

The Journal of Caribbean Ornithology

RESEARCH ARTICLE

Vol. 31:51–56. 2018

Seabird surveys of globally important populations in the British Virgin Islands

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Photo: Susan Zaluski

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Abstract The British Virgin Islands is home to two globally important and eight regionally important populations of breeding seabirds, distributed across the 60 islands that make up the territory. Here, we re-survey key sites within the islands to assess breeding numbers of the globally important Magnificent Frigatebird (*Fregata magnificens*) and Roseate Tern (*Sterna dougallii*) populations. Our 2013–2014 surveys suggest that both these populations have declined since 1995, with the Roseate Tern population showing the steepest declines. We identify potential threats facing these populations, including those from invasive species and entanglement with fishing line. This study highlights the need for regular, systematic seabird surveys across the territory and the neighboring territories of the U.S. Virgin Islands and Puerto Rico, to ensure any population declines or threats facing populations are identified, and appropriate conservation management practices implemented.

Keywords *Fregata magnificens*, Magnificent Frigatebird, Roseate Tern, seabird census, *Sterna dougallii*

Resumen Muestreos de poblaciones de aves marinas de importancia global en las Islas Vírgenes Británicas—Las Islas Vírgenes Británicas son el hogar de dos poblaciones nidificantes de aves marinas de importancia global y de otras ocho poblaciones importantes a nivel regional; que están distribuidas a través de las 60 islas que conforman el territorio. Remuestreamos los sitios claves dentro de las islas para estimar el número de parejas nidificantes de las poblaciones de *Fregata magnificens* y *Sterna dougallii*, que son importantes globalmente. Nuestros muestreos de 2013–2014 sugieren que ambas poblaciones han disminuido desde 1995 siendo las poblaciones de *Sterna dougallii* las que mostraron un declive más marcado. Identificamos las amenazas potenciales que enfrentan estas poblaciones, que incluyen las especies invasoras y los enredos con sedales o líneas de pesca. Este estudio destaca la necesidad de muestreos regulares y sistemáticos de aves marinas a lo largo de todo el territorio y de áreas vecinas como las Islas Vírgenes de Estados Unidos y Puerto Rico, para asegurar que cualquier amenaza o decline poblacional a la que se enfrenten estas poblaciones es identificada y se implementan las prácticas de manejo apropiadas para su conservación.

Palabras clave *Fregata magnificens*, muestreo aves marinas, *Sterna dougallii*

Résumé Études des populations d'oiseaux marins d'importance mondiale dans les îles Vierges britanniques—Les îles Vierges britanniques abritent deux populations d'oiseaux marins nicheurs d'importance mondiale et huit d'importance régionale, réparties sur les 60 îles qui composent le territoire. Ici, nous étudions de nouveau les sites clés des îles pour évaluer le nombre de couples reproducteurs des populations de Frégate superbe (*Fregata magnificens*) et de Sterne de Dougall (*Sterna dougallii*). Nos relevés de 2013–2014 suggèrent que ces deux populations ont diminué depuis 1995, la population de Sterne de Dougall affichant le plus fort déclin. Nous identifions les menaces potentielles auxquelles font face ces populations, y compris celles provenant d'espèces envahissantes et celles causées par l'enchevêtrement avec des lignes de pêche. Cette étude souligne la nécessité d'effectuer des relevés réguliers et systématiques des oiseaux marins sur le territoire des îles Vierges britanniques ainsi que sur les territoires voisins des îles Vierges américaines et de Porto Rico, afin de s'assurer que tout déclin de la population ou toute menace à laquelle les populations sont confrontées est identifié et que des pratiques de gestion et de conservation appropriées sont mises en œuvre.

Mots clés dénombrement des oiseaux marins, *Fregata magnificens*, Frégate superbe, *Sterna dougallii*, Sterne de Dougall

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The British Virgin Islands (BVI) is a UK Overseas Territory located at the eastern end of the Greater Antillean chain of Caribbean islands, and forms part of the Puerto Rico and the Virgin Islands Endemic Bird Area (Fig. 1; Wege and Anadón-Irizarry 2008). The 60 islands that make up the BVI support 15 breeding seabird

populations (Table 1). At its closest point, the BVI is less than 5 km away from the United States Virgin Islands (USVI), which consists of 50 islands. Despite political separation, the islands share similar biogeography, and the local foraging ranges of many BVI seabird species and other marine species likely span both BVI and USVI territorial waters. The last complete seabird survey for the BVI was conducted in 2004–2005 (McGowan et al. 2006), and reported globally significant populations of Magnificent Frigatebirds (*Fregata magnificens*) and Roseate Terns (*Sterna dougalli*), in addition to eight regionally significant populations. The BVI has three designated Important Bird Areas (IBAs; Wege and Anadón-Irizarry 2008), of which Green Cay and Great Tobago were designated primarily for breeding colonies of Roseate Terns and Magnificent Frigatebirds, respectively.

