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Year 1 Results of Seabird Breeding Atlas of the Lesser Antilles

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INTRODUCTION

Environmental Protection In the Caribbean (EPIC) carried out breeding seabird research in the Lesser Antilles between February and June 2009, to determine the abundance and distribution of breeding seabirds within the archipelago. The research spans two years, with the study continuing in January to July 2010. This allows each island to be surveyed both in the winter (February-mid April) and summer (May- July) breeding seasons.

The basis for the project was the limited existing data on breeding seabird populations in the Lesser Antilles. Many islands had never been systematically surveyed, had incomplete data sets or only anecdotal accounts. Research was, therefore, undertaken in the following islands: St. Maarten, Saba, St. Eustatius, St. Kitts, Nevis, Montserrat, Antigua, Barbuda, St. Lucia, St. Vincent and the Grenadines, Grenada and the Grenadines. It is intended that breeding surveys will be completed in Sombrero, north of Anguilla in 2010 (they were not undertaken this year due to inclement weather). Similarly, it is planned that Dominica will be included in 2010. It was not surveyed in 2009 due to the perception that data was extant, which was later confirmed incorrect. Anguilla, St. Barthelemy, Guadeloupe, Marie-Galante, Martinique and Barbados have complete seabird data and were not surveyed by the team. Existing data from these latter islands will be incorporated into the Atlas.

The research will form the Seabird Breeding Atlas of the Lesser Antilles. A hard copy will be given to all participating countries in the study area, generally to the government. The data will inform the Society for the Conservation and Study of Caribbean Birds (SCSCB) Waterbird Conservation Plan and will be available to the public on the web at the West Indies GIS and OBIS/SEAMAP. The study involved an ongoing literature review of breeding seabird records within existing papers, books and articles, as well as gathering information held in libraries and bird group archives. Anecdotal information from fishermen and other interest groups was also noted. This was particularly interesting in the case of the nocturnal Audubon's Shearwater, when locations were suggested for historic colonies that were otherwise hard to locate within the time frame of the study. Information on egg poaching and other threats to seabirds was also forthcoming as well as anecdotal trends in seabird numbers.

The field work included collecting data on the number of breeding seabirds and threats to their populations on every island within the study area. Consistent methods were used and documented to allow repeat surveys in the future.

Outreach included presentations and meetings with governments and interest groups, education at schools, and media campaigns. A permit to undertake the non-obtrusive research was obtained in every participating country. Katharine Lowrie (Project Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) undertook the research.

Table 1. Seabird Species Recorded and Breeding Status during the 2009 Lesser Antilles Study.

Species, Common Name	**Species, Latin Name**	**Status**
Red-footed Booby	*Sula Sula*	Breeding
Brown Booby	*Sula leucogaster*	Breeding
Masked Booby	*Sula dactylatra*	Breeding
Magnificent Frigatebird	*Fregata magnificens*	Breeding
White-tailed Tropicbird	*Phaethon lepturus*	Breeding
Red-billed Tropicbird	*Phaethon aethereus*	Breeding
Brown Pelican	*Pelecanus erythrorhynchos*	Breeding
Audubon's Shearwater	*Puffinus puffinus*	Breeding

Laughing Gull	*Larus atricilla*	Breeding
Royal Tern	*Sterna maxima*	Non Breeding
Sandwich Tern	*Sterna sandvicensis*	Non-Breeding
Roseate Tern	*Sterna dougallii*	Breeding
Sooty Tern	*Onychoprion fuscatus*	Breeding
Bridled Tern	*Onychoprion anaethetus*	Breeding
Brown Noddy	*Anous stolidus*	Breeding

Note: Islands will be surveyed during the summer and winter seasons. Birds that were not recorded breeding may yet be confirmed breeding within the study area when summer surveys are undertaken in the northern islands.

GENERAL METHODS

Field Work Overview

Water-based Surveys

The research was undertaken throughout the Lesser Antilles from a live-aboard 50ft wooden yacht (with motor). This provided the means for moving between islands and the platform for surveying most of the islands. Occasionally fishing boats, other motor boats or a two-person plastic kayak were used to survey islands. These were particularly useful in shallow water as their drafts were much less than the main survey boat.

Wherever possible, islands were surveyed on land. The researchers most frequently swam to islands (with a dry bag of equipment), but sometimes used a kayak, particularly when accessing islands surrounded by strong currents. The survey boat would meanwhile either anchor or 'heave-to' nearby. A note of where islands were accessed and where the survey boat was anchored is made in the individual island reports. It should be emphasised, however, that anchorage and boarding depended on prevailing weather conditions at the time and should be up to the discretion of the skipper and surveyors.

Most islands (particularly the main islands) were circumnavigated first by the survey boat (or occasionally local fishing/marine park boat) to gain an understanding of the key areas for breeding seabirds. This was often the only available survey technique on large islands with many offshore islands or steep cliffs. Binoculars (8x45 waterproof) were used to search the coastline for breeding seabirds. One surveyor observed the breeding activity and the other recorded the data in a 'Rite in the Rain' book. The third surveyor (Captain) also searched for breeding activity. A digital camera (FugiFilm, FinePix S5800) was used to take photos of breeding colonies, aid counting and serve as a visual memoir.

Areas where seabirds were observed flying, roosting or perching were inspected, as well as areas of guano. The large and conspicuous species (boobies, frigatebirds, pelicans and tropicbirds) were often visible from a distance through binoculars (particularly the highly visible white booby chicks). *Laridae* generally required closer inspection to determine breeding, but generally all seabirds were visible from some distance in the air when colonies were present.

Crevice nesting species, particularly tropicbirds, were often best surveyed from a boat during the peak period when birds returned to their nests and spiralled conspicuously around their nest sites. The peak period for surveying White-tailed Tropicbirds was potentially between 0900-1000 (few birds were observed during the survey) and Red-billed Tropicbirds between 1530-1700, when maximum counts were made. Inaccessible or vertiginous cliffs and small islands with good site lines

were often best surveyed by boat. Water-based surveys were more time efficient than land surveys, allowing more data to be gathered in a shorter time span.

Data Recorded

When breeding was confirmed a GPS (Garmin GPS 72) reading using Universal Transverse Mercator (UTM) datum was noted. If a GPS location could not be taken (i.e. malfunctioning GPS) 'Google Earth' and navigation charts was used to determine the approximate colony location. The following data were recorded: the time, date, location (name of area), survey type (water-based, land-based or aerial count), species, non-adults, chicks, nests, eggs, predated adults, predated non-adults, predated chicks, predated eggs, Apparently Occupied Nests (AON) and notes. An 'AON' was registered when the surveyor was unable to confirm how many eggs/chicks were in a nest, but the nest/cavity was apparently occupied based on the behaviour of the adult bird. Where data were unknown or when seabirds were not observed, negative entries were made. These data were recorded in all survey methods used.

With most species, the time at which the colony was surveyed was found important. For example, the largest count of Bridle Terns was obtained in the late afternoon on Jamesby Island, Tobago Cays, as birds returned from foraging trips. Similarly, flocks of boobies often left islands in the early morning to forage, returning in the late afternoon and evening. Tropicbirds, as mentioned previously, were also very time dependent. Audubon's Shearwater, mentioned below, is a nocturnal species so survey methods are also restricted to specific times.

Weather was not systematically noted as it was generally consistently hot and sunny. The occasional thunderstorm was experienced, however, and noted, as the torrential downpour of rain had a marked effect on the birds and made surveying very difficult. Overcast weather provided useful surveying conditions as birds and their chicks/eggs were less likely to suffer from heat exposure if flushed.

Land-based Surveys

Surveying islands on the land was generally the ideal method for obtaining a complete record of breeding seabirds. This was not always possible, however, due to island topography or sea conditions preventing landings. Care had to be taken when surveying species sensitive to disturbance such as Brown Pelicans and Magnificent Frigatebirds which will clatter off nests possibly damaging chicks and eggs. Further, smaller species such as Sooty Terns can become entrapped in thorny vegetation if startled by a surveyor. Surveyors moved quickly through the colony to limit disturbance and to prevent flushed birds from leaving eggs and chicks exposed to the sun, which can kill them in 15-20 minutes (Burger & Lawrence, 2000).

Complete counts of nesting seabirds was particularly successful on small islands and when surveying small colonies. Large, tree-nesting species such as Magnificent Frigatebirds, Red-footed Boobies and Brown Pelicans were often counted from a distance using binoculars before the survey commenced, as they would often fly from the breeding site when disturbed. A second count would be taken if the birds did flush and the highest count recorded (some perching birds may have been missed on the initial count).

Different seabird species displayed behaviour which helped nest discovery including: hovering and squawking above the breeding colony (Laughing Gulls, Sooty Terns, Bridle Terns and Brown Noddies), perching near the nest (Bridle Tern) and mobbing the surveyor (Brown Noddy). The booby species would often remain on their nests, apparently unperturbed. The few sightings of Audubon's Shearwater on nests indicated a similar calm tendency.

'Flushing' birds was an important method when complete nest searches could not be made and provided a quick method when surveying in potentially damaging tropical solar heat. It was particularly useful for species such as Laughing Gulls and Bridled Terns whose nests were difficult to find or when the nests of species such as Sooty Terns were hidden under inaccessible vegetation such as cacti. As the surveyors walked through the colony, the number of birds flushed could be counted in the sky above. Occasionally, a complete count of nests was made and a complete count of the birds flying above it. This provided a 'K' value, the ratio of birds to nests, which was obtained at several sites.

Aerial surveys were also used when recording the number of breeding adults from the boat and when recording birds from a vantage point on land. This was the most often used technique when surveying tropicbirds as they are highly visible in the air when adults return to feed a chick or make a mate switch at the nest. They seldom fly close to land when not breeding (Walsh-McGehee, 2000).

The land-based surveys were carried out by two people, one observing and calling out the records, the other writing them down. Sometimes, a third surveyor accompanied the team and searched for nests.

Large Colonies

When colonies were too large to allow a complete count, the population for each species was extrapolated by using index plots. The colony was approached from a random location and the first nest identified. Using the track function on the GPS, the surveyors walked 5m past the first nest. A GPS location was recorded, representing the centre of the plot. The size of the circular plot was determined by consulting Burger and Lawrence's (p 151, 2000) table of nests occurring with varying sample sizes at various colony densities. For example, when an average of 0.25 Sooty Tern nests were recorded per m^2 a plot area of $10m^2$ (radius 1.78m) was used. When only 0.007 Laughing Gull nests were recorded per $m^{2,}$ a large plot area was used of $300m^2$ (radius 9.77m).

The plots were created using string (pre-marked at regular radii) held by the recorder in the middle at the UTM point, while the surveyor held onto the other end of the string and searched for eggs/nests/adults etc. within the plot. The starting point was marked to ensure that the same area was not surveyed twice. Plots were generally spaced 30m apart along a transect line, except when a large amount of land had to be covered, in which case 50m divided plots. Where possible, a series of plot-transects (50 m apart) were made across a colony. GPS coordinates were recorded at the colony edges to allow the population size to be extrapolated from the plots.

Large colonies of tree nesting birds (Red-footed Boobies and Magnificent Frigatebirds), birds nesting in crevices or cryptic locations (tropicbirds, Laughing Gulls, Bridled Terns) and steep or inaccessible terrain, generally rendered plot surveys ineffectual. In this case, an accessible ghut or transect (generally 10-20m wide) was searched by two surveyors. GPS coordinates were taken from the bottom and top extremities of the area and the number of breeding birds within the area used to extrapolate the population for the remaining colony.

When islands had to be surveyed from the boat, but large numbers of birds such as Sooty Terns were observed, often hidden under vegetation, 1 or $10m^2$ plots were visualised from the boat (based on experience from land plot surveys) and the number of birds counted within the sample areas. This data could then be extrapolated for the remainder of the area occupied by the colony. The colony area was estimated from the boat in cases where it was not the whole island and GPS coordinates could not be obtained. An aerial count of the birds was also made to compare with the extrapolated results.

Audubon's Shearwater

Audubon's Shearwater, being a nocturnal species, required a modified survey method. This involved inspecting islands for suitable nesting habitat during the day, often in areas where birds were historically found and returning at night to survey using the method outlined below. When daytime habitat inspections were not possible, random surveys where carried out. Crevice searches were employed when surveying small islands. However, on all but one occasion, crevice searches proved unsuccessful, potentially because the species nests deep in holes and cannot easily be found or due to low population numbers.

The preferred method was broadcasting the male, female and duet calls of the species on a mini-disc (Sony Net MD Walkman MZ-N707 Type R) from a mega blaster (Cass Creek Big Horn Speaker) after sunset up to 2300 hours. The calls were played for one minute and then stopped for one minute, for up to 30 minutes, to allow any birds nearby to respond. The number of responses was recorded, providing a presence/absence score and an indication of colony size. Surveys were avoided on moonlit nights, but if there was no option but to continue with the survey and there was no cloud cover, the presence of moonlight was noted. Audubon's Shearwater, like other members of the *Procellariiformes* order, is affected by lights and less likely to call during moonlit nights (Bretagnolle et al. 2000).

Threats Survey Method

Threats to breeding seabirds including signs of humans, predators such as dogs, mongooses, and rats and livestock such as goats were noted on all islands surveyed. This dataset is not complete, being generally collected casually, as cataloguing threats was not the focus of the survey efforts. The threats to breeding seabirds are numerous: Humans alter habitat rendering it unsuitable for seabirds, introduce seabird predators, eat seabirds and their eggs, and disturb nesting seabirds which can cause seabirds to abandon colonies. Carnivores including rats, dogs and mongooses eat seabird eggs and some species of incubating adults. Herbivores including goats and cattle graze out seabird habitat and trample eggs. Traditional, wooden, sprung, rat traps, baited with peanut butter, were set on the edge of colonies or near anchoring sites when surveyors were present for over five hours (preferably overnight) to assess whether rats were present.

INTERPRETING RESULTS INCLUDING LIMITATIONS

This report is based on only one season's raw data, involving one breeding survey on each island; as such the data sets are incomplete. The figures quoted for breeding seabird populations will likely change once the full data sets are compiled. The final complete reports with full data analysis and extrapolation will be available in 2010 and will replace this mid-term report.

The results presented in the individual island reports are generally raw data and based on individuals unless otherwise stated. Data that have been extrapolated are acknowledged. It is emphasised that the results were based on the first year's survey and that another year's work is necessary before a full data set (including migratory species for the northern islands) is available.

