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SEABIRD DENSITIES AT SEA IN SAINT VINCENT AND THE GRENADINES, WITH COMMENTS ON THEIR HISTORIC AND CURRENT POTENTIAL BREEDING STATUS

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Abstract.—I censused 332 seabirds of seven species along 54.1 km² of transects (0.5 km wide) between St. Vincent and Union Island during 23 and 28 December 2001. Boobies, which were most common between St. Vincent and Bequia, accounted for 75.6% of the seabirds observed. Red-footed Booby (*Sula sula*) brown-morph adults outnumbered white-morph adults by a ratio of 7.5:1. Red-footed Booby outnumbered the Brown Booby (*S. leucogaster*) by a ratio of 2.5:1. Magnificent Frigatebird (*Fregata magnificens*) was widespread but occurred in low densities. Royal Tern (*Sterna maxima*) was widespread, accounting for 18.6% of seabirds. Small numbers of Brown Pelican (*Pelecanus occidentalis*), Laughing Gull (*Larus atricilla*), and Sandwich Tern (*S. sandvicensis*) occurred only in the central Grenadines. The historic and current potential breeding status of each species is discussed.

Resumen.—DENSIDADES DE AVES MARINAS EN EL MAR EN SAN VICENTE Y LAS GRENADINAS. Se contó 332 aves marinas de siete especies en 54,1 km² de transectos (anchura de 0.5 km) entre el San Vicente y la isla de Union durante 23 y 28 diciembre 2001. Las bobas, que fueron más comunes entre San Vicente y Bequia, constituyeron 75.6% de las aves marinas observadas. Adultos de Boba Patirroja (*Sula sula*) de fase marón fueron más común que adultos de fase blanco por una ración de 7.5:1. La Boba Patirroja fue más común que la Boba Prieta (*S. leucogaster*) por una ración de 2.5:1. La Tijereta (*Fregata magnificens*) fue amplia distribuida pero se existió en densidades bajas. La Gaviota Real (*Sterna maxima*) fue amplia distribuida, y constituyó 18.6% de las aves marinas. Se encontraron numeros bajos de Pelican Pardo (*Pelecanus occidentalis*), Gaviota Cabecinegra (*Larus atricilla*), y Gaviota Piquiaguda (*S. sandvicensis*) solamente en el las Grenadinas centrales. Se resume el estado historico y corriente potencial de nidificar para cada especie.

Key words: breeding, densities, distribution, Grenadines, Saint Vincent, seabirds

ALTHOUGH THE WINDWARD Lesser Antillean islands provide nesting and foraging habitat for a variety of seabird species, little is known about the breeding populations of seabirds and virtually nothing is known about the offshore distribution and seasonal variation of seabird populations within the region (see reviews and references therein by Halewyn and Norton 1984, Schreiber and Lee 2000a). In St. Vincent and the Grenadines, the only

available historical data on the distribution and breeding of seabirds are provided by Wells (1902), Clark (1905), Devas (c. 1943), and Bond (1950). Unfortunately most of the information is anecdotal and more than a century old. Apparently no subsequent attempts have been made to survey the breeding seabird colonies within the archipelago.

Given the many threats to the dwindling numbers of seabird colonies within the region (e.g., Halewyn

Table 1. Seabird densities (birds/10 km²) along three transects in St. Vincent and the Grenadines.

Species	St. Vincent– Bequia	Bequia– Canouan	Canouan– Union	Total	% Comp.
Brown Booby	18.3	2.7	3.1	10.2	16.6
Red-footed Booby	53.0	1.1	–	25.5	41.6
Immature booby sp.	14.0	3.8	15.3	10.7	17.5
Brown Pelican	–	–	6.1	1.1	1.8
Magnificent Frigatebird	2.3	0.5	1.0	1.5	2.4
Laughing Gull	–	–	1.0	0.2	0.3
Royal Tern	12.9	–	29.6	11.5	18.6
Sandwich Tern	–	–	4.1	0.7	1.2

and Norton 1984, Lee and Schreiber 2000b), surveys of seabird populations at their breeding colonies--as well as in their breeding and nonbreeding foraging areas at sea--are urgently needed. In this paper I provide data on seabird densities at sea in Saint Vincent and the Grenadines based on observations from ships during December 2001. I further summarize historic observations of seabirds within the archipelago, summarize recent observations of visiting birders in the region posted at Internet websites (Smith and Smith 1998, Wells and Wells 2000), and discuss the potential breeding status of each species.