Magnificent Frigatebirds are distributed on the Pacific and Atlantic coasts of the Americas, from California (USA) to Ecuador (including the Galapagos), and from Florida to southern Brazil (BirdLife International 2018a). The BVI colony represents one of the largest in the Caribbean region, and the only colony within the Virgin Islands. Roseate Terns are present on all continents except Antarctica (BirdLife International 2018b), however they have declined in many regions. In 1987, Roseate Terns were listed as Endangered in the USA and are currently red-listed in the UK after suffering the greatest population decline of any seabird species between 1970 and 1988 (Mitchell et al. 2004). It is therefore of particular importance for the BVI to effectively monitor these globally important populations.

Seabirds typically exhibit a high degree of breeding site fidelity, returning to the same colony year after year (González-Solís et al. 1999, Zador et al. 2009, Gauthier et al. 2010, Braby et al. 2012). However, environmental conditions such as food supply, disturbance, and predation can cause abandonment of breeding sites, particularly for smaller seabird species which are more vulnerable to effects of predation and disturbance (Crawford 2003). Despite suitable breeding habitat being available on other cays within the BVI, Great Tobago is the only cay to support a breeding colony of Magnificent Frigatebirds, indicating high breeding site fidelity for this species. Likewise, breeding site fidelity for over 30 yr has been demonstrated for Roseate Terns in the USA and Europe (Burger et al. 1996, Mavor et al. 2008). However, the Caribbean Roseate Tern populations are reported to be less con-

sistent in their breeding site selection. Movement of color-banded birds among three key breeding areas in Puerto Rico and the USVI ranged from 2% to 50% over 3 yr (Shealer et al. 2005). In addition, two color-banded Roseate Terns which bred in the USVI in 1993 bred in the BVI in 1994 (Saliva and Pierce 1996). Roseate Terns have been reported breeding at 12 different cays in the BVI since 1976, making regular surveys of this species a large undertaking.

Here, we review previous information on the breeding populations of Magnificent Frigatebirds and Roseate Terns in the BVI, and compare with survey data collected during 2013 and 2014. We also present data on the status of other summer breeding seabirds, and present a review of the threats facing the BVI's seabirds.

Methods

Magnificent Frigatebirds

Two complete colony counts of Magnificent Frigatebirds were conducted on Great Tobago (18°26'45"N, 64°49'30"W) during 2013 and 2014. Magnificent Frigatebirds on Great Tobago nest on the crowns of trees and bushes, primarily in a few large stands of seagrape (*Coccoloba uvifera*) trees. In recent years, birds have begun nesting on the slopes on the outer edges of the colony in loblolly (mapoo) trees (*Pisonia subcordata*), and even in a few prickly pear tree cacti (*Opuntia rubescens*). On 10 April 2013, active nests were counted by moving systematically through the colony counting active nests in each individual tree. A second count was undertaken on 27 January 2014 by taking photographs of the colony from a high vantage point in the middle of the island and counting incubating adults and chicks by examining the photographs using Microsoft Office Picture Manager software (Microsoft, Redmond, WA, USA).

Roseate Terns and Other Summer Breeding Seabirds

Twenty islands within the BVI were surveyed from 10 to 22 June 2014 by Jost Van Dykes Preservation Society (JVDPs) staff and volunteers from their sailing and education vessel Endeavour II. All sites with previous breeding records of Roseate Tern were surveyed (with the exception of Guana Island and Virgin Gorda). In many cases, the small rocks and cays of the BVI have no suitable landing points, and so islands were circumnavigated



Fig. 1. Location of the British Virgin Islands relative to the U.S. Virgin Islands and Puerto Rico (map produced in ArcMap 10.0 [Esri, Redlands, CA, USA]).

Table 1. Breeding seabirds within the British Virgin Islands (McGowan *et al.* 2006), and their global or regional importance (defined by BirdLife International criteria [Wege and Anadón-Irizarry 2008]).