Red-footed Boobies and Brown Boobies nest year-round, so it is unlikely that a full population count will be achieved through the two surveys. Large numbers of roosting birds were often recorded; these were not included in the results if evidence of breeding was not confirmed, but they may nest during the year. The booby breeding population was measured by the number of chicks or active nests (if higher) to indicate the number of breeding pairs.

Red-billed and White-tailed Tropicbird figures were usually based on the sum of the maximum count of aerial birds at different locations around the island. Occasionally habitat was searched and the number of chicks or nests used as the population figure. Aerial surveys are an accepted method of

census for the species (Walsh-McGehee, 2000). Wingate (William Mackin, pers. comm.) used a 'K' value of six, based on experience surveying White-tailed Tropicbirds in the Bahamas. Thus, the number of White-tailed Tropicbirds recorded flying near nesting habitat could be multiplied by six to obtain a more realistic population estimate. It is possible that a similar method could be used for Red-billed Tropicbirds.

Magnificent Frigatebird figures were based on the number of nests or chicks counted, as frigatebirds rear only one chick at a time. Brown Pelican population estimates were based on the number of adults present since they often rear two to three chicks per nest.

Laughing Gulls figures were most frequently a product of aerial counts of flushed birds. Brown Noddy, Bridle Tern and Sooty Tern figures were based on the number of birds flying or the number of eggs/chicks/nests/incubating birds, which ever was highest. Population estimates were extrapolated from sample plots where large colonies were recorded. The number of nests/eggs was generally used to obtain the number of pairs of Roseate Terns, otherwise the results were based on aerial or perched breeding individuals.

Various difficulties were encountered during the field work. Island terrain and vegetation was a habitual problem, shortening survey time and preventing access to colonies. Surveying islands at the optimum time of day for a maximum count of seabirds was often impossible due to time limits.

Table 2. Equipment List

'Rite in the Rain' Book	Two Pencils (in case one is dropped / surveyors split)
GPS (spare batteries)	Pre-marked string
Binoculars	Camera (spare batteries)
Rat traps with peanut butter bait	Bio-degradable tape (mark traps or access onto islands etc)
First Aid Kit: tweezers, antihistamine cream, antiseptic cream, sun cream.	Water and Snacks
Sun Hat	Mask, Snorkel, gloves and old shoes if swimming on to islands
Dry bag	Shirt and trousers (prevent scratches and sunburn)
VHF Radio to contact boat (safety, time saving)	

Additional Surveys

The location and number of seabirds feeding, foraging or roosting (but not breeding) was recorded casually during the research to aid understanding of general seabird distribution within the Lesser Antilles.

Environmental Note

The survey boat took great care when anchoring to avoid coral or seagrass and used mooring buoys where available. The skipper chose a survey route through the islands that would allow maximum sailing to avoid engine emissions. The engine was, however, used more than desired; further lengths will be taken to lessen motoring next survey season, including using smaller boats where possible when surveying islands. Renewable energy including solar and wind are used to power appliances on the boat, organic waste is separated and dumped overboard when sailing, rather than added to

landfill. Recycling is impossible on most islands in the Lesser Antilles, although St. Martin and Antigua have limited recycling and some islands (bars) take glass drink bottles.

Safety Note

There are many inherent risks involved in seabird research due to the nesting ecology of the birds. They are often found breeding on remote islands as a result of colony allegiance, proximity to fishing grounds and the need for habitat with limited disturbance and threats. This environment presents strong currents, rough weather and waves and steep cliffs (a threat to surveyor and boat particularly on windward coasts). Risks specifically involved in surveying in the Caribbean include unchartered water (risk of submerged rocks and reefs), prevalence of unconsolidated rocks and a number of poisonous/thorny plants and animals, including: Devil Nettle *Cnidoscolus urens*, The Brazil *Comocladia dodonea*, grass burrs, Cacti spp., Acacia spp. and stinging ants. Manchineel *Hippomane mancinella*, a tree species often found growing at the edge of beaches should also be identified as its sap and fruits (appearance of small apple) are poisonous.

ISLAND ACCOUNTS

Saba

Introduction

EPIC seabird research team, Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) started its field research on Saba, Netherland Antilles, on 19 February 2009. The surveys were thus carried out during the winter field season in the Caribbean, so only year-round breeders or seabirds with prolonged breeding seasons were recorded. The breeding summer migrants such as terns and noddies were not, therefore, present. Offshore rocks were not included in the study due a weather warning from the Harbour Master regarding unsuitable sea state on the windward side of the island.

Outreach was also conducted in the form of a newspaper article in The Daily Herald, a presentation to interested islanders and a workshop with the Junior Scouts. EPIC's seabird research was outlined, information on the location of breeding seabird colonies requested and the conservation of seabirds promoted.

The most recently published data on the status of breeding seabirds on Saba was presented by Collier and Brown 2009 and by Collier and Brown 2008. These reported that Audubon's Shearwaters were reported as occurring in globally significant numbers, with an estimated population of 1000 pairs based on available habitat. Seven hundred and fifty to 1000 pairs of Red-billed Tropicbirds were estimated to breed (also a globally significant population), while <5 pairs of White-tailed Tropicbirds were recorded as breeding. Brown Boobies were recorded as breeding historically in the 1950s on Diamond Rock, but no studies have since recorded their presence.

The entire coastline of Saba has been designated as an Important Bird Area (IBA) covering 2,000 ha of critical terrestrial and marine habitat for the entire population of breeding seabirds. The IBA was triggered due to the restricted-range and congregatory birds present.

Walsh-McGehee (2000) reported 300-400 pairs of White-tailed Tropicbirds breeding in 1990s, with the population declining to between 50-100 pairs in 1998. The decline was primarily believed to be due to the larger, more aggressive, Red-tailed Tropicbirds out-competing the diminutive White-tailed Tropicbirds for nesting sites.

The population of both Audubon's Shearwaters and Red-billed Tropicbirds was considered threatened due to the presence of invasive species including, cats, rats and goat (Collier and Brown 2008). Both seabird species nest on the ground within cavities, under rocks or within burrows, rendering them vulnerable to mammalian predators. Cats in particular have been cited as extirpating colonies on Bermuda (Lee 2000). The presence of rats on islands with breeding Shearwaters or other seabird species have also been proven globally to cause declines in populations (Howald *et al.* 2007).

Sooty Terns (c. 30 pairs), Bridled Terns and Brown Noddies were recorded breeding on Diamond Rock in 2004. Bridled Tern and Brown Noddy were also found breeding on Green Island with an estimated 30 pairs for each species on both Diamond Rock and Green Island.

Method

The survey boat was moored at Fort Baii on the southwestern corner of the island. This provided little protection from the strong swell that caused the boat to rip free from the mooring. The boat was later moved to Ladder Baii which proved more protected, but the choice of anchorage would of course depend on the discretion of the captain and prevailing weather and sufficient means to reach the landing harbour at Fort Baii. The island was accessed by dinghy.

Aerial surveys of Red-billed Tropicbirds were undertaken from the survey boat at Fort Baii using binoculars. Counts were made at 0900-1030 hours and at 1500-1700 hours, for 10 minute periods, with the highest number of tropicbirds flying registered. Notes were taken of any AONs or nests observed. Further aerial counts of Red-billed Tropicbirds using the same method (with the addition of a telescope as necessary) were undertaken on land from various vantage points around the coastline of Saba. The choice of the survey points was based on historical breeding sites indicated by Collier (EPIC unpublished data), research undertaken by Lee and Walsh-McGhee (2000) and verbal information from Sabans. The survey sites included: Sulphur Mine, New Booby Hill, Spring Bay Trail, Well's Bay Road, Well's Bay, Well's Bay Anchorage, Old Booby Hill and various points along the North Coast Trail. An efforts was made to locate White-tailed Tropicbirds during surveys.

The breeding colony at Fort Baii was also surveyed by foot with nest sites located and breeding data collected. It is unlikely that all the birds breeding on the cliffs were found. Aerial counts should be used for the purpose of the population census. During all surveys, all birds showing breeding behaviour (on nests, Apparently Occupied Nests or when flying) were recorded.

Areas of suitable breeding habitat for Audubon's Shearwaters were located through historic records (Lee and Walsh-McGehee 2000) and information from islanders. The sites were investigated during daytime fieldwork and the surveys undertaken after sunset. Mini disc recordings of the male, female and duets of Audubon's Shearwater were broadcasted and any call responses noted. The surveys were carried out at: Rainforest Ravine, Booby Hill, First and Last House, Garbage Dump, Well's Bay, and Hell's Gate.

Results

Brown Booby

No breeding Brown Boobies were identified during the surveys. Ten roosting and foraging birds were, however, observed at Spring Bay, from Sulphur Mine, and from the North Coast Trail.

White-tailed Tropicbird

No White-tailed Tropicbirds were recorded during the surveys. Large colonies of Red-billed Tropicbirds were recorded, however, and it is possible that the researchers failed to detect White-tailed Tropicbirds amongst the congregations of the larger species.

Red-billed Tropicbird

The largest colony of Red-billed Tropicbirds was recorded at Old Booby Hill, including Spring Bay and Core Gut on the other side. A conservative estimate of 135 birds was recorded wheeling in the sky near their breeding site within the cliffs and valleys, between 1500 and 1600 hours. A total of 28 birds were observed flying near the North Coast Trail cliffs between the hours of 0900 and 1130 (potentially underestimating the number of breeding birds due to the survey extending beyond the most productive hours). Sixteen individuals were recorded in Fort Baii and nine birds within the Well's Bay area. The presence of breeding birds was also noted at Sulphur Mine but the survey was undertaken at the wrong time of day.

Audubon's Shearwater

Twenty Audubon's Shearwater calls were registered in response to the broadcasts at Rainforest Ravine, with an estimated five birds present, including one bird that mobbed the surveyors. Three very distant calls were detected at the rubbish dump near Fort Baii and one call heard at the First and Last House, Hell's Gate. The residents of the house reported hearing many calls most nights from their veranda after 2200 hours (Sue and Paul Fleuren pers. comm.) the survey was undertaken at 2033 hours and may, therefore, have been too early. Three calls were also heard from potentially three different birds flying over the survey boat between 2230 and 2300 hours at Well's Bay. No birds were recorded at Booby Hill (the survey was undertaken before sunset) or on Hell's Gate Road.

Sooty Tern, Bridled Tern, and Brown Noddy

Terns and noddies were not recorded, as it was the wrong time to survey. Surveys will be undertaken for these and other summer migratory species in summer 2010.

Threats

Rats were recorded on the island, with burrows noted near the Rubbish Dump at Fort Baii. A government sponsored rodent control programme has been activated in localised areas (Collier and Brown 2008), but it is likely that this has now been discontinued. Cats were also observed on the island, again, particularly within the proximity of the Rubbish Dump where over 50 pairs of eyes were observed shining in the surveyors' head torches. A feral cat sterilisation programme has been launched on the island, with at least 200 cats sterilised (Collier and Brown 2008). Residents are, however, divided on acceptance of the programme.

Discussion

Only two species of seabird, Audubon's Shearwater and Red-billed Tropicbird, were confirmed breeding on Saba. The numbers of Red-billed Tropicbirds recorded was likely to be far short of the actual breeding population, due to the prolonged (likely year round) breeding ecology of the species and in view of census extrapolation techniques, whereby it is suggested that the number of birds recording flying during peak nest visiting periods should be multiplied by six to obtain a true population estimate (Will Mackin pers.com 2009).

White-tailed Tropicbirds were not recorded during the surveys. It is feasible, however, that they could have been missed amongst the large flocks of Red-billed Tropicbirds. Renewed efforts will be made to find any remaining individuals during the repeat surveys in June 2010.

Although only two seabird species were confirmed breeding on Saba, both potentially represent globally significant populations, highlighting Saba's importance for the conservation of these species in the Lesser Antilles. It is, however, likely that the burgeoning population of feral cats and rats are impacting shearwater and tropicbird populations. Numerous global case studies have illustrated seabird colonies present but declining in the presence of invasive predators; invasive predator eradication programmes often result in rapid recoveries for seabird populations.

Rats and cats represent significant threats to breeding seabirds and are likely reducing populations on the island. An invasive species eradication programme would likely dramatically increase the significant populations of breeding seabirds on the island.

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St. Eustatius

Introduction

The EPIC seabird research team composed of Katharine Lowrie (Project Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) began the first season's breeding seabird research in St. Eustatius, Netherland Antilles, on 24 February 2009. The surveys were thus carried out during the winter field season in the Caribbean, so only year-round breeders or seabirds with prolonged breeding seasons were recorded. The breeding summer migrants such as terns and noddies were not, therefore, present.

Outreach was also conducted in the form of a newspaper article in the St Eustatius Daily Herald and a presentation to the STENAPA (St Eustatius National Parks Foundation) staff and interns. EPIC's seabird research was outlined, information on the location of breeding seabird colonies requested and the conservation of seabirds promoted. STENAPA staff and interns also accompanied the EPIC team on two water-based seabird surveys.

The most recently published data on the status of breeding seabirds on St Eustatius is presented by Collier and Brown (2009 and 2008). Five species have historically been reported breeding on the island: Red-billed Tropicbird, White-tailed Tropicbird, Brown Booby, Sooty Tern and Audubon's Shearwater. Surveys conducted by Collier and Brown in 2003 conservatively estimated the breeding population of Red-billed Tropicbirds as c.100-200 pairs (although part of the island with suitable nesting habitat was not surveyed due to time constraints). Previous surveys by Walsh-McGehee in 2002, estimated there to be 250 pairs. Such population estimates represent a globally significant population. The main breeding areas were cited within the Bovine IBA and the cliffs above the airport. STENPA staff also highlighted Zeelandia Baii to the south of the Boven IBA and cliffs at Fort Royal, to the North of Oranjestad Bay as supporting the species.

A population of <10 pairs of White-tailed Tropicbirds was recorded by Walsh-McGehee in 2002 on 'White Wall' within the Quill IBA (Collier and Brown, 2009). No White-tailed Tropicbirds were found during surveys undertaken by Collier and Brown within the Boven IBA.

An estimated 10 pairs of Brown Boobies have been recorded breeding on 'White Wall'.

Audubon's Shearwater historically bread on the island, being reported as common in the 1950s within the rocks and cliffs south of Tumble Down, Dick Baii. An oil terminal has since been developed in the area, severely altering potential nesting habitat as well as introducing lighting. Gallows Baii was also an historic breeding site. In 2003, one resident reported still hearing Shearwaters calling on the island.

Sooty Tern was also said to breed on the island in 1950, but no recent observations have been recorded.

Cats and rats present threats to all the ground nesting species recorded as breeding on St Eustatius, predating eggs, chicks and adults. Severe overgrazing, particularly by goats, further degrades breeding habitat.