STUDY AREA AND METHODS

A comprehensive review of the marine environment of St. Vincent and the Grenadines is provided by Anonymous (1991). The islands are situated upon a shallow coastal shelf less than 100 m deep, with a narrow trough >500 m deep separating St. Vincent from the Grenadines. Some upwelling of deeper ocean waters, which potentially provides nutrients for seabirds and their food supply, is thought to occur along the eastern edge of the insular shelf.

On 23 December 2001, I twice censused seabirds from aboard the *Admiral I* between St. Vincent (Kingstown) and Bequia (Port Elizabeth) during 09:07–10:00 h and 17:05–17:55 h. On 28 December 2001, I censused seabirds from aboard the *Barracouda* from Union Island (Ashton Harbour) to Mayreau (Saline Bay) during 07:14–07:31 h, from Mayreau to Canouan (Charlestown) during 07:40–08:15 h, from Canouan to Bequia during 08:40–10:22 h, and from Bequia to St. Vincent during 10:32–11:18 h. The sea was relatively calm during the censuses, with waves < 2 m high. Visibility was excellent with partly cloudy skies and no rain.

I searched for seabirds from one side of the ship (nearly always with the better light) on a deck about 7 m above the sea. I censused seabirds along a fixed-width transect by counting all birds within 500 m that crossed an imaginary line perpendicular to the ship. Identification was facilitated with 7x42 binoculars. Seabird numbers were recorded at 5 min intervals.

I measured transect lengths on 1:50,000 and 1:200,000 scale maps and calculated the area of each transect and mean ship speed. From north to south, these transects were: St. Vincent-Bequia, 17.1 km (8.55 km² surveyed); Bequia-Canouan, 37.3 km (18.65 km²); Canouan-Mayreau, 11.8 km (5.9 km²); and Mayreau-Union, 7.8 km (3.9 km²). Ship speeds were 19.9 km/hr for the *Admiral I* and 22.2 km/hr for the *Barracouda*.

For the purposes of analyses, I combined data for the three counts along the St. Vincent-Bequia transect and combined data for the Canouan-Mayreau-Union transects. For each seabird species I calculated density along each of three transects, and compared the abundance of each species (using Mann-Whitney *U* tests; Zar 1984) between distances < 2 km (herein termed “inshore”) and > 2 km from land (herein termed “offshore”) based on data taken during 5 min samples (each roughly 1.5-2 km). Statistical tests were computed with Statistix 3.1 software (Anonymous 1990), with two-tailed probabilities and $\alpha = 0.05$.

RESULTS

I censused 332 seabirds of seven species during this study (Table 1). The total density of seabirds in the archipelago was 6.1/km². The density did not differ between inshore and offshore waters for any species (Table 2).

Boobies of two species accounted for 75.6% of

Table 2. Seabird abundance during 5 min samples (each roughly 1.5–2 km) at distances < 2 km ($n = 24$) and > 2 km ($n = 33$) from land, with results of Mann-Whitney U tests (z values) for differences (none significant).

Species	<2 km	>2 km	z
	Mean (SD) range	Mean (SD) range	
Brown Booby	0.54 (1.50) 0–7	1.18 (3.25) 0–16	0.61
Red-footed Booby	2.38 (7.62) 0–37	2.46 (6.33) 0–26	0.36
Immature booby sp.	1.46 (3.75) 0–14	0.70 (2.27) 0–12	0.02
Brown Pelican	0.25 (1.03) 0–5	0.00 (0.00) 0–0	0.53
Magnificent Frigatebird	0.29 (0.00) 0–2	0.00 (0.00) 0–0	1.59
Laughing Gull	0.04 (0.20) 0–1	0.00 (0.00) 0–0	0.26
Royal Tern	2.50 (6.31) 0–24	0.06 (0.24) 0–1	1.83
Sandwich Tern	0.17 (0.82) 0–4	0.00 (0.00) 0–0	0.26

the seabirds observed (Table 1). The Red-footed Booby (*Sula sula*) was the most common seabird (Table 1), with brown-morph adults outnumbering white-morph adults by a ratio of 7.5:1. The Red-footed Booby outnumbered the Brown Booby (*S. leucogaster*) by a ratio of 2.5:1 (Table 1). Immature boobies accounted for 28.3% of all boobies observed; of these, only 18% were observed closely enough to be identified to species. Booby densities were highest between St. Vincent and Bequia (Table 1); in this area a few scattered individuals flew in a northwestward direction during the morning, in contrast with many flocks (more than 150 were seen beyond the transect) that flew southeastward in the late afternoon.