Species	Global Importance	Regional Importance
Laughing Gull (<i>Leucophaeus atricilla</i>)		X
Brown Noddy (<i>Anous stolidus</i>)		
Bridled Tern (<i>Onychoprion anaethetus</i>)		X
Least Tern (<i>Sternula antillarum</i>)		X
Gull-billed Tern (<i>Gelochelidon nilotica</i>)		X
Roseate Tern (<i>Sterna dougallii</i>)	X	
Common Tern (<i>S. hirundo</i>)		X
Sandwich Tern (<i>Thalasseus sandvicensis acufavidus</i>)		X
Cayenne Tern (<i>T. s. eurygnathus</i>)		
White-tailed Tropicbird (<i>Phaethon lepturus</i>)		
Red-billed Tropicbird (<i>P. aethereus</i>)		
Audubon's Shearwater (<i>Puffinus lherminieri</i>)		
Magnificent Frigatebird (<i>Fregata magnificens</i>)	X	
Brown Booby (<i>Sula leucogaster</i>)		X
Brown Pelican (<i>Pelecanus occidentalis</i>)		X

by sailing boat or dingy to check for breeding activity. In addition to recording Roseate Terns, the presence of Laughing Gulls (*Leucophaeus atricilla*), Brown Noddies (*Anous stolidus*), Bridled Terns (*Onychoprion anaethetus*), and Sandwich Terns (*Thalasseus sandvicensis*) was also recorded. As surveys could not be conducted by foot, it was not possible to record actual breeding numbers. Instead, we recorded the presence of seabirds as either (1) breeding (adults flying up from or landing in the vegetation, adults carrying fish into the colony, or protective display behavior at the colony); (2) likely breeding (birds flying from the ground or cliff faces but breeding not confirmed); or (3) present (no signs of breeding observed).

In addition to seabird surveys on board Endeavour II, the IBA of Green Cay was surveyed on foot on 10 June 2014. Roseate Tern nests were located, but a total count was not made in an attempt to minimize disturbance to the breeding site.

Tropicbirds

Red-billed Tropicbirds (*Phaethon aethereus*) and White-tailed Tropicbirds (*P. lepturus*) were also recorded during these summer seabird surveys, although peak breeding for these species occurs during the winter months.

Previous Survey Data

Previous survey data for Magnificent Frigatebirds and Roseate Terns were compiled to allow comparisons with this survey. Two

previous studies reported the number of breeding Magnificent Frigatebirds on Great Tobago in 1995, 2004, and 2005 (McGowan *et al.* 2006, Wege and Anadón-Irizarry 2008). Past Roseate Tern data were compiled by JP, who coordinated annual Roseate Tern counts in the BVI between 1993 and 2003. These counts were undertaken by circumnavigation of cays by boat with the exception of the more accessible islands (Cockroach, Seal Dogs, and Green Cay) where direct nest counts were undertaken. In addition, McGowan *et al.* (2006) recorded Roseate Tern numbers in surveys undertaken between 2004 and 2005.

Results

A total of 903 breeding pairs of Magnificent Frigatebirds were recorded in 2013, and 925 breeding pairs in 2014. This represents a decline from the 3,000 breeding pairs reported in 1995 (Table 2), but is higher than numbers recorded in 2004–2005, and still qualifies as a globally important population (Wege and Anadón-Irizarry 2008).

Three Roseate Tern breeding sites were recorded during the 2014 surveys: Green Cay, West Seal Dog, and Broken Jerusalem (Table 3). All sites had been previously used by Roseate Terns, although breeding had not been reported on Broken Jerusalem since 2005 (Table 4). On the 10 June visit to Green Cay, the majority of nests located contained two eggs. We estimated 50–200 adults breeding at each of the three colonies (Table 4). Data on the presence of other summer breeding seabird species and tropicbirds are shown in Table 3.

Discussion

While infrequency in survey data may prevent the detection of all population trends, it appears that since the early 1990s the two globally important breeding seabird populations in the BVI have declined significantly in number.

Magnificent Frigatebirds

Magnificent Frigatebird numbers declined from c. 3,000 pairs in 1995 to 500 pairs in 2005, but have since increased to 903 pairs in 2013 and 925 pairs in 2014 (Table 2). While the decline since 1995 may be attributable to differences in count method, incompleteness of survey, or the time of year the count was undertaken (Ratcliffe *et al.* 2008), the decline could equally be due to reduction in nesting habitat due to the presence of goats (*Capra aegagrus hircus*) on the island and also to a landslide

Table 2. Breeding numbers of Magnificent Frigatebirds on Great Tobago.