Method

The survey boat was moored at a STENAPA mooring buoy at Oranjestad Baii, at the west of the island. STENAPA staff provided a motor boat from which the EPIC team was able to circumnavigate the island whilst surveying the coastal habitat for breeding seabirds. Being more manoeuvrable and with a shallow draft, the motor boat allowed surveys to be undertaken very close to the cliffs. The survey began at Oranjestad Baii and progressed north around Boven, down to the Quill and back to Oranjestad. A second water-based survey was carried out with the STENAPA motorboat to Fort Royal Cliffs, south to White Wall and then back to Fort Royal Cliffs. This meant that Fort Royal Cliffs were surveyed three times from the boat, in the same weather conditions, at different times of the day. The basis for the surveys was to determine the ideal time of day to conduct aerial surveys for Red-billed Tropicbirds.

Land-based surveys were also conducted with aerial counts of Red-billed Tropicbirds from Zeelandia Baii, looking to Gilboa Hill and below the airport cliffs extending to Fort Royal. A full count of breeding birds was carried out on Zeelandia Beach with all cavities inspected and chicks, nests and adults recorded. Any threats to breeding seabirds were also noted, including invasive predators and ungulates.

Two night-time broadcasts for Audubon's Shearwater were conducted from the STENAPA boat at Tumble Down Baii at 2123 hours and from the track head of Gilboa hill at 2243 hours and then intermittently along the Gilboa track down to the bottom of Signal Hill. The surveys were undertaken on moonless nights, but there was a strong wind at Tumble Down Baii, limiting the detection range of any calls.

Results

Brown Booby

No breeding Brown Boobies were identified during the surveys, but four birds were observed roosting and foraging around the island.

Magnificent Frigatebird

No Magnificent Frigatebirds were recorded breeding on St. Eustatius. Thirty birds were observed foraging around the island and 23 recorded roosting at Venus bay, in the Boven IBA.

White-tailed Tropicbird

No White-tailed Tropicbirds were recorded during the surveys. Large colonies of Red-billed Tropicbirds were recorded, however, and it is possible that the researchers failed to detect White-tailed Tropicbirds amongst the congregations.

Red-billed Tropicbird

The largest population of Red-billed Tropicbirds was found at Fort Royal Sea Cliffs. The maximum count was obtained in the late afternoon when 146 individuals were recorded flying near the cliffs. Significantly smaller counts were obtained at other times of day; only 11 birds were noted at 1025 hours and 38 birds at 1450 hours. Twenty-one birds were recorded flying around Boven cliffs and five near Lynch during morning counts. Further small colonies of birds were observed around the island during afternoon surveys, including 9 individuals at Gallows Baii, 11 at Crooks Castle and 9 at White Wall. Thirty-six Red-billed Tropicbirds were recorded during land based aerial counts looking to Gilboa Hill from Zeelandia in the afternoon. Searches of the low cliffs along Zeelandia Baii yielded 7 adults, 6 chicks, 9 nests and 7 AONs. Further land-based surveys of the cliffs in Shildpadden Baii detected 2 chicks, 2 nests and 14 adults flying.

Brown Pelican

No breeding colonies of Brown Pelicans were found. Eight foraging and roosting birds were recorded.

Audubon's Shearwater

No responses were detected along the track at Gilboa. A potential call was heard at Tumble Down Baii, but it was very distant and windy. Residents spoke of hearing Audubon Shearwater's in the past, but no details of the time of year or more recent locations were provided.

Threats

Rats, cats, cattle, donkeys, goats and pigs were recorded on the island. No evidence was found of predated tropicbird chicks, but this does not preclude such occurences. One resident did, however, acknowledge eating Red-billed Tropicbird chicks. Large over-grazed areas were noted, including cliff erosion along Zeelandia Baii where cattle and donkeys feed.

Discussion

The Red-billed Tropicbird colony is globally significant. The numbers of Red-billed Tropicbirds recorded was likely to be far short of the actual breeding population, due to the prolonged (likely year round) breeding ecology of the species and in view of census extrapolation techniques, whereby it is suggested that the number of birds recording flying during peak nest visiting periods should be multiplied by six to obtain a true population estimate (Will Mackin pers. com.). The importance of surveying for Red-billed Tropicbirds at the correct time of day (around 1630 hours) was highlighted by the repeat surveys at Fort Royal Sea cliffs, suggesting that some of the survey data outside of this timeframe may have been conservative.

It is possible that a small colony of White-tailed Tropicbirds, if present, could have been overlooked during the surveys amongst the large flocks of Red-billed Tropicbirds. Renewed efforts will be made to find any individuals during the repeat surveys in June 2010.

Further surveys in 2010 need to be undertaken to determine whether Audubon's Shearwater is indeed still breeding on St Eustatius. Efforts to remove predators including rats and feral cats would be very important to reviving any extant populations of the bird, as well as benefiting other breeding seabirds.

Acknowledgements

The EPIC team would like to thank the STENAPA staff for their fantastic support and provision of resources. Particularly, Lee Munson (Marine Park Manager), Hannah Madden (National Park Ranger,) Nicole Esteban (Manager, St. Eustatius National Parks) and the staff at the Marine Park desk.

St. Christopher (Kitts)

Introduction

The EPIC seabird research team, Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) departed St. Eustatius on 1 March 2009 arriving in Basseterre, St. Kitts the same day. Breeding seabird surveys were, thus, carried out during the winter field season in the Caribbean, so only year-round breeders or seabirds with prolonged breeding seasons were recorded. The breeding summer migrants such as terns and noddies were not present.

Outreach was also conducted in the form of a newspaper article in the St. Kitts and Nevis Observer and online at SKNvibes. An article was also written for the St. Christopher Heritage Society newsletter, a presentation given to a biogeography class of students at St. Theresa's Convent School and a radio interview on Winn FM.

Reports have been produced by local bird watchers and groups, listing bird species and their location on St. Kitts. The St. Christopher Heritage Society in Basseterre held much of this information. Published literature included Collier and Brown (2009 and 2008) and Steadman *et al.* (1997).

Nine species of seabirds have historically been recorded breeding on St Kitts:

Three White-tailed Tropicbirds were recorded offshore of Basseterre in 1982 (Ryan, 2007) and two near Turtle Beach Bay (Street, 1994). Two Red-billed Tropicbirds were recorded breeding on Booby Island in 2004.

Magnificent Frigatebirds nested at Nag's Head in July 1985. Nine nests with chicks were recorded. Brown Pelicans were reported as nesting at Nag's Head in July 1985, where 56 nests with chicks were observed. Booby Island was also highlighted as providing breeding habitat for the species in 1920 (Collier and Brown 2009). Historically, frigatebird colonies were cited at 'First Rock', Ballast Bay to Green Point on the Southeast Peninsula and also Helden's Point, Sandy Bay, Grange Bay and Old Road Bay, but they have since been extirpated.

One hundred to 150 pairs of Laughing Gulls were estimated breeding on Booby Island in late May 2004. Thirty pairs of Least Terns were observed breeding with eggs and chicks at Greatheeds Pond in June 1935. Thirty pairs were also recorded on the shoreline from Greatheeds Pond to Barker's Point in 2004. In July 1985, 5 nests were observed at Little Salt Pond, 1 nest at Mosquito Bay Beach, 16 pairs at Cockleshell Bay and 4 pairs at Major's Bay. In late May 2004, 5 nests and 20 adults were recorded at Mosquito Bay and 5 nests and 27 adults on the northeast end of Great Salt Pond. No Least Terns were observed on the other ponds, Cockleshell Bay or Major's Bay.

Twelve Roseate Terns (including juveniles) were recorded at White House Bay in July 1988. In the mid-1990s, Roseate Terns were estimated as having a breeding population of 100-200 pairs on the island. In late May 2004, six pairs were recorded on Booby Island. The Sooty Tern population was estimated to 50-100 pairs in the mid 1990s. In late May 2004, 200-250 nests were estimated on Booby Island. Fifty to 57 Bridled Terns and 6-10 Brown Noddies were estimated as breeding on Booby Island in Late May 2004.

The Southeast Peninsula of St Kitts was identified as an IBA for congregatory seabirds with Least Tern and Brown Pelican reported as breeding in regionally significant numbers. Booby Island (between St. Kitts and Nevis) is also listed as an IBA also due to the important breeding seabird populations.

Threats to breeding seabirds included a range of factors on the island, including the construction of the Southeast Peninsula road that impacted Least Tern habitat. Other planned development initiatives, particularly for the tourist industry, will further remove and degrade the remaining breeding habitat. Invasive predators were cited as a concern throughout the island, including the African Green Monkey *Cercopithecus aethiops*, Indian Mongoose *Herpestes auropunctatus,* rats and cats (Collier and Brown 2009). These species prey on seabird eggs, chicks and potentially incubating adults. Other non-native species include the herbivores cows, goats and white-tailed deer *Odocoileus virginianus.* Although they do not prey directly on seabirds, they can trample nests and alter/degrade nesting habitat. Tern nests, for example, were considered vulnerable to trampling by cattle that accessed and poached the ponds. The deleterious practice of humans harvesting seabirds eggs on Booby Island was also mentioned (Collier and Brown 2009).

Methods

Breeding seabirds were searched for along the west coast of St Kitts from the survey boat. The survey boat anchored at Basseterre. The main body of the island, from Basseterre to the north, was surveyed by bicycle, following roads or tracks that best allowed views to the coast. An audio recording of the call of the Audubon's Shearwater was played to residents to ascertain if the bird was familiar.

Further surveys were conducted from the survey boat along the south coast of the peninsula before anchoring at Bugg's Hole. A kayak was then used to access the Southeast Peninsula, including Nag's Head, Major's Bay, Banana Bay, Cockleshell Bay and Scott Island. A circumnavigation of Booby Island from the survey boat was also undertaken. In all surveys, any birds showing breeding behaviour (on nests, Apparently Occupied Nests or when flying) were recorded.

Results

No seabirds were confirmed breeding during the winter survey period, 1-6 March 2009. The Audubon's Shearwater was not recognized by the three people approached (a countryman who wanders St. Kitts in search of monkeys and bees and two farmers). The only potential breeding species was one unidentified sub-adult tropicbird flying near Nag's Head.

Roosting or foraging birds were recorded including: occasional sighting of Brown Boobies roosting on cliffs (4 individuals) and Magnificent Frigatebirds observed flying around most of the island, with a roost of 19 females and sub-adults at Bugg's Hole Anchorage. Brown Pelicans (individuals or small flocks of generally < 5) were regularly seen foraging or roosting around the island, particularly at the far end of the Southeastern Peninsula. Three birds were recorded roosting at Nag's Head near potential old nests. Twelve Royal Terns were also recorded fishing along the coastline.

Threats

African Green Monkeys, Indian Mongooses, rats, cats, cattle and goats were recorded. While no evidence of predated seabirds was registered, such occurrences seem likely. Severe grazing and poaching of pond shorelines by cattle was noted. Hundreds of dead fish were also noted around the perimeter of a pond at the eastern side of Major's Bay. The cause of the incident was not obvious. No birds were observed foraging on the dead fish.

Discussion

The lack of breeding White-tailed Tropicbirds, Red-billed Tropicbirds, Magnificent Frigatebirds and Brown Pelicans formerly confirmed as breeding on St. Kitts is of concern. The time of year should not have been prohibitive, as these species have a prolonged breeding season or nest year round. In addition, they were observed breeding on other islands by the research team at a similar time of year.

Presence/absence broadcasts for Audubon's Shearwater were not undertaken due to time constraints. It is hoped that these will be achieved during 2010. There is some potential breeding habitat along the coastline and inland, but predation has likely extirpated any remaining colonies. When tested for recognition of the shearwater's distinctive call residents were not familiar with it, unlike on other islands.

Migratory *Sterna* will be surveyed in the summer of 2010. Records obtained from the literature review suggest that the ponds of the Southeast Peninsula are important for this order. The proposed development of this area, therefore, would be very harmful and potentially extirpate the final breeding seabirds from the island. Invasive species are also a significant threat and coupled with development, likely resulted in the loss of seabird breeding colonies. Any egg poaching activities will only exacerbate these problems.

Acknowledgements

We would like to thank Dr. Challenger for assistance in procuring a permit. Assistance from Kate Orchard of the St. Christopher Heritage Society as well as Michael Ryan and Percival Hanley was much appreciated.

Nevis

Introduction

The EPIC seabird research team, Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) surveyed Nevis between 6-8 March 2009. Breeding seabird surveys were, thus, carried out during the winter field season in the Caribbean, so only year-round breeders or seabirds with prolonged breeding seasons were recorded. The breeding summer migrants such as terns and noddies were not, therefore, present but will be surveyed in 2010.

The outreach undertaken on Nevis included a newspaper article in the St. Kitts and Nevis Observer, an article online at SKNvibes and a radio broadcast on Winn FM.

Very limited breeding seabird data was available for Nevis and none included population estimates. Reports by local bird watchers on the presence of birds and their location on St. Kitts generally included Nevis. Published literature included Collier and Brown (2009 and 2008).

In 2004 Magnificent Frigatebirds and Laughing Gulls were reported to nest in the Hurricane Hill-Newcastle area. Least Terns were also recorded as breeding on the north end of White Bay in 2004. Roseate Terns are believed to breed on Nevis, with recent sightings near Indian Castle, but this has not been confirmed (Collier and Brown, 2009 and Jim Johnson pers. comm.). Brown Pelicans were also cited as breeding on Hurricane Hill, but no dates or numbers were supplied (Jim Johnson pers. comm.).

Methods

Nevis was circumnavigated by the survey boat on 6 March 2009. All birds showing breeding behaviour (on nests, Apparently Ocuppied Nests or when flying) were recorded. The boat was anchored on the west coast of Nevis at Charlestown; the island was accessed by dinghy.

Results

No seabirds were confirmed breeding on Nevis during the winter survey period.

Small numbers of Magnificent Frigatebirds, Brown Pelicans and Royal Terns were observed flying around the island.

Threats

Rats were observed on the island, as well as ubiquitous goats, cats and cattle.

Discussion

Habitat degradation or destruction through development and invasive species, as well as direct predation by invasive species and humans, are likely the main reasons for total lack of breeding seabirds recorded during the winter months. Further surveys in 2010 will confirm whether summer breeding seabird species are present on Nevis.

Acknowledgments

We would like to thank Jim Johnson of Top to Bottom tour company for information on seabird breeding locations.