The Brown Pelican (*Pelecanus occidentalis*) was recorded only in the central Grenadines between Canouan and Union Island (Table 1). Several dozen distant pelicans were observed well beyond the transect at Pelican Cay, to the north of Mayreau. The Magnificent Frigatebird (*Fregata magnificens*) was widespread, but occurred in low densities (Table 1).

The Royal Tern (*Sterna maxima*) was widespread, accounting for nearly a fifth of the seabirds observed (Table 1); its density was nearly significantly higher inshore ($P = 0.067$; Table 2), especially at Bequia and Union Island, than offshore. The Laughing Gull (*Larus atricilla*) and Sandwich Tern (*S. sandvicensis acufavidus*) occurred in very small numbers only at Union Island (Table 1), where higher numbers (12 Sandwich Terns and five Laughing Gulls) were noted the day before on 27 December 2001.

DISCUSSION

Although based on only two days of observation,

this study provides the first estimates of seabird densities at sea in St. Vincent and the Grenadines. In recent years several experienced birders have cruised through the archipelago (Smith and Smith 1998, Wells and Wells 2000). Given the relative comfort and low cost of public transportation among the islands, visiting birders and ornithologists could easily replicate this study to provide further data on seasonal and annual variation of seabird densities within the archipelago and in other island groups of the region. To aid seabird researchers in obtaining further information, I have provided historical comments on the potential breeding of seabirds within the archipelago in an Appendix.

Given that boobies nest in the Caribbean from October-May (Schreiber 2000), in the Grenadines from February-May (Clark 1905; see Appendix), and in Tobago from June-April (French 1991), the substantial numbers of boobies observed likely represent a resident breeding population. The few previously reported booby colonies from the Grenadines (Wells 1902, Clark 1905, Bond 1950; see Appendix) are currently regarded as extirpated or having only a few pairs (Schreiber 2000), but apparently have not been visited by an ornithologist in several decades. Clark (1905) also reported seeing large numbers of both species in the channel between St. Vincent and Bequia.

The persistent northwestward flight of boobies in the morning and southeastward flight in the evening suggest that most individuals were foraging in an unknown area north or west of St. Vincent and nesting or roosting to the south in the Grenadines. I also observed large flocks of boobies flying southward along the east coast of St. Vincent during the evening of 29 December 2001. However, Wells and

Wells (2000) failed to observe large concentrations to the north of St. Vincent, observing only 20 Brown and 11 Red-footed (eight brown, three white) Boobies while sailing from the Pitons, St. Lucia, to Cumberland Bay, St. Vincent, on 4 December, and eight Brown and ten Red-footed (nine brown, one white) Boobies when returning along the same route on 9 December 2000. A century ago, Clark (1905:231) reported that both Brown and Red-footed Boobies are often seen along the west coast of St. Vincent, where some Brown Boobies spent the night along the cliffs, but “The majority, however, begin to fly down the coast at about three in the afternoon, making for Battowia, which island is the favorite roosting place of all sea birds in this region.”

Elsewhere within the archipelago, Wells and Wells (2000) observed the following numbers of boobies: 15 Brown and 36 Red-footed (mostly brown) Boobies between Cumberland Bay, St. Vincent, and Admiralty Bay, Bequia, on 5 December; 22 Brown and 21 Red-footed (17-18 brown, 3-4 white) Boobies between Bequia and Tobago Cays, but mostly near Bequia, on 6 December; 11 Brown and four Red-footed Boobies between Tobago Cays and Bequia on 7 December; and 84 Brown and 16 Red-footed Boobies between Bequia and Cumberland Bay, St. Vincent, on 8 December 2000. Raffaele *et al.* (1998) regarded the Red-footed Booby as rare in St. Vincent and the Grenadines, but my observations and those of Wells and Wells (2000) indicate it is still common.

