2014 seasons, and 12 cavities were re-used in a second nesting attempt by at least one bird in the 2013-2014 season. Long-term monitoring will enable us to paint a clearer picture of nest fidelity among tropicbirds.

7. Conclusion

Our results show that compared with the 2012-2013 season, this season fared slightly better (figure 3). Apparent hatching, fledging and overall breeding success are higher this year than last. However, there were numerous incidents of predation of eggs by rats and one incident of possible cat predation. It is therefore clear that rats are having a detrimental impact on Red-billed Tropicbird nesting success on St. Eustatius, and this needs to be addressed.

8. Discussion and Future Plans

For the 2014-2015 season we would like to begin an island-wide rodent control campaign in collaboration with the St. Eustatius Public Health and Agriculture & Fisheries departments. We will then continue to monitor the Pilot Hill site to assess whether rodent reduction has a positive impact on nesting success.

Provided we can find suitable field tech support, we will also collaborate with the Saba Conservation Foundation to assist them with monitoring, camera traps and feral cat control on Saba (twice a month).

9. Acknowledgements

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