Montserrat

Introduction

The EPIC seabird research team, Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) undertook breeding seabird surveys between 16-20 March 2009. Breeding seabird surveys were, thus, carried out during the winter field season in the Caribbean, so only year-round breeders or seabirds with prolonged breeding seasons were recorded. The breeding summer migrants such as terns and noddies were not, therefore, present.

Outreach included discussing the research and seabird conservation with ZJB radio, a presentation to Look Out Primary School and an article published in the Montserrat Reporter. EPIC also met with the Forestry Department and bird watchers on the island.

The Royal Society for the Protection of Birds has undertaken some research on seabirds on Montserrat, due to island being a United Kingdom Overseas Territory. Surveys were undertaken in August 1999 and August 2006 with resident ornithologist James 'Scriber' Daley. The most recent publications presenting data gathered are Allcorn and Daley 2009 and Hilton *et al.* 2008. Eight breeding seabird species were recorded during the surveys.

Brown Boobies were observed breeding on Montserrat in 1999 and 2005, with the largest colony (c. 9 pairs) north of Rendezvous Bluff, estimated in 2005. Small colonies of Red-billed Tropicbirds were recorded breeding in cliffs around the island, with the main concentrations on North-West Bluff and beneath the Soufriere Hills. A maximum of 16 tropicbird pairs were estimated breeding on the island. Magnificent Frigatebirds were recorded on Pinnacle Rock with 27 pairs counted in 2005. Pinnacle Rock, St. Peter's and Garibaldi Hill were the locations of breeding Brown Pelicans with 14 pairs recorded in 2005. Audubon's Shearwater had not been recorded breeding in over forty years (James Daley pers. comm.). Royal Terns were also considered likely to be breeding on Montserrat, potentially in new habitat created by pyroclastic fans at Plymouth.

Seabirds breeding on Montserrat suffer threats similar to other locations within the Caribbean, particularly highlighted was predation by invasive species including cats, rats and pigs, potential poaching by humans and anthropogenic habitat degradation and damage.

Methods

Initial surveys were undertaken on the survey boat around the northern section of the island, from Well Carr's Bay to Pinnacle Rock. Breeding seabirds were searched for between 1515 and 1630 hours. A full survey of the island was made by fishing boat between 0715 and 1115 hours with the circumnavigation beginning at Well Carr's Bay and heading south. Scriber Daley and a local fisherman accompanied the EPIC team. All birds showing breeding behaviour (on nests, Apparently Occupied Nests or when flying) were recorded.
Audubon's Shearwater was surveyed from Rendezvous Bay in a dinghy and from land on 18 and 19 March between 2045-2145 hours and 2113-2143 hours respectively.

Care was taken during the water-based survey within the Montserrat Volcano Observatory restriction area on the southern end of the island. Similarly, land-based surveys were not permitted in the south of the island due to the active volcano.

The survey boat was anchored at Well Carr's Bay and land accessed by swimming or dinghy.

Results

Red-billed Tropicbird

Based on aerial counts, 110 Red-billed Tropicbirds individuals were recorded breeding on Montserrat.

Audubon's Shearwater

For the first time, Audubon's Shearwater was confirmed as breeding in cliffs above Rendezvous Bay. Birds responded to the broadcasted calls and mobbed the surveyors in their dinghy. Thirty-six calls were recorded during a half hour survey. Approximately 5-10 pairs may have been breeding on the headland, but this is a very crude estimate based on a 'presence/absence' survey method.

No other seabirds were recorded during the surveys, which included areas where Brown Booby, Magnificent Frigatebird and Brown Pelican were reported breeding in the past.

Threats

In addition to human impacts, threats to seabirds identified on Montserrat included rats, goats, cattle, and donkeys.

Discussion

The population of Red-billed Tropicbirds is significant yet the number of birds recorded is likely far short of the actual breeding population; this is due to the prolonged (likely year round) breeding

ecology of the species and in view of census extrapolation techniques, which suggest a multiplication factor of six for aerial tropicbird counts to determine populations (Will Mackin pers. comm.).

The absence of three species of seabird formerly confirmed breeding on the island in 2006 is of great concern. The follow up survey in 2010, during the summer breeding season, will provide further data of this potential extirpation.

The discovery of breeding Audubon's Shearwater on Montserrat is notable and will be followed up by an investigation of the breeding site in 2010. Audubon's Shearwater is predated upon by introduced mammals including cats and rats. It is recommended that any predatory species identified within the vicinity of the breeding colony are controlled. In addition, human disturbance in the area should be strictly limited.

Acknowledgements
EPIC would like to thank the Forestry Department of Montserrat for their support.

Antigua

Introduction
The EPIC seabird research team, Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) visited Antigua between March and April 2009. The Environmental Awareness Group (EAG) has been carrying out regular surveys of many offshore islands, including Green, York, Rabbit and Great Bird, as part of an invasive species (Black Rat *Rattus rattus*) eradication programme to restore populations of the endemic Antiguan Racer snake *Alsophis antiguae*. EAG also monitors other offshore islands, as well as keeping records of birds observed on the main island.

Due to the extensive work undertaken by EAG, EPIC did not carry out a full seabird survey of Antigua and the offshore islands. EAG will continue to provide data to EPIC for the 2009 survey season (Donald Anthonyson pers. comm.) EPIC did join EAG (Victor Joseph and Junior Prosper) in surveys of Lobster, Redhead, Rabbit and Great Bird Island. Additionally, EPIC surveyed Green Island and Five Islands, which are seldom surveyed. After further conversations with EAG, EPIC has agreed to do complete surveys during the summer breeding season on Antigua in 2010 to ensure consistent methods and to allow surveys of islands/areas that are not regularly surveyed.

Outreach was undertaken on Antigua, including a presentation to over 70 students at Clare Hall Secondary School, a presentation to the Antigua Yacht Club, and an article for the Antigua Sun and The Observer. A radio broadcast on Observer FM also allowed the research to be discussed in public and members of the public called in with questions regarding seabird conservation.

Breeding seabird data held in the EAG annals was provided by Donald Anthonyson. Much of the data compiled by EAG has been incorporated into the published literature, Sylvester *et al*. 2009 and Prosper *et al*. 2008. Many of Antigua's 51 offshore islands have been designated together as an IBA. Laughing Gulls were cited as breeding in globally significant numbers on the islands, while populations of Brown Pelican, Royal Tern and Least Tern were noted as breeding in regionally important numbers (Prosper *et al*. 2008). The following summarises the information:

Brown Boobies were recorded breeding in 2004 on Five Islands.

Magnificent Frigatebird was noted on York Island in 2004, but breeding was not confirmed.

Red-billed Tropicbirds were noted on Green Island (three to four pairs) in 2004 and 2006.

Brown Pelicans were recorded in 2006 on Redhead Island (three pairs) and on Rabbit Island (nine pairs). Green Cay was also suggested as a possible breeding site. Between 53-55 pairs were recorded breeding on Five Islands, Rabbit, Redhead and York Island in May 2004.

Audubon's Shearwater historically bred on Antigua (midden material has been excavated at Mill Reef for example). It was suggested that the species may still breed on offshore islands such as Great Bird or Hell's Gate.

Laughing Gulls were recorded on Lobster Island in August 2008, with a maximum of 300 adults. In June 2006, 21 pairs (based on number of nests detected) were found breeding on Great Bird Island and 26 pairs on Rabbit Island. In May 2006, one pair was recorded on Redhead Island. Approximately 80 pairs of Laughing Gull were found breeding on Great Bird Island and York Island in 2004.

Least Terns were recorded breeding at McKinnin's salt ponds and other dried ponds on Antigua in 1997, but none were recorded in 2004.

Roseate Terns were observed on Great Bird Island (40 adults) in June 2006 but nesting was not confirmed. Four pairs were counted on Green Island in 2004.

Sooty Terns were recorded on Great Bird Island which supported 225 pairs in June 2006 and 500 pairs were noted on Green Island and Great Bird Island in 2004.

Bridled Terns (four) were noted Great bird island in June 2006. A small population of seven pairs was also noted on Five Islands and two pairs on Great Bird Island in 2004.

Brown Noddies have been recorded breeding. In 2006, 15 pairs were noted on Redhead Island, one pair on Lobster Island and 32 on Rabbit Island. In 2004, approximately 140 pairs were recorded breeding on Great Bird, Green and Rabbit Island.

Many threats to breeding seabirds on Antigua were outlined by Sylvester *et al.* (2009), specifically the lack of legislation to protect species and resultant habitat loss, degradation and disturbance. Introduced species including Indian Mongoose, rats, dogs and cats predate on seabirds, while herbivores have severely overgrazed habitat. Hunting and pollution further threaten seabirds. All these factors increase the vulnerability of seabirds to natural disasters such as hurricanes.

EAG has been working to minimise threats by working with government, educating the public, and controlling predators on offshore island. The control of rats through the Antigua Racer Conservation Project has caused the most tangible benefits to date with increases in breeding seabirds and a rise in the population of the snake from 50 in 1995 to 300 in 2008 (Prosper *et al*. 2008).

Methods

EPIC surveyed Lobster, Rabbit, Redhead and Great Bird islands with Victor Joseph and Junior Prosper on 29 March 2009. Local fishermen motored the survey team to the islands and waited while the surveys were undertaken. A complete count of the Brown Pelican breeding colony was made from land and a further count from water to verify the count and to prevent further disturbance. A nest search of cavities and boulders was undertaken to determine the population of Red-billed Tropicbirds. Any nests found were marked with flagging tape to allow further monitoring by EAG and

the nest contents recorded. Only half of Great Bird Island was surveyed during the visit due to time constraints. EPIC is awaiting records from EAG to complete the data set.

EPIC surveyed Green Island on foot on 1 April 2009, just before 1600 hours. The survey boat was anchored over sand in Ten Pound Bay and the island accessed by kayak. All flying Red-billed Tropicbirds were counted from the highest points at the centre and East of the island (near Man of War Point). A survey for Audubon's Shearwater was also undertaken at night from the survey boat on a calm evening.

Five Islands were surveyed on 9 April 2009. The islands were circumnavigated by kayak for any signs of breeding seabirds (while the survey boat moored at Jolly Harbour). When evidence of breeding was found, the kayak was tied to a rock and the island surveyed by foot. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.

Results

Red-billed Tropicbird

Large colonies of Red-billed Tropicbirds were recorded on Great Bird Island with 21 nests recorded (incomplete data set) and on Green Island where 107 individuals were counted. Eleven nests were found during the aerial count with little effort, a full nest count was not undertaken.

Brown Pelican

Brown Pelicans were also noted breeding on Rabbit Island, c. 20 pairs, and on Five Islands where 21 pairs were estimated (population estimate based on the number of nests for both islands). No seabirds were recorded breeding on Redhead or Lobster Islands during the survey.

Audubon Shearwater

No Audubon's Shearwaters responded to the broadcasted calls.

Threats

Indian Mongooses were observed during the day on the main island.

Discussion

Great Bird Island and Green Island supported significant colonies of Red-billed Tropicbirds. The population recorded was likely far short of the actual breeding population, due to the prolonged (likely year round) breeding ecology of the species. In addition, census extrapolation techniques suggest that the number of birds recording flying during peak nest visiting periods should be multiplied by six to obtain a true population estimate (Will Mackin pers. comm.). Using such a technique, the Green Island population may be greater than 600 individuals. The results from Great Bird Island were incomplete, with further nests likely to be added to the data set when obtained from EAG.

The population of Brown Pelicans on Five Islands and Rabbit Island was also significant with c. 41 pairs recorded overall. Data from EAG suggests that this number is likely an underestimate, with further pairs recorded later in the season.

Rat eradication work undertaken by EAG on offshore islands illustrates the importance of invasive species control in increasing seabird populations and other native flora. Further efforts should be made to undertake similar programmes on other offshore islands where seabird populations are still extant and funding is available.

Full surveys by EPIC in 2010 should provide further data on the islands currently monitored by EAG and those seldom visited, as well as data on those species only breeding during the summer months.

Acknowledgements

EPIC would like to thank the Environmental Awareness Group for their support and advice during their surveys and outreach on Antigua, particularly Victor Joseph, Donald Anthonyson, Junior Prosper, Kim Derrick and Brian Cooper.

Redonda

Introduction

The EPIC seabird research team, Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) surveyed Redonda in March 2009. Breeding seabird surveys were, thus, carried out during the winter field season in the Caribbean, so only year-round breeders or seabirds with prolonged breeding seasons were recorded. The breeding summer migrants such as terns and noddies were not, therefore, present.

No outreach was conducted on Redonda, as it is an isolated, extinct volcano with no human occupants. Redonda is part of the tripartite state of Antigua and Barbuda, where outreach was undertaken. Redonda lies to the northwest of Montserrat. It has a history of human occupancy with guano and phosphates being mined between 1895 and 1914 (Sylvester *et al*. 2009). The remnants of the mining industry are still present today.

Published literature on the breeding seabird status of Redonda was extracted from Allcorn and Daley 2009, Sylvester *et al.* 2009 and Prosper *et al.* 2008. The Environmental Awareness Group (EAG) of Antigua also provided unpublished records from seabird surveys that they had undertaken on the island.

Red-footed Boobies were recorded breeding on Redonda in 1984 when 1,000 pairs were estimated; more recent surveys by EAG in August 2004 estimated 60 pairs (Sylvester *et al.* 2009).

More than 150 pairs of Brown Boobies were recorded in 2001 (Allcorn and Daley 2009), 12 pairs were recorded nesting in 2004 (Sylvester *et al.* 2009) and 33 nesting pairs in September 2006 (EAG unpublished data). Masked Boobies were also noted as possibly breeding due to the presence of juveniles, but it was too late in the season to confirm (Sylvester *et al.* 2009).

At least 100 pairs of Magnificent Frigatebirds were estimated breeding in 2001 (Allcorn and Daley 2009) and 25 pairs breeding in 2004 (Sylvester *et al.* 2009.).

No evidence of Audubon's Shearwater had been recorded on Redonda, but it was suggested that they could be present (Sylvester *et al.* 2009).

Four pairs of Sooty Terns and six pairs of Bridled Terns were found breeding in 2004. Brown Noddies were also cited breeding, with over 140 individuals recorded (Sylvester *et al.* 2009).

Breeding colonies of Red-footed Boobies, Brown Boobies, Masked Boobies and Magnificent Frigatebirds were cited as regionally significant (Prosper *et al.* 2008).

Rats and goats were noted as present on the island. During surveys in 2009, EAG recorded goats dying due to drought conditions (EAG unpublished data).

Methods

Few boats venture near Redonda as the sea is generally rough, with the island offering little protection from the open ocean. Fishermen were, however, observed in the surrounding waters once during the five days in which the EPIC research team was present on Redonda.