Although the Brown Pelican was considered to be common throughout the Grenadines a century ago, it has not been reported nesting in the archipelago (Wells 1902, Clark 1905, Collazo *et al.* 2000; see Appendix). A number of Brown Pelicans were also noted in the central Grenadines by Smith and Smith (1998) on 25 May 1998, and by Wells and Wells (2000) on 6-7 December 2000. The long-term local persistence of this species in the central Grenadines suggests that the several dozen seen at Pelican Cay, which presumably has a long association with pelicans as its name implies, might represent a small breeding colony from which individuals disperse to nearby islands. Because Brown Pelicans nest throughout the year in the West Indies (Collazo *et al.* 2000) and from February-April in Trinidad (French 1991), the birds might have been breeding during my visit.

The few scattered individuals of Magnificent Frigatebirds suggest that there are no large colonies of breeding birds, which if present should have been nesting in December (French 1991, Lindsey *et al.*

2000). Small numbers of widely scattered frigatebirds were also reported by Smith and Smith (1998) and Wells and Wells (2000). There are no recent data on former breeding colonies in the Grenadines (Wells 1902, Clark 1905, Lindsey *et al.* 2000; see Appendix).

The small numbers of Laughing Gull, Royal Tern, and Sandwich Tern presumably represent wintering individuals since these species nest during spring and summer (Chardine *et al.* 2000, Norton 2000). All three species have been reported (or at least implied) breeding in the Grenadines, though no recent data are available (Wells 1902, Clark 1905, Bond 1950, Chardine *et al.* 2000, Norton 2000; see Appendix).

There were several species of potentially nesting seabirds (see Appendix) that I did not observe, but were recently reported by others. Wells and Wells (2000) observed one Audubon's Shearwater (*Puffinus lherminieri*) between St. Lucia and St. Vincent on 4 December, five between Bequia and Tobago Cays on 6 December, and one between Bequia and St. Vincent on 8 December 2000, but Smith and Smith (1998) did not see any in May 1998. Wells and Wells (2000) observed two Red-billed Tropicbirds (*Phaethon aethereus*) between St. Lucia and St. Vincent on 4 December, an unidentified tropicbird at Bequia on 7 December, and two unidentified tropicbirds between St. Vincent and St. Lucia on 9 December 2000, but Smith and Smith (1998) also failed to see any in May 1998. Smith and Smith (1998) noted two Masked Boobies (*S. dactylatra*) south of Bequia on 25 May 1998, and Wells and Wells (2000) observed a “possible” individual between St. Lucia and St. Vincent on 4 December, plus another “possible” individual between St. Vincent and Bequia on 5 December 2000. Smith and Smith (1998) reported Roseate Tern (*S. dougalii*), Bridled Tern (*S. anaethetus*), Sooty Tern (*S. fuscata*), and Brown Noddy (*Anous stolidus*) to be common, but mostly between St. Vincent and Bequia, and just south of Bequia, on 22 and 25 May 1998; none were seen by Wells and Wells (2000) in December 2000.

The results of this study, combined with recent observations of other birders, indicate that substantial numbers of potentially breeding seabirds still exist in St. Vincent and the Grenadines. Surveys of the isolated islets within the archipelago, especially those where seabirds previously have been reported to breed (see Appendix), are urgently needed to assess whether these seabirds actually breed and whether any steps need to be taken to preserve them.

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APPENDIX

Historical comments on the potential breeding status of seabirds in St. Vincent and the Grenadines, including the Grenadine islands politically belonging to Grenada. Unless breeding is implied, descriptions of eggs, nests, and nest site selection are excluded.

Audubon's Shearwater.—“...lives in holes and under rocks on most of our islets...Bonaparte Rocks are a favourite abode...On Easter Monday, 2nd April, 1888, I paid a visit to a small islet called Labaye Rock, about a mile off the Port of Granville...a young bird was discovered in a hole under a stone... This caused me to make a thorough research...I found an adult bird with a young in one hole, and a full-grown female and one egg in another” (Wells 1902:241). “...breeding, according to Wells, on most of the small islets about Carriacou, especially on Bonaparte Rocks” (Clark 1905:229).

Red-billed Tropicbird.—“It frequents Frigate

Island and Rose Rock, from which I have taken its eggs” (Wells 1902:251). “There is a considerable colony of them near Old Woman’s Point, just west of Kingstown, and another at Layou [St. Vincent]... at Bequia they breed in numbers in the inaccessible cliffs of Bequia Head...great numbers breed on Battowia and Balliceaux, and there are other colonies on Frigate Island, Rose Rock, Kick-‘em-Jenny, and Les Tantes, between Carriacou and Grenada” (Clark 1905:230). “From this, and the evidence (as well) of fisherman, is established that the *Lea Rocks* (one of them in particular) and *Kick-‘em-Jenny* are homes and nesting--, as well as resting--places” (Devas c. 1943:61).