Year	Breeding Pairs
1995	c. 3,000 ^a
2004	800 ^b
2005	500 ^b
2013	903 ^c
2014	925 ^c

^aReported by Wege and Anadón-Irizarry (2008)

^bMcGowan *et al.* (2006)

^cThis study

Table 3. Breeding presence of summer seabird species recorded during surveys conducted between 10 and 22 June 2014. (B = breeding, L = likely breeding, and P = present)

Island/Cay	Laughing Gull	Brown Noddy	Bridled Tern	Roseate Tern	Sandwich Tern	tropicbird species
Broken Jerusalem				B		
Carrot Rock	P		P			
Cockroach Island	P		P	P		
Cooper Island— Cistern Point	P		L			B
Dead Man's Chest	P					
East Seal Dog	B		B	P		
Fallen Jerusalem	B					
George Dog			P			
Ginger Island		B				
Great Tobago						B
Green Cay	B			B	B	
Jost Van Dyke	P					
Necker Island	L		L			
Peter Island	B			P		
Prickly Pear						
Round Rock						
The Indians						
Watson Rock						B
West Dog	B		B			
West Seal Dog	B		B	B		

which occurred in July 2011 (caused by overgrazing leading to erosion) which destroyed the seagrape trees and a number of nests within a section of the colony.

Roseate Terns

Although actual counts of breeding pairs could not be made, it is clear that the Roseate Terns breeding within the BVI no longer number in the range of 600 to 2,000 breeding pairs as previously reported (R.L. Norton pers. comm., Saliva and Pierce 1996, Schreiber and Pierce 2009), with only 230–370 terns estimated breeding on three cays during this survey (Table 4). Roseate Terns in the Virgin Islands are difficult to survey as they move breeding sites between years (Fig. 2), including between sites within different territories such as the neighboring USVI and Puerto Rico (Shealer *et al.* 2005). However, surveys conducted by Department of Planning and Natural Resources USVI Fish & Wildlife in 2014 also reported a decline in the USVI breeding population since 2005 (Nellis *et al.* 2014) from 500–1,000 pairs recorded in 2009 to 495 pairs in 2014. This indicates a Virgin Islands-wide decline in numbers.

Other Breeding Seabirds

Laughing Gull was the most abundant summer breeding seabird, being present on 12 of the 20 surveyed cays, followed by Bridled Terns which were recorded on 8 cays. Brown Noddies were only recorded at Ginger Island.

Threats Facing BVI Seabirds

Seabirds, including those in the BVI, face a variety of threats both at their breeding colonies, from factors such as predation,

human disturbance, and coastal development, and at their foraging grounds, for example due to fisheries bycatch and pollution (Croxall *et al.* 2012). Roseate Terns are particularly sensitive to disturbance at their breeding sites caused by human activity and the presence of predators (Burger and Gochfeld 1991). This survey found signs of nest predation of Roseate Terns on Green Cay. Pierce (2009) reported a variety of potential predators of Roseate Tern nests from hermit crabs (*Coenobita clypeatus*) to Laughing Gulls and rats (*Rattus* spp.), all of which are present on Green Cay and most of the other previously reported breeding sites for this species in the BVI.

The practice of egg collecting in the BVI was reported prior to the 1970s, and Schreiber and Pierce (2009) reported finding a pile of 250 eggs on West Seal Dog in 1997. It is not clear if egg collecting is still a major threat. However it appears that human disturbance on Green Cay has increased, due to development on the eastern end of nearby Jost Van Dyke. The establishment of a restaurant and small marina in the early 2000s brought an influx of marine traffic, with the waters adjacent to Green Cay serving as a popular anchorage for visiting yachts, and increased numbers of tourists visiting Green Cay. The development on Jost Van Dyke has also likely resulted in higher densities of black rats (*Rattus rattus*) at this end of the island, with residents on the small island of Little Jost Van Dyke (just 150 m from Jost Van Dyke and 100 m from Green Cay) reporting increasing rat infestations since 2007. This could have also resulted in a higher rat population on Green Cay.

Magnificent Frigatebirds are less susceptible to predation by rats, but feral goats on Great Tobago have reduced available breeding habitat and prevented regeneration of new habitat

Table 4. Breeding Roseate Tern numbers reported in the British Virgin Islands (1976–2014). Counts are of flying adults at the breeding colony. Counts in 1976 undertaken by Mirecki *et al.* (1977); 1990–2014 by JP; 2004–2005 by McGowan *et al.* (2006); and in 2014, this study. B = breeding observed, but no count was conducted.