The survey boat was anchored in over 12m of water off the southwest of Redonda. Land surveys were only possible on two of the five days in which the team were present at Redonda. The island was accessed by swimming with dry bags and by dinghy. Both methods were risky due to strong waves crashing against the base of the cliffs. On reaching the base of the cliffs only one ghut provided access via climbing/scrambling onto the island and this was very steep and composed of unconsolidated material. On reaching the summit of the island, the terrain was far more accommodating allowing a full survey of breeding seabirds.

All seabirds were counted on the top of the island, including nesting Brown Boobies, Masked Boobies and Red-billed Tropicbirds. Seabirds nesting in the ghuts were counted from a vantage point at the top of the ghut and/or neighbouring ghut. It is possible that a limited number of birds may have been missed during this census. Crevices were checked for nesting tropicbirds and Audubon's Shearwaters.

In addition to land-based surveys, aerial counts of seabirds were made from the anchored survey boat each hour between 0817 and 1715 hours. Water-based surveys from the sailboat anchorage and when approaching and departing Redonda were particularly important for recording Red-billed Tropicbirds, as it was not possible to fully survey for nesting birds on the island, either through aerial surveys or nest counts. Surveys for Red-billed Tropicbirds on the eastern cliffs were only possible from land, as a dinghy trip around the island had to quickly be aborted due to high seas.

Five rat traps were set, two at the landing site at the base of the cliff and a further three at the top of the ghut and baited with peanut butter. These were left for five hours. Evidence of threats to seabirds was recorded.

Results

Red-footed Booby

A Red-footed Booby population of c. 99 pairs was recorded (based on number of nests which supplies the highest figure).

Brown Booby

Fourteen pairs of Brown Boobies (based on number of nests) were breeding at the time of the survey. Significant numbers (>770 adults and sub-adult) of Brown Boobies were observed roosting on the cliff sides. It was not clear whether these birds breed on Redonda at other times of the year.

Masked Booby

Ten breeding pairs were recorded during the survey (based on the number of eggs and chicks). A further 15 suspected nests were recorded but they did not appear active. Additional birds (c. 20) were observed perched or flying over the island.

Magnificent Frigatebird

Approximately 160 pairs of Magnificent Frigatebirds were counted breeding on Redonda (based on the number of nests).

Red-billed Tropicbird

The maximum count of Red-billed Tropicbirds was achieved at 1600 hours from the anchored survey boat at the southwest corner of Redonda when 31 birds were recorded in the sky at one time. The highest count of Red-billed Tropicbirds during the day census from the survey boat was 25 individuals at 1627 hours, but varied significantly from the low of two at 0817 hours and four at 1715 hours, highlighting the importance of surveying this species at the correct time of day.

Audubon's Shearwater

No Shearwaters were recorded during daytime crevice checks. A possible call was heard between 2125 and 2155 hours by three surveyors broadcasting calls from the survey boat. It was a very windy night and no further calls were heard.

Large mixed flocks of Boobies and Magnificent Frigatebirds were noted fishing and flying in the sea in a c. 5 mile radius of Redonda. A sailor noted that the number of birds observed flying around Redonda, however, has dropped ten-fold in the last 18 years that he has been travelling past the island.

Threats

A large population of rats was present on the island, determined by the unusually high number of sighting of Brown Rats during the day, with five live and one dead. No rats were trapped (suggesting that ample prey was available from elsewhere, potentially seabird chicks/eggs). High concentrations of lizards were also observed (c. 2 per m^2). The lizards could be preying on seabird eggs and chicks as well, but are endemic, with possibly three species present on the island (Prosper *et al*. 2008). Feral goats were also recorded on the island, including within the sheer ghuts. An estimated 50- 100 were present.

Discussion

Redonda supported a significant diversity of breeding seabirds with five species confirmed breeding during the winter season and Audubon's Shearwater possibly breeding (further surveys are needed). Large flocks of Brown Boobies were also found to use Redonda as a roosting area, potentially breeding at other times of the year. Indeed, all the species recorded either nest year round or have a protracted nesting period, suggesting the breeding populations were likely higher than recorded.

The eastern cliffs of Redonda were not satisfactorily surveyed for Red-billed Tropicbirds due to hazardous seas state. It is therefore likely that the breeding population is greater than the number of birds recorded. Additionally, if Wingate's method for extrapolating breeding populations of

tropicbirds from aerial counts is used, then the population count should be increased by a factor of six (William Mackin pers. comm.).

Invasive species are potentially causing significant population declines in the breeding seabird populations on the island. Feral goats have caused severe over-grazing, leaving mainly rock and a few resilient low growing plants. A few stunted trees have managed to survive in the ghuts, providing the only nesting sites for the important Red-footed Booby and Magnificent Frigatebird breeding populations. Both species of rat have been recorded on the island, with Brown Rat observed in large numbers during the 2009 EPIC surveys.

It is likely that these predators are reducing breeding success on the island, with species such as Audubon's Shearwater potentially near extirpated, if present at all, due to rats. Redonda would benefit greatly from an invasive species control programme. Such programmes have been shown to dramatically increase populations of breeding seabirds on islands globally (Howald *et al.* 2007).

Barbuda

Introduction

Barbuda was surveyed between 3- 5 April by the EPIC seabird research team, Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant). Breeding seabird surveys were, thus, carried out towards the end of the winter field season in the Caribbean, so only year-round breeders or seabirds with prolonged breeding seasons were recorded. The breeding summer migrants such as terns and noddies were not yet present but will be surveyed in 2010. Barbuda has little information on breeding seabirds outside of Codrington Lagoon, where the Magnificent Frigatebird colony is based.

Limited outreach was undertaken, except a press release sent to The Antigua Sun and The Observer, due to the intensive surveys on the island.

Records of seabird colonies were extracted from Sylvester *et al*. 2009, Prosper *et al*. 2008 and Sarah Trefry's unpublished data. Little data was available on Red-billed Tropicbirds, with small numbers recorded breeding during the winter of 1977 (Sylvester *et al.* 2009). One of the biggest colonies of Magnificent Frigatebirds has been recorded nesting in Codrington Lagoon. A count in 2008 yielded 5,300 individuals (Prosper *et al.* 2009). Brown Pelicans were also recorded nesting within the Lagoon with 20 nests noted in January 2009 (Trefry unpub. data). One thousand Laughing Gull individuals have been recorded on Barbuda and Common Terns are believed to nest in Codrington Lagoon (Sylvester *et al*. 2009).

No threats were cited specifically for Barbuda, but those outlined for Antigua were pertinent, including: lack of legislation to protect species, resultant habitat loss, degradation and disturbance. Introduced species including, rats, dogs and cats predated seabirds, while herbivores severely over-grazed habitat. Hunting further threatened seabirds. All these factors increased the vulnerability of seabirds to natural disasters such as hurricanes.

Methods

The survey boat was anchored near Cocoa Point and the island accessed by swimming and dinghy. The perimeter of Barbuda was walked on foot over two days by four surveyors (teams of two with one recorded and one observer) using bikes to access the northeast section. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Not all areas could be surveyed

at the optimum time for Red-billed Tropicbirds, due to the size of the area covered and surveys being done on foot. The Codrington Lagoon area was not surveyed as this was considered to be thoroughly surveyed by Environmental Awareness Group (EAG) based in Antigua and is being monitored by Sarah Trefry who is studying Magnificent Frigatebirds for her PhD (University of New Brunswick, Canada). A kayak was used to access Cocoa Point and part of Gravenor Bay, as the water was shallow with many coral reefs and part of the beach access was private.

Results

Red-billed Tropicbird

Thirty-eight individual Red-billed Tropicbirds were observed flying over the 'Highlands' on the eastern side of Barbuda. Only two nests were found with one chick in each, although 12 AONs were identified.

No other breeding seabirds were found during the island survey. (These results do not include Codrington Lagoon which was not surveyed, but supports breeding Magnificent Frigatebirds and Brown Pelicans). Roosting and foraging seabirds were observed, however, including 38 Brown Pelicans, 6 Brown Boobies and 13 Magnificent Frigatebirds.

Threats

Goats, sheep, donkeys and cattle were recorded grazing on the island and were having a dramatic impact on the vegetation, reducing it in extent and height. Cats were noted within the vicinity of the 'Highlands' and rats were likely present as rubbish was evident. Evidence of hunting (remains of goats and tortoises) were also recorded.

Discussion

Barbuda is renowned as having the largest colony of Magnificent Frigatebirds in the Eastern Caribbean and one of the most important breeding colonies in the whole of the Caribbean. The Codrington Lagoon Important Bird Area supports the colony, as well as a small colony of Brown Pelicans and possibly Common Terns. Red-billed Tropicbirds were also recorded spread in low densities nesting in the cliffs of the 'Highlands'. The numbers of Red-billed Tropicbirds recorded was likely to be far short of the actual breeding population, due to the prolonged (likely year-round) breeding ecology of the species. In addition, census extrapolation techniques suggest that the number of birds recording flying during peak nest visiting periods could be multiplied by six to obtain a true population estimate (Will Mackin pers. comm.)

Cats were noted within the vicinity of the nesting Red-billed Tropicbirds and along with rats, would likely prey on Tropicbird chicks and eggs.

A further survey in 2010 will also need to cover the many ponds on Barbuda as potential breeding habitat for summer breeding terns and gulls.

Acknowledgements

EPIC would like to thank Dr. Schreiber and Dr. Diamond for sharing their knowledge of Barbuda and Sarah Trefry for providing original data.

St. Lucia

Introduction

The EPIC seabird research team composed of Katharine Lowrie (Field Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) undertook breeding seabird surveys between April 17 and 21 on St Lucia. The surveys were, thus, carried out at the end of the winter field season and the very beginning of the summer survey season in the Caribbean. The first of the summer migrants (Sooty Terns, followed by Bridled Terns and Brown Noddies) were just beginning to collect on annual breeding grounds. Any year-round nesters or species with prolonged breeding periods should, however, be represented in the study.

Various articles were written to promote the EPIC research, the conservation of seabirds and to request any information on present or historic seabird colonies. An article was published in 'The Star' and sent for publication to the newsletters of the Ministry of Agriculture Fisheries and Food and the National Trust. EPIC organised a meeting at the Government's Forestry Department, where the project was presented to four members of the Forestry staff (Mr. Bob, Donald Anthony, Alwin Dornelly and an office staff member) and to Laurent Jean-Pierre from the National Trust. A programme of outreach was agreed upon for the 2010 season.

The EPIC team had limited data on breeding seabird distribution on St. Lucia except that provided by Anthony and Dornelly 2008 and 2009.

Maria Major and Maria Minor were emphasised as breeding seabird hotspots within Point Sable National Park IBA (one of the five IBAs in the country). The last census recorded Red-billed Tropicbird (12 pairs), Roseate Tern (10 pairs), Bridled Tern (unknown), Sooty Tern (>32,000 pairs) and Brown Noddy (10 pairs) breeding in regionally important numbers. The literature also noted other areas on St. Lucia where breeding seabirds were believed to be nesting including: Frigate Island (Magnificent Frigatebird and Brown Noddy), Anse de Chastanet (White-tailed Tropicbird), Cape Moule a Chique and North of Louvet Beach (Red-Billed Tropicbird), L'Islet and L'Islet a Ramier Islands (Roseate Tern). Fous Islands, Lapin Islands and Burgot Rocks were highlighted as potential Brown Booby nesting sites, but this needs confirmation. Praslin was also indicated as a site worth surveying for seabirds, but again no records were available.

Methods

On 17 April 2009, the EPIC team began a circumnavigation of St. Lucia on the survey boat. They sailed (motor assisted) north from Rodney Bay and down the east coast of St. Lucia to Maria Islands at the south of St. Lucia, where they anchored. The boat was manoeuvred as close as possible to the coastline and offshore islands to allow an accurate survey of breeding birds. The passage was not straightforward as the entire area is incompletely surveyed, with reefs, rocks and rough seas.

All seabirds showing breeding behaviour (on nests, Apparently Occupied Nests or when flying) were recorded in addition to separate counts of non-breeding seabirds. Threats to seabirds were noted including mongooses, cats, dogs, cows, goats, rats and people. Three rat traps were baited with peanut butter on Maria Major in the early morning on the first day of the survey and removed early the following morning.

On reaching Maria Islands a kayak was used to paddle to Scorpion Island which was inaccessible for the survey boat due to a coral reef fringe. Maria Islands were accessed by kayak and swimming.

Travelling by foot, the trails and beach front of Maria Major and the entire island Maria Minor were traversed.

Surveys continued around the west coast of the island on the survey boat, as described above, ending in Rodney Bay on 21 April 2009, where the surveys had commenced.

Results

Sooty Terns

On 18 April 2009 >1,500 Sooty Terns were observed on Maria Major and in the surrounding sea (foraging as far as Moule a' Chique) during aerial surveys. There were no signs of nests or eggs, but birds were seen mating and alighting in potential nesting habitat.

Brown Noddy

More than 30 Brown Noddies were also observed perched on cliffs on Maria Major and foraging in the sea off Moule a' Chique. Two Brown Noddies were seen flying with nesting material on Maria Major.

Red-billed Tropicbird

Two Red-billed Tropicbirds were noted flying near the eastern cliffs of Maria Major and found breeding at Tortue Point, Trou Gras Point, and Pointe de Caille.

Brown Booby

Brown Booby adults and chicks were noted at Fous Islands, Falaise Point, Povert Point. Forty-two Brown Booby pairs were recorded in total.

No seabirds were found nesting on the west coast of St. Lucia, apart from Anse de la Liberte, Anse John and Grand Caille Point where Red-billed Tropicbird AONs holes with guano were observed, but no adults recorded. No birds were recorded on Maria Minor or Scorpion Island.

Non-breeding seabirds were noted during the survey on Fous Islands including: a pair of Masked Boobies, a flock of Magnificent Frigatebirds and a single adult Brown Pelican. Laughing Gulls and Royal Terns were also noted foraging around the island as were Brown Boobies and Magnificent Frigatebirds.

Threats

No rats were trapped on Maria Major. Two fishermen and two other people (activity unknown) were observed on Maria Major during the visit. A tour group from the National Trust was also seen. Rat bait stations were observed on Maria Minor but it was not possible to open them to observe the contents. No other threats were recorded on the islands during the surveys, but Anthony and Dornelly (pers. comm.) reported having seen Carib Grackle, *Quiscalus lugubris* feeding on Sooty Tern eggs in the past (the Grackle was abundant during our surveys). Cows, mongooses and rats were observed on the main island. It is unlikely that rats were present on the small offshore rocks/islets on the windward side of St Lucia where breeding Brown Boobies were located, as strong currents and high seas would likely prevent rats from swimming to the rocky outcrops.