Masked Booby.—“Occurs sparingly on Kick-‘em-Jenny, and probably also at Battowia. The eggs [implying breeding] are uniform dull white” (Clark 1905:231). “Colonies thriving in the Grenadines” (Bond 1950:5).

Brown Booby.—“Hundreds of boobies, mainly of this species, nest at Battowia and Kick-‘em-Jenny, and there is said to be a large colony on Little Tobago (off Petite Martinique)...The breeding season is from February to May” (Clark 1905:231).

Red-footed Booby.—“This bird is not numerous in Carriacou, though large numbers of them inhabit Kik-‘en-jenny [*sic*], a rock about ten miles distant... They lay one egg only [breeding implied]” (Wells 1902:242). “It is said to breed commonly on Battowia...It nests in numbers on Kick-‘em-Jenny” (Clark 1905:231). “Nests...in the Grenadines (Battowia, Kick-‘em-Jenny and, perhaps, Little Tobago)” (Bond 1950:6).

Brown Pelican.—“I was under the impression that they nested on some of the outlying rocks, but have now determined that they resort to the coast of Florida to breed, during the months of February, March, and April. In May and June they begin to return in numbers, and the young of the year are easily distinguished” (Wells 1902:242). “It occurs mainly in the winter months, and almost wholly disappears in the spring, but returns in early summer... does not breed anywhere in these islands, but is merely an annual visitor, possibly from southern North America and the Greater Antilles...after careful search and exhaustive enquiry I could find not the slightest sign of their ever having done so” (Clark 1905:232).

Magnificent Frigatebird.—“They nest in colonies at Kick-en-jenny [*sic*]” (Wells 1902:243). “In the Grenadines they breed in numbers on Battowia, whence the young are sometimes taken for

food” (Clark 1905:233).

Laughing Gull.—“They breed on the islets, Isle-de-large being a favorite one, in the months of May and June” (Wells 1902:239). “They nest on the small islets about Carriacou, and rather generally on the more isolated keys all through the Grenadines” (Clark 1905:256).

Royal Tern.—“They breed on the rocks; but I have hitherto been unsuccessful in procuring their eggs” (Wells 1902:239). Clark (1905:257) described the eggs but did not specifically mention breeding.

Sandwich Tern.—“Breeds...among the Grenadines (Tobago Cays)” (Bond 1950:55).

Roseate Tern.—“A few years ago these birds used to frequent Jack-a-dan Island, off the Port of Hillsborough [Carriacou], in large numbers; they also used to breed there, but for some reason they have now deserted it, and seem to have made Frigate Island and Rose Rock their nesting places” (Wells 1902:239-240). “...breeding, among other places, at Frigate Island and Rose Rock near Carriacou. Formerly it bred in numbers at Isle Jaques Adam near the town of Hillsborough, but for some reason has of late years deserted this locality” (Clark 1905:257). “...it breeds with us, e.g., on Green Island” (Devas c. 1950:53).

Bridled Tern.—“Numerous at Isle-de-Large, Rose Rock and White Island. At the eastern end of White Island is a conical hill where the Noddy congregates in large numbers. The hill is honeycombed and is just the place for it to deposit eggs. I have taken several sets of eggs at Rose Rock and Isle-de-large in May; the colony at White Island is inaccessible” (Wells 1902:240). “...nesting abundantly at Lee Rocks, and on Rose Rock. There are smaller colonies on many of the smaller keys, and a number breed on White Island, in the midst of a rookery of several hundred Noddies (*Anous stolidus*)” (Clark 1905:258).

Sooty Tern.—“...it breeds in numbers on the islets between this island [Carriacou] and Grenada; a few may be seen at Bonaparte Rocks and Isle-de-large” (Wells 1902:240). “...breeding on Isle Ronde, Kick-‘em-Jenny, Lee Rocks, Bonaparte’s Rocks, and Isle de Large, as well as on some of the smaller islets” (Clark 1905:258).

Brown Noddy.—“...nesting at Isle de Large, Rose Rock, and White Island near Carriacou, and on Western Key off Bequia. There are also other less important breeding areas” (Clark 1905:259).