Island/Cay	1976	1990	1993	1994	1995	1996	1997	1998	2001	2002	2003	2004	2005	2014
1 Broken Jerusalem							20						35	50–70
2 Carrot Rock							12	100						
3 Cockroach Island	20			636			50		221		150	550		
4 Cooper Island— Cistern Point	10		25				35	25	200			20	20	
5 Green Cay		1,200	696	1,060	347	1,755		420						100–200
6 Guana Island	30													
7 Necker Island													10	
8 Peter Island						B								
9 Round Rock			150		40				150			75		
10 Seal Dogs					523		375				50			80–100
11 Virgin Gorda													5	
12 Watson Rock					30									

(Campbell and Donlan 2005). Entanglement with fishing line has also been identified to be a major threat for this breeding colony, with 60 birds found dead at the breeding colony in 2012 either entangled with fishing line in the vegetation or found with hooks and line in their throats (SZ pers. obs.).

Restoring and Protecting Seabird Populations

There are many examples of successful restoration programs for seabirds, which include measures such as prevention of human disturbance, predator removal, provision of nest shelters to reduce predation by aerial predators, and restoration of natural vegetation (Avery *et al.* 1995, Jones and Kress 2012). Indeed the BVI Government, BVI National Parks Trust, and JVDPS, in collaboration with global partners, have already conducted a successful rat eradication program on Sandy Cay, and are in the process of eradicating feral goats from Great Tobago, as well as producing feasibility studies for the eradication of rats from Great Tobago

and Green Cay. In addition to these efforts, other cays should be prioritized for seabird restoration work, and measures such as artificial nest boxes, decoys, and call-playback may be useful to encourage re-establishment of populations once predators have been removed.

An education program is already underway to reduce negative interactions with fisheries (coordinated by JVDPS), both for local and visiting fishers, to inform them of the measures they should take if a seabird is caught by hook and line. Further investigation of appropriate measures that can be taken, e.g., fast sinking lures and bird scarers on lines, should also be investigated (Bull 2007, Bugoni *et al.* 2008).

However, the immediate priority for seabird conservation in the BVI is to establish a long-term monitoring plan for seabirds to ensure complete and systematic surveys are conducted regularly. Cross territorial surveying is also encouraged; both measures will allow for a better understanding of seabird population trends and provide valuable information to address any observed declines and inform conservation measures.

Acknowledgments

These surveys were funded in part by the UK Overseas Territory Project Fund administered by the Office of the BVI Governor and the UK's Darwin Plus Initiative under the project "Using seabirds to inform Caribbean marine planning." We would like to thank staff and volunteers from the Jost Van Dykes Preservation Society (in particular La Vern Peterkin and Krista Ransier), BVI National Parks Trust, and the Department of Conservation & Fisheries for assisting with logistics and fieldwork. Thanks also to Clive Smith and Colen Corea from BVI Airport Authority for assisting with fieldwork.

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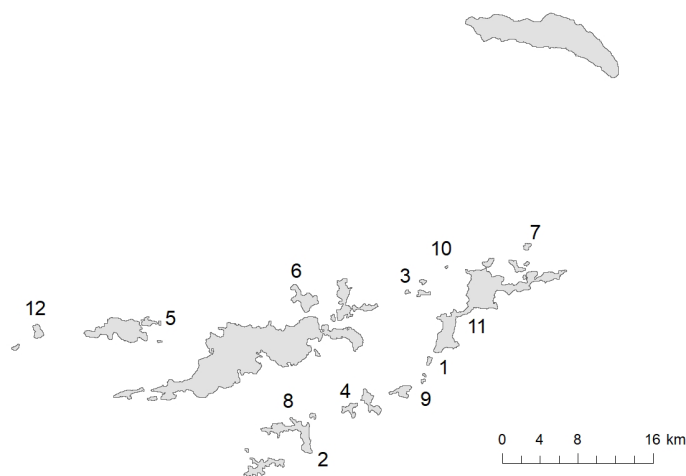


Fig. 2. Locations of Roseate Tern breeding sites within the British Virgin Islands recorded between 1976 and 2014. Numbered sites detailed in Table 4.

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Cite this article as:

Zaluski, S., A. George, C. Petrivic, J. Pierce, N. Woodfield-Pascoe, and L. Soanes. 2018. Seabird surveys of globally important populations in the British Virgin Islands. *Journal of Caribbean Ornithology* 31:51–56.
<https://doi.org/10.55431/jco.2018.31.51-56>