Discussion

Maria Major Island likely supports a regionally important colony of Sooty Terns. It was not possible to obtain a representative population count as the birds appeared to be just returning from their wintering grounds, with numbers increasing by the day. Summer seabird surveys in 2010 should provide a more accurate population count.

The Brown Booby population on the mainland cliffs and offshore islands is important and is likely an underestimate of the actual number of birds breeding, as the species breeds all year.

Surveys were undertaken rapidly on Maria Major Island as the newly arrived Sooty Terns were extremely flighty, appearing disturbed by our presence. It is recommended that the sensitivity of Sooty Terns to human disturbance by, for example, tour groups should be monitored, particularly at the pre-breeding stage.

Further surveys to ascertain presence or absence of rats on the Maria Islands should be undertaken in 2010.

These 2009 surveys, plus a repeat survey in 2010, should provide a useful gauge of the status of breeding seabirds on St Lucia, informing future action including management plans and monitoring.

Acknowledgements

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St. Vincent & the Grenadines

Introduction

The EPIC seabird research team Katharine Lowrie (Project Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant) began the first season's breeding seabird research in St. Vincent on 9 May 2009, completing surveys in the country in Petite St. Vincent on 1 June 2009. On arrival in St. Vincent, EPIC met with the government's Forestry Department to request a permit to undertake seabird surveys in St Vincent and the Grenadines. EPIC discussed the seabird research programme with government staff and Andrew Lockhart from National Parks. Mr. Brian Johnson (Director of Forestry) granted permission for the surveys to begin. Research was undertaken during the summer breeding season in St. Vincent and the Grenadines, thus the full complement of *Laridae* as well as the year round breeders should have been present.

A presentation was given to delegates from five schools (29 students and teachers), the National Trust, Department of Forestry, National Parks and the Police Youth Club of Barrouille. EPIC broadcasted on NICE radio, MBC radio and SVG TV. Articles were submitted to Searchlight and The Vincentia and a third article submitted on the project by a freelance journalist who attended a presentation and interviewed the team.

There is very limited data on breeding seabird distribution in St. Vincent and the Grenadines, with many of the islands and rocks never having been surveyed. Frost *et al.* (2009), Culzac-Wilson (2008), Hayes (2002) and Devas (1943) do provide some information.

From these references, the mainland of St. Vincent was thought to have breeding White-tailed Tropicbirds at Old Woman point (near Johnson Point), Young Island and Duvernette Island. There

were also references to breeding Red-billed Tropicbirds on Layou and Old Woman Point, however, it was noted that the surveyor may have confused individuals of this species with those of White-tailed Tropicbirds.

Within the Grenadines, the literature reported seabird breeding at the following locations:

- Battowia:Brown Noddies, Bridled Terns, Red-footed Boobies, Brown Boobies, Red-billed Tropicbirds and Laughing Gulls
- All Awash: Brown Noddies, Sooty Terns, Roseate Terns, Magnificent Frigatebirds, Brown Boobies, Laughing Gulls, Brown Pelicans and Royal Terns.
- Mustique: Brown Pelicans, Royal Terns, Booby sp. and potentially Sandwich Terns.
- Petit Canouan: Laughing Gulls, Roseate Terns, Magnificent Frigatebirds, Brown Noddies, Brown Boobies, Royal Terns and Sooty Terns.
- Carriacou and surrounding islands: Audubon's Shearwater,Roseate Terns
- Bequia: Red-billed Tropicbirds, Brown Boobies, Red-footed Boobies and Roseate Terns.

Four islands have been designated as Important Bird Areas (IBAs): Battowia, All Awash, Mustique, and Petit Canouan.

Battowia was noted for its regionally significant colony of Red-footed Boobies (c. 3,000 pairs). While data was not available on the other species potentially nesting on Battowia (Magnificent Frigatebirds, Boobies and Gulls), it likely supports the second largest seabird colony in the country and maybe of global importance for seabirds.

All Awash was thought to represent the country's third largest seabird colony, with Roseate Terns suspecting of nesting in regionally significant numbers. Magnificent Frigatebird, Brown Booby, Laughing Gull and Royal Tern were also noted on All Awash.

Brown Pelican (in regionally significant numbers), Royal Terns and Sandwich Tern were reported as breeding on Mustique.

Petit Canouan was noted for its globally important Roseate Terns and Laughing Gull colonies and regionally important Magnificent Frigatebird, Brown Booby, Royal Tern and Sooty Tern colonies.

Threats to the IBAs were noted as the following: hunting of young seabirds on Battowia and poaching of eggs and young from All Awash and Petit Canouan by residents and fishermen. Indeed, Petit Canouan's habitat has been converted from dry scrub and woodland to grassland by the action of poachers to facilitate egg harvesting. The island has been described as 'The island for the egg birds' by residents. Goats on Battowia impact vegetation, while feral cats and soil erosion caused by house and garden construction threaten seabirds and their nest sites. Development of buildings, particularly as a result of the growth in tourism, is a threat to seabirds throughout the area.

Methods

St. Vincent was circumnavigated by the survey boat, with Amos Glasgow (Conservation Manager) and Fitzroy Springer (Wildlife Officer) from the Forestry Department. All birds showing breeding behaviour (on nests, AONs or when flying) and their locations were recorded. The surveys progressed to the St. Vincent Grenadines, with the EPIC team sailing/ motoring to every island/rock

within the area. See Table 2 in the Appendix for a detailed description of the methods used and for photos of selected islands within the Grenadines.

Results

Table 3. Breeding Seabirds Recorded on Islands within St. Vincent and the Grenadines.

No.	Island	Breeding Seabirds	Species
1	St Vincent	YES	White-tailed Tropicbird
2	Duvernette Island	YES	White-tailed Tropicbird
3	Young Island	NO	
4	Milligan Cay	YES	Bridled Tern, Brown Noddy, *Roseate Tern*
5	Bequia	YES	Red-billed Tropicbird, Roseate Tern
6	Bullet Cay, Bequia	YES	Brown Booby
7	Semples Cay, Bequia	NO	
8	Middle Cay, Bequia	NO	
9	Isle a Quatre, Bequia	YES	White-tailed Tropicbird, Brown Noddy, Roseate Tern
10	Pigeon Island, Bequia	NO	Brown Noddy, Red-billed Tropicbird
11	Petit Nevis, Bequia	NO	
12	Syrup Cay, Bequia	YES	Bridled Tern
13	Big Cay, Bequia	YES	Brown Noddy, Sooty Tern, Bridled Tern, Brown Booby
14	West Cay, Bequia	YES	Brown Noddy, Sooty Tern
15	Baliceaux	NO	
16	Battowia, Church Cay	YES	Brown Noddy, Red-billed Tropicbird, Sooty Tern, Laughing Gull, Roseate Tern, Brown Booby
17	Battowia	YES	Brown Noddy, Red-billed Tropicbird, Brown Booby, Laughing Gull, Red-footed Boobies
18	Bullet Cay, Battowia	YES	Sooty Tern, Red-billed Tropicbird, Brown Booby, Brown Noddy
19	All Awash	YES	Red-footed Booby, Sooty Tern, Red-billed Tropicbird, Brown Booby, Brown Noddy
20	The Pillories Big	YES	Roseate Tern, Red-billed Tropicbird, Brown Booby, Brown Noddy
21	Mustique	NO	
22	Island S of Rabbit	YES	Laughing Gull, Brown Noddy,
23	Rabbit Island	YES	Laughing Gull, Bridled Tern, Red-billed Tropicbird, Brown Noddy
24	The Pillories Littlest	YES	Brown Noddy, Sooty Tern, Bridled Tern, Laughing Gull
25	The Pillories Middle	YES	Red-billed Tropicbird, Laughing Gull, Brown Noddy, Bridled Tern
26	Double Rock Mustique (N of Mustique)	NO	
27	North Rocks, Mustique, (NE Mustique)	YES	Roseate Tern
28	Brooks Rock	YES	Masked Booby, Brown Noddy, Brown Booby
29	Wilks Rocks	YES	Brown Noddy, Bridled Tern,
30	Petit Mustique	YES	Laughing Gulls, Red-billed Tropicbirds, Brown Noddy, Bridled Tern
31	Petit Cay	YES	Brown Noddy, Sooty Tern, Bridled Tern
32	Savan Rock North	YES	Brown Booby
33	Savan Main	YES	Red-billed Tropicbird, Brown Noddy

No.	Island	Breeding Seabirds	Species
34	Savan Little	YES	Laughing Gull
35	Savan Rock 1	YES	Red-billed Tropicbird, Brown Booby, Sooty Tern, Brown Noddy
36	Savan Rock 2	YES	Brown Booby, Brown Noddy, Sooty Tern
37	Petit Canouan	YES	Sooty Tern, Laughing Gull, Red-billed Tropicbird, Brown Booby, Bridled Tern
38	Canouan	NO	
39	Dove Cay	YES	Laughing Gull, Bridled Tern
40	Canouan Baleine,	YES	Laughing Gull, Bridled Tern
41	Sail Rock	YES	Sooty Tern, Brown Booby, Brown Noddy, Brown Booby
42	Palm Island	NO	
43	Palm Island, Pelican Rock	NO	
44	Union Island	YES	White-tailed Tropicbird
45	Union Island Frigate Island	NO	
46	TCMP Catholic Island	YES	Laughing Gull, Audubon' Shearwater, Brown Noddy, Bridled Tern, Red-billed Tropicbird
47	TCMP Ellen Rock	YES	Roseate Tern, Bridled Tern, Brown Noddy*, Laughing Gull*
48	TCMP Pelican Cay	NO	
49	TCMP Baradal	YES	Laughing Gull, Bridled Tern, Brown Noddy
50	TCMP Jamesby	YES	Bridled Tern, Brown Noddy, Laughing Gull
51	Mayreau	NO	
52	Petit St Vincent Mopion	NO	
53	Petit St Vincent Punaise	NO	
54	Petit St Vincent	NO	

Note: Seabirds in *italic* refer to birds that were potentially breeding on the island, but due to the state of the sea or other circumstances, it was not possible to confirm breeding.

Red-footed Booby

A large colony of Red-footed Boobies was found in mid-June on Battowia. The nests were located on low trees in the high cliffs and ghuts surrounding the island, as well as upon trees in the interior of the island. An estimate of 1,300 pairs is based on the number of chicks within the survey plot (ghut1) and extrapolated for total colony area. The overall number of adults and sub-adults extrapolated from surveys were c. 12,000 individuals.

Red-footed Booby and Brown Booby adults and juveniles were recorded leaving Battowia at dawn, generally flying north to forage in the sea around St. Vincent and beyond. A boat based count of birds flying (adults and non-adults) was undertaken while southwest of Battowia between 0543 and 0643 hours on 19th June, with birds counted every five minutes. During the period, 1,130 Red-footed and Brown Boobies were counted.

Red-footed Boobies were also recorded on All Awash with 45 pairs (based on number of chicks) observed in nests in the tress.

Brown Booby

Thirty-four breeding pairs of Brown Boobies (based on the number of chicks) were recorded on Battowia. Otherwise only small numbers of breeding Brown Boobies were found in the Grenadines: Sail Rock (8 pairs), Big Cay, and Bullet Cay off Bequia (7 pairs), Savan Islands (6 pairs), Brooks Rock near Mustique (5 pairs) and All Awash and Church Cay near Battowia supported 4 pairs respectively, with a few other island supporting even lower populations.

Small aggregates of adults and non-adults were recorded roosting and foraging on many islands within the Grenadines. Islands with large roosts of Brown Boobies included Battowia, All Awash, Church Cay, Sail Rock, Brooks Rock, and Battowia and Savan Islands.

Masked Booby

Masked Booby was only recorded breeding on Brooks Rock where three pairs (based on the number of chicks) were recorded. Masked boobies were also occasionally recorded foraging at sea, including near St. Vincent and Bequia.

Magnificent Frigatebird

No breeding colonies were recorded within the area. A large roost of over 200 individuals was, however, recorded on Battowia. A small roost of six female birds was also observed on Petit Canouan. Small numbers (generally under 10) of Magnificent Frigatebirds were observed gliding in the thermals around most islands, numbers would increase near harbours were tens of birds would sometimes gather when the fishing boats arrived.

White-tailed Tropicbird

White-tailed Tropicbirds were recorded breeding in small colonies around the St. Vincent mainland on Duvernette Island and Old Woman's Point. They were also observed breeding on Isle a Quatre, Bequia and Bloody Head near Union Island.

Red-billed Tropicbird

A colony of Red-billed Tropicbirds was found breeding in Battowia where 50 individuals were recorded flying near the island exhibiting breeding behaviour. Otherwise, very low numbers of Red-billed Tropicbirds were recorded within the area, with Savan Islands supporting 19 individuals and All Awash 10 individuals. Bequia, Petit Canouan, The Pillories, Petit Mustique, Church Cay, Petit Dominica and Mabouya all had less than 10 individuals each.

It is likely that the number of breeding tropicbirds recorded is lower than the actual breeding population within St. Vincent and the Grenadines. An accurate population estimate for Red-billed Tropicbirds is notoriously difficult to obtain due to a nearly year-round breeding season and the limited survey window available during peak arrival times (0900-1000 and 1600-1700 hours). In addition, tropicbird breeding sites are often on inaccessible cliffs, under rocks and within crevices, requiring substantial survey time and effort (Walsh-McGehee 2000).

Brown Pelican

No breeding Brown Pelicans were recorded within St. Vincent and the Grenadines. Small roosting sites were observed on the following islands: Canouan Baileen (2 birds), Union Island at cliffs by Bird

Island (11 adults and 2 juveniles), Nord-ouest Point, Union island (1 bird) and Pelican Island in the Tobago Cays (5 adults and 1 juvenile).

Audubon's Shearwater

Due to the rigours of field work and the number of islands surveyed during a day, only eight broadcasts for Audubon's Shearwater were made throughout the area, including two during full moon and one during partial moonlight. Potential nesting habitat was checked, however, during 22 land-based surveys.

The only breeding shearwaters found within the entire country were three nests, with one chick in each nest, located within crevices in the cliffs on Catholic Island, Tobago Cays.

Laughing Gull

The largest colony of Laughing Gulls was recorded at Battowia, spread over much of the island. Sample plots based on the number of nests extrapolated gave an estimated 3,000 individuals. Other large colonies were recorded on The Little Pillories (386 individuals), Petit Mustique (340 individuals) and Dove Cay (104 individuals).The last three counts were land-based aerial counts, including flushes. A complete count of nests on the ground and gulls in the air was made on Canouan Baleine, to the southwest of Dove Cay. This provided a 'K' value measure of 2.5 gulls to each nest with eggs/chicks.

Royal Tern

No royal terns were found breeding. Occasional sightings of 1-3 foraging birds near coastlines were recorded around St. Vincent, Bequia and Mustique.

Sandwich Tern

No breeding Sandwich Terns were found. A few birds were observed foraging during the circumnavigation of St. Vincent and a single bird seen off Frigate Island, Union Island and at Jew Bay, Carriacou.

Roseate Tern

During water-based surveys the following observations were made: 75 birds perched, likely breeding, on North Rocks at Mustique, 15 birds and 3 nests on the northeast side of Isle a Quatre at Bequia , 27 birds north of the windwardside of Bequia, 6 birds and 1 AON on The Pillores (big) and 3 birds and 2 AONs on Church Cay at Battowia.

During land-based surveys the following observations were made: 27 adults flying or flushed on Ellen Rock at Tobago Cays and 14 eggs and nests recorded. Fifteen Roseate Terns were perched on Milligan Cay on 12 June, but no signs of breeding detected. It is likely that the birds nest on the island but the survey was conducted just before breeding began.

Sooty Tern

The largest colony located during the survey was at Petit Canouan, comprising over 100,000 Sooty Tern individuals, estimated using sample plot extrapolation. Smaller colonies of Sooty Terns were

also estimated using sample plots from the boat at Sail Rock (c. 2,500 individuals), All Awash (c. 370 individuals) and Bullet Cay, Battowia (c. 250 individuals). Direct aerial counts were used for the colony on West Cay at Bequia (c. 100 individuals). Small numbers of birds were also found breeding on other islands within the area, including Church Cay, Battowia, Savan Islands and The Pillories (big).

Bridled Tern

The largest colony of Bridled Terns was found at Petit Canouan, with over 500 individuals recorded through sample plot extrapolation. Jamesby, within the Tobago Cays, also supported a significant population of the species with c. 180 birds recorded during land-based aerial and ground counts. Using land-based aerial and ground counts, it was found that The Pillories supported c. 95 birds, Milligan Cay had c. 50 individuals, and Rabbit Island had c. 30 individuals. Further small colonies of Bridled Terns (under 20 individuals) were found on a number of other islands within the area.

Brown Noddy

The largest colony of Brown Noddies was found at Petit Canouan (extrapolation from sample plots) with over 1,000 individuals. On The Pillories, 210 individuals were counted (during land-based aerial counts), 180 during water-based surveys of Sail Rock and 150 individuals during land-based ground and aerial surveys of Jamseby. Further small colonies of under 70 individuals were found on islands including: Rabbit Island, Pigeon Island, Bequia, Petit Cay near Petit Mustique, Ellen Rock and Milligan Cay.

Threats

Poaching of seabird and their eggs and chicks was reported by residents and fishermen. Indeed, the survey team found evidence of people on nearly all offshore islands surveyed, suggesting a threat to the ground nesting seabirds**.** Petit Canouan was said to be a particular target of egg poachers with battles, sometimes with firearms, breaking out between fishermen desiring the greatest haul of eggs (Mustique Fisheries Manager Darnley Hazel and Lystra Culzac-Wilson of Avian Eyes pers. comm.). After surveying Dove Cay, near Canouan, the survey team watched three people collect all the Laughing Gull eggs just counted. The young men came to the survey boat afterwards with over 50 eggs in their buckets and suggested that any wild food was available as a quick and easy meal. Red-footed Booby remains, including feathers, skulls, feet and a bloody chopping block were found on the beach at Baliceaux. It was reported that each fisherman took at least five Red-footed Booby adults or chicks on each voyage. A fisherman also said that he had noticed seabird numbers declining over the years on the offshore islands (Darnley Hazel pers. comm.)

The main islands also had goats, dogs, cats, cattle and rats. Carnivore droppings (potentially mongoose) were also found on Jamesby and Mabouya.

Discussion

The most important island for breeding birds, based on diversity of species and the number of large colonies, was Battowia, with the largest Red-footed Booby colony in St. Vincent and the Grenadines. All Awash was the only other island with a Red-footed Booby breeding colony. Battowia also supported the largest colony in the area of Red-billed Tropicbirds, Laughing Gulls and Brown

Boobies. Bullet Cay at Battowia also supported over 250 Sooty Terns. The largest *roost* of Magnificent Frigate Birds in the area was also noted on Battowia.

Petit Canouan was also significant in the area, supporting the largest colony of Sooty Terns, Bridled Terns and Brown Noddies.

The islands surrounding Mustique (North Rocks, The Pillories, Rabbit and Brooks) supported a diverse population of breeding seabirds. These included the largest colony of Roseate Terns in the area, the second largest colonies of Laughing Gulls and Brown Noddies (Pillories) and the third largest colony of Bridled Terns, as well as a small colony of Brown Boobies. Of particular significance was the small colony of Masked Boobies breeding on Brooks Rock, representing the only breeding colony of the species in the area.

Other islands of note included Sail Rock which supported the area's second largest colony of Sooty Terns, the third largest of Brown Noddies and the second largest colony of Brown Boobies (8 pairs). The Tobago Cays had the only colony of Audubon's Shearwater, the second largest colony of Roseate Terns (Ellen Rocks) and Bridled Terns (Jamesby) and the fourth largest colony of Brown Noddies (Jamesby) in St. Vincent and the Grenadines. St. Vincent and Bequia supported the only breeding populations of White-tailed Tropcbirds in the area, with Bequia also having notable colonies of Brown Boobies, Roseate Terns and Sooty Terns. Savan Rocks supported the second largest population of Red-billed Tropicbirds and a notable colony of Brown Boobies. All Awash had four breeding seabird colonies, with the second largest population of Sooty Terns in the area and a small colony of Red-footed. The most important offshore island on St. Vincent was Milligan Cay with the fourth largest colony of Bridled Terns and Roseate Terns, as well as breeding Sooty Terns. Duvernette Island was also important in supporting breeding White-tailed Tropicbirds.

Results from Canouan Baleine were interesting as a complete count of all Laughing Gulls flying/flushed and all nests (including eggs and chicks) was possible due to the small size of the island. This provides an indication of the likely number of breeding pairs of Laughing Gulls when only an aerial count is possible. The greatest accuracy would be achieved if the colony to be extrapolated was surveyed at a similar time and day of the month and after further complete counts in different locations were made to verify such a 'K' value.

Surveys did not determine whether rats were present or absent on the offshore islands. Rats and other introduced mammals are a threat to seabirds and can reduce breeding populations dramatically (Howald *et al.* 2007). Mammal faeces, potentially Mongoose, were found on Mabouya and Jamesby. If the species or rats are confirmed on the islands, it is recommended that an invasive species control programme is considered on suitable islands with significant seabird populations. Further surveys will be undertaken in 2010 to find evidence of rats and other invasive species.

Poaching of seabirds, eggs and chicks was widespread on many offshore islands. Particularly damaging harvesting was noted on Battowia and Petit Canouan. Although seabirds may have been traditionally used as a food source, present degraded populations of seabirds can likely not sustain current harvesting practices. It is suggested that a campaign to dissuade people from eating seabirds and their eggs is started, highlighting their decline and their importance in indicating the health of the ocean and other ecosystem benefits.

EPIC intends to return to St. Vincent and the Grenadines in winter 2010 to undertake a second breeding survey. They will repeat the survey method outlined in this paper.

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Grenada & the Grenadines

Introduction

The EPIC seabird research team, including Katharine Lowrie (Project Manager), David Lowrie (Captain and Surveyor) and Megan Friesen (Research Assistant), began the first season's breeding seabird research in the north of the Grenadian Grenadines at the beginning of June 2009. The study began in Carriacou and Petite Martinique, after which EPIC sailed (intermittently motored-assisted) south on their survey boat, surveying all islands/rocks in the chain before arriving in Grenada on 17 June, where further data collection and outreach was carried out. Research was undertaken during the peak summer breeding season in Grenada and the Grenadines, thus the full complement of *Laridae* as well as the year round breeders should have been present.

Outreach included meeting with the Forestry and Fisheries departments of Grenada, wherein research and seabird conservation topics were presented and the implications for Grenada and the Grenadines discussed. The EPIC team was interviewed by MTV of Grenada, with the broadcast appearing on the news. They also delivered a presentation on seabird ecology and EPIC research attended by 104 residents and yachts people. Fishermen were also approached near Isle de Ronde and asked about seabird threats and population trends.

There was very limited data on breeding seabird distribution in Grenada and the Grenadines, many of the islands and rocks had never been surveyed. Frost *et al.* (2009), Rusk (2008) and Devas (1943) provided some information on the presence of seabirds in the archipelago. (See Table 4).

Table 4. Literature Review of Seabird Distribution in Grenada and the Grenadines.

Carriacou & Islets (including Bonaparte Rocks)	Audubon's Shearwater, Roseate Tern, Sooty Tern
Diamond Rock (Kick-'em Jenny)	Red-billed Tropicbird, Brown Booby, Red-footed Booby, Brown Noddy
Les Tantes	Red-billed Tropicbird, Brown Booby, Red-footed Booby, Bridled Tern, Roseate Tern, Laughing Gull, Brown Noddy, Sooty Tern, Bridled Tern
Large Island	Laughing Gull, Brown Noddy, Sooty Tern
Frigate Island	Red-billed Tropicbird, Sooty Tern, Roseate Tern
Jack A Dan	Roseate Tern, Sandwich Tern

Sandy Island	Roseate Tern
Rose Rock	Red-billed Tropicbird, Brown Noddy, Bridled Tern, Roseate Tern
Lee Rocks	Red-billed Tropicbird, Brown Noddy, Sooty Tern, Bridled Tern
The Sisters (near Les Tantes)	Brown Booby, Red-footed Booby, Roseate Tern, Brown Noddy, Bridled Tern
Mabouya	Roseate Tern
Isle de Ronde	Red-billed Tropicbird
Saline Island (South of Carriacou)	Red-billed Tropicbird
Carriacou	Gull-billed Tern, Roseate Tern, Least Tern
Grenadines	Laughing Gull
Green Island (N Grenada)	Roseate Tern, Bridled Tern
Glover Island	Laughing Gull, Roseate Tern
Grenada	Red-billed Tropicbird, Laughing Gull, Bridled Tern, Roseate Tern (W/N coasts)

Methods

The survey boat was manoeuvred around the many islands within the area and water-based or land-based surveys undertaken. Nocturnal surveys for Audubon's Shearwater were conducted where possible. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Threats to breeding seabirds such as introduced mammals (i.e. rats, cats, dogs, goats, donkeys) were noted. A full description of the methods used on each of the islands/rocks surveyed in the Grenadines is provided in Appendix I Table 2 of this report, as well as a selection of photos of the islands.

Results

Table 5. Breeding seabirds recorded on islands within Grenada and the Grenadines.

No.	Island	Breeding Seabirds	Species
1	Petite Dominique	YES	Red-billed Tropicbird
2	La Baleine	NO	
3	Fota	YES	Roseate Tern
4	Petite Martinique	NO	
5	Jack A Dan	NO	
6	Sandy Island, Carriacou	NO	
7	Mabouya	YES	Red-billed Tropicbird, Laughing Gull
8	The Sisters Rock, Little, Carriacou	YES	Sooty Tern, Bridled Tern, Brown Noddy
9	The Sisters Rock, Large, Carriacou	YES	Brown Noddy, Sooty Tern
10	Carriacou	NO	
11	Little Mushroom	YES	Brown Noddy, Roseate Tern, Bridled Tern

12	Mushroom Island	YES	Bridled Tern, Brown Noddy, Red-billed Tropicbird, Laughing Gull
13	White Island	YES	Brown Noddy
14	Saline Island	YES	Brown Noddy, tropicbird species.
15	Cassada Rock	NO	
16	Frigate Island	YES	Bridled Tern, Brown Noddy, Red-billed Tropicbird, Laughing Gull, Sooty Tern
17	Large Island	YES	Brown Noddy
18	Rose Island	YES	Bridled Tern, Brown Noddy, Red-billed Tropicbird
19	Bonaparte Rocks	YES	*Brown Noddy, Roseate Tern, Sooty Tern, Laughing Gull*, Red-billed Tropicbird
20	Little Bonaparte	YES	*Sooty Tern*, *Red-billed Tropicbird,* Roseate Tern
21	Tantes West	YES	Red-billed Tropicbird, Brown Noddy, Brown Booby, Laughing Gull
22	Tantes South	YES	Red-billed Tropicbird
23	Tantes North	YES	Laughing Gull, Brown Noddy
24	Tantes East	YES	Red-footed Booby, Brown Noddy, *Brown Booby,* Laughing Gull, Red-billed Tropicbird, *Magnificent Frigatebird,*
25	Diamond Rock	YES	Red-billed Tropicbird, Laughing Gull, Brown Noddy, Bridled Tern, Red-footed Booby, Brown Booby, Audubon's Shearwater (1 dead)
26	The Sisters, Grenada	YES	Brown Noddy, Bridled Tern*, Sooty Tern,* Red-billed Tropicbird, Red-footed Booby, Brown Booby, Laughing Gull
27	Isle de Ronde	NO	
28	Isle de Caille	YES	Laughing Gulls, Brown Noddy
29	London Bridge	YES	Brown Noddy, Brown Booby, Bridled Tern,
30	Bird Island	YES	*Brown Booby, Laughing Gull, Sooty Tern,* Brown Noddy, *Roseate Tern,* Bridled Tern, Red-billed Tropicbird
31	Sandy Island, Grenada	NO	
32	Sugar Loaf Island	NO	
33	Green Island	NO	
34	Black Rock	NO	
35	Conference Island	YES	Laughing Gull, Bridled Tern
36	Telescope Rock	YES	Brown Noddy, *Bridled Tern*
37	Marquise Island	NO	
38	Bacolet Island	NO	
39	Point de Petite Trou (island)	YES	Roseate Tern
40	Adam Island	NO	
41	Gary Island	NO	
42	Hog Island	NO	
43	Tara Island	NO	
44	The Porpoises	NO	
45	Glover Island	YES	Laughing Gull
46	Grenada	NO	

Note: Seabirds in *italic* refer to birds that were potentially breeding on the island, but due to the state of the sea or other circumstances, it was not possible to confirm breeding. Rows highlighted refer to good populations of a species or a good population of a species and a diversity of species.

The main islands had goats, dogs, cats, cattle, rats and Manacou *Didelphis virginiana* (the last was observed only at Carricaou). Fishermen acknowledged eating seabirds and their eggs in the islands north of Grenada (Isle de Ronde, Les Tantes, Diamond and The Sisters) and it is likely that this practice is widespread. In addition, turtle nests were found poached on White Island by Carriacou, with eggs/hatchlings taken. A carnivore dropping (potentially mongoose) was found on Diamond Rock and mongooses were observed on the Grenada mainland. A dead Magnificent Frigatebird caught up in a fishing line was found on The Sisters, Grenada, while two captive juvenile Brown Boobies were observed on the beach at Petit Martinique. Goats were observed on West Tantes and also Frigate Island (in the latter case, shotgun cartridges were also found).

Discussion

Of the 46 islands surveyed, just over half (27) had breeding seabirds nesting upon them. The large, populated islands (Grenada, Carriacou and Petite Martinique) did not support breeding birds. Near-shore islands that did support breeding birds included: Glover Island, Pointe de Petite Trou, Conference Island, Telescope Rock (off Grenada),Mabouya, Sister Rocks, Mushroom, Little Mushroom, White Island and Saline Island (off Carriacou).

The islands with the highest diversity of breeding species (7) and also abundance of sea birds, were Les Tantes with: Red-footed Boobies (c. 459 adults), Laughing Gulls (c. 109 adults), Bridled Terns (33 adults), Brown Noddies (28 Adults), Red-billed Tropicbirds (24 adults) and Brown Boobies (3 pairs). The Red-footed Boobies were breeding on Les Tantes East in large numbers. Unfortunately, sea conditions prevented a full count of chicks/nests. It is hoped that a landing will be feasible in 2010. Magnificent Frigatebirds (71) were also noted on Les Tantes East but it was not possible to ascertain whether they were breeding; this will be assessed in 2010.

Diamond Rock, a few miles northwest of Les Tantes, also supported a diverse colony of breeding seabirds comprised of the following six, and possibly seven, species: Red-footed Boobies (370 individuals), Laughing Gulls (100 adults), Red-billed Tropicbirds (72 adults), Brown Noddies (9 adults), Brown Boobies (4 pairs), Bridled Terns (2 adults) and possibly Audubon's Shearwater (1 dried, dead adult was found). Magnificent Frigatebirds were also noted *roosting* on the island, with c. 67 individuals recorded. The colony of Red-footed Boobies was notable, but a full count of nests and chicks was not possible from the boat or land due to habitat barriers and time constraints. Similarly, the Laughing Gull colony was large and extensive, particularly on the east and southeast sides, but it was not possible to fully access the colony due to habitat and time constraints. It is likely that counting birds aerially greatly underestimates the colony size.

Frigate Island, South of Carriacou had five species of seabirds breeding in large colonies. The number of individuals recorded for each species was as follows: c. 582 Laughing Gulls, 102 Bridled Terns, 53 Sooty Terns, 33 Brown Noddies and 10 Red-billed Tropicbirds. A large colony of Laughing Gulls (210) was also recorded on Glover Island, at the south-western tip of Grenada.

The largest colonies of Roseate Terns were found breeding on Fota near Petit Martinique and the Bonaparte Rocks (c. 60-70 individual birds). Pointe de Petit Trou and Little Mushroom also had small populations.

Of the 15 species of seabirds recorded during the 2009 Lesser Antilles study, Grenada and the Grenadines supported eight species (Magnificent Frigatebird and Audubon's Shearwater are yet to

be confirmed). No Brown Pelicans were recorded breeding within Grenada and the Grenadines. Individual Brown Pelicans were recorded roosting on Sister Rocks, Hillsborough Bay, Mt. St. Louis, Carriacou and Isle de Ronde. Sandwich Terns were observed foraging but no breeding was registered. Royal Terns, Masked Boobies and White-tailed Tropicbirds were not observed at all within the area.

Surveys did not determine whether rats were present or absent on the offshore islands. Rats and other introduced mammals are a threat to seabirds and can reduce breeding populations dramatically (Howald *et al.* 2007). Mammal faeces, potentially mongoose, were found on Diamond Rock. If the species or rats are confirmed on the islands, it is recommended that an invasive species control programme is considered on suitable islands with significant seabird populations. Further surveys will be undertaken in 2010 to find evidence of rats and other invasive species.

Poaching of seabirds, eggs and chicks was widespread on many offshore islands. Although seabirds may have been traditionally used as a food source, present degraded populations of seabirds can likely not sustain harvesting. It is suggested that a campaign to dissuade people from eating seabirds is started, highlighting their decline and their importance in indicating the health of the ocean and other ecosystem benefits.

Further outreach and research will continue in 2010 with the area being surveyed for breeding seabirds during the winter season.

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APPENDICES

Appendix I

Table 1. Summary of survey methods used on St. Vincent and the Grenadines.

Note: Islands listed in order surveyed. **W**- Water-based of all visible birds, **LG**- Land Ground survey (count of birds on the ground by foot/bicycle) **LA**- Land Aerial survey (count of birds flying above by foot/bicycle) **B-** Audubon Shearwater Broadcast

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
1	St Vincent	**W B** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Manoeuvred as close as possible to the island along the 15m contour. Audubon Shearwater broadcast at Petite Byahaut from the survey boat.	Anchored at Wallilabou Bay and near Duvernette Island.	Coastline is incompletely surveyed, with reefs, rocks and rough seas. Few yachts travel down the windward side of the island. (Amos Glasgow and Fitzroy Springer of Forestry Department accompanied EPIC).
2	Duvernette Island	**W LG B** Aerial count of White-tail Tropicbirds from boat at 0830. Also walked up the stairs on the island to the top. Audubon Shearwater broadcast by the island from the survey boat.	Anchored N of Duvernette.	Unable to investigate the crevices for Tropicbirds etc. during land survey. Aerial count most effective. (No birds were seen in the *afternoon* on the previous day). Three surveyors.
3	Young Island	**W** Sailed around the west and north coast. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Maneuvered as close as possible to the island.		Island has been developed with hotels, little habitat for birds.
4	Milligan Cay	**LG LA**. All eggs, nests, adults on nests were counted *where accessible*. An aerial count of birds flushed was also undertaken.	Swam onto N side of island. Survey boat anchored on N off island in heavy chop.	Rough seas. Often birds were under low cacti etc. so could not be counted. A complete count of all nests was not possible due to time and terrain. The aerial count should compensate for this. Three surveyors.
5	Bequia	**W B** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Maneuvered as close as possible to the island. Audubon Shearwater broadcast at Friendship Bay and Port Elizabeth-	Anchored at Admiralty Bay and Friendship Bay.	Rough seas on windward side, particularly rounding Man and Brute Point.

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
		Admiralty Bay from boat.		
6	Bullet Cay, Bequia	**W** Surveyed E coast, view of N, E and S and most of W. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Maneuvered as close as possible to the island.		
7	Semples Cay, Bequia	**W** Surveyed east side of island. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		
8	Middle Cay, Bequia	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		
9	Isle a Quatre, Bequia	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Aerial counts of White-tailed Tropicbirds at ideal time of day- 0937.
10	Pigeon Island, Bequia	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		
11	Petit Nevis, Bequia	**W LG** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. On land followed path along S coast from anchorage to NE of island overlooking Syrup Cay. Also surveyed E coastline on foot.	Anchored in bay W of island. Swam ashore.	Three surveyors.
12	Syrup Cay, Bequia	**W LA** Viewed island from boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Also surveyed from NE vantage point on Petite Nevis.		Reefs, rocks, rough seas.
13	Big Cay, Bequia	**W** Surveyed S and N coastline from boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		
14	West Cay, Bequia	**LG LA** Surveyed island for nests, eggs and adults. Also aerial count of breeding birds as flushed.	Survey ship 'hove to' S of island. Swam onto S shore of island from boat.	Count of nests, eggs, likely to be below actual number as difficult to access whole island due to thick scrub. The aerial count should compensate for this.
15	Baliceaux	**W LG B** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Land-based survey from Landing Bay to North Bay. Audubon's Shearwater broadcast from the survey boat at North Bay.	Anchored Landing Bay and North Bay. Swam and dinghy to island.	

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
16	Battowia Church Cay	**W LG LA** Land survey only on lower reaches of island, the higher area was inaccessible on the day. Birds flushed during land survey were counted. Also circumnavigated on the survey boat for birds missed. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.10m2 index plots were approximated from the boat for a 20x20m colony of Sooty	Swam to NW side of island.	Strong currents. Rough seas and shoreline. Not ideal for swimming to. Should be possible to climb rock next time with decent shoes.
17	Battowia	**LG W LA B** Land-based survey of all Red-footed Boobies in ghut 1. Ghut 1 used as the extrapolation plot for Red-footed Boobies on Battowia. Two GPS coordinates were taken for the width of the ghut from the top and bottom. Ten ghuts of a similar size to ghut 1 were counted during the island circumnavigation. A GPS reading was taken from the boat at the start and end of the 'ghut' and the boat' distance from the island estimated in metres. Central ghut also contained Red-footed Boobies. GPS readings were taken at the top and bottom. The population of breeding Red-footed Boobies should be extrapolated by multiplying the count for ghut 1 by the ten other ghuts and adding the central ghut area. Aerial counts of Red-footed Boobies were made from the boat (looking to ghut 1) between 0543- 0643 as they left Battowia to forage. Laughing Gull nests and eggs were counted in three transects with $50m^2$ circular plots, 50 m apart. Transect 1 began 5 meters from the first Laughing Gull nest found and spanned the length of the island. Transect 2 was started 50m away from the first transect. Transect 3 began 5 meters from the first nest found on the SE of Battowia to account for any variation in nest density on a different aspect of the island. GPS coordinates were taken at the colony perimeter. Any other breeding seabirds were recorded when surveying plots (e.g. Brown Boobies) and during a survey of the island when most of its accessible perimeter was surveyed by foot . All other seabirds showing breeding behaviour (not found during the	Swam to island and paddled dinghy to island. Anchoring sites are not suitable close to Battowia with poor holding, surge and strong currents. *In the future the survey vessel should be anchored in the East facing bay on Baliceaux (with stern anchor) and a dinghy used to pass the straits to Battowia, either anchoring off, or depositing surveyors into Ghut 1.	Rough seas for swimming / landing dinghy. Ghut 1 was the first ghut (gulley) climbed on reaching the island. Trees/scrub, cacti, devil's nettle present. Much of the island is inaccessible. The circumnavigation allowed surveys of the cliffs. Red-footed Boobies and Brown Boobies returning in the evening from foraging, generally approximated at 2 per second during a 90 minute watch. Laughing Gull colony was on much of the island, save the cliffs. Some breeding seabirds may have been missed during the land survey (specifically nesting Brown Boobies). Three surveyors.

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
		land surveys) were recorded on nests, AONs or when flying during the water-based circumnavigation. An Audubon's Shearwater broadcast was made near gut 1 from the survey boat.		
18	Bullet Cay, Battowia	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Strong currents and rough seas around the island. Apparently it is possible to land on the rock from a fishing boat- will attempt in 2010.
19	All Awash	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Additionally, two Sooty Tern colonies of $70m^2$ and $25m^2$ were estimated from the boat. The number of terns visible per m^2 was estimated.		Unable to land on the island due to heavy breaking swell.
20	The Pillories Big	**W, LG, LA**. The island was surveyed in 2.5 hours (c. ¼ was not assessed, but the W and LA surveyors should compensate for this). Trees/ground weas searched for Brown Noddy nests and any flushed birds were counted. Bridle Tern nests were also surveyed but it is likely that nests were missed as they are often difficult to find under boulders or within crevices. Apparently Occupied Nests were counted, where birds took flight from the ground and hovered close, but there was not enough time to locate the nest. Aerial birds were also registered. Laughing Gull nests were camouflaged and difficult to find in the limited time, so squawking adults hovering above the nesting area (showing breeding behaviour) were counted as well as flushed individuals, birds flying above the island and any nests/ eggs found. Sooty Terns were surveyed from the boat, with a plot approximated? within the $12m^2$ colony. Pairs (Brown Noddy and Bridled Tern) nesting or showing breeding behaviour on inaccessible cliffs, that could not be surveyed by foot, were surveyed from the boat.		The island is steep and wooded making orientation difficult. Markers such as bio-degradable tape are useful as were gloves and a mask and snorkel. One surveyor.
21	Mustique	**LG** W Britannia Bay to Gallicaux Bay surveyed (on foot) and to Rabbit Island. Also a car survey from Britannia Bay to the southern tip of the	Mooring buoy in Britannia Bay.	Three surveyors.

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
		island. W coast surveyed by boat. All birds showing breeding behaviour were recorded on nests, AONs or when flying.	Numerous rocks, wrecks and fast currents make passing to the North possible but risky.	
22	Island S of Rabbit	**LA** The island was viewed from the mainland with a telescope.		One surveyor.
23	Rabbit Island	**LG LA** Initially viewed island through telescope from mainland. Entire island was walked where accessible. An aerial count of Laughing Gulls was made after the first nest was found- there was not time to find all nests. All Brown Noddy nests/adults/eggs were counted plus aerial counts. Bridled terns nests were found where possible and an aerial count made.	Swam to island from main land.	One surveyor.
24	The Pillories Littlest	**LG LA**. Island was searched for Laughing Gull nests, which were very difficult to find in low scrub. A count of aerial gulls showing breeding behaviour was made. Brown Noddies and Bridled Terns were counted nesting on cliffs and aerial counts were made of birds.	Anchored North of island. Swam to island.	
25	The Pillories Middle	**LG LA** A search of the cliffs around the entire island was made. All nests, eggs and adults on nests of Bridled Terns, Brown Noddies and Laughing Gulls were counted. An aerial count of birds flushed was also made. The gulls were mainly found nesting on the cliff sides as were the other seabirds. It is likely that the number of nests for Gulls and Bridled Terns was undercounted, so the aerial survey was important. Sooty Terns were also found displaying breeding behaviour but no nests found. Roseate Terns were seen flying around the island but no nests were found- they may not be breeding on the island.	Swam from The Pillories Littlest to Middle.	
26	Double Rock	**W** Sailed past northwestern side of island, could view most of island. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Ship wreck visible poking out of sea.

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
27	North Rocks	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		
28	Brooks Rock	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Attempted to swim onto island but waves were too rough, so swam back to boat.
29	Wilks Rocks	**W** Surveyed eastern side of rocks. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		A portion of the W side of Wilks rock could not be surveyed, as it could not be seen from a vantage point on Mustique and it could not be circumnavigated by boat due to reefs and underlying rocks.
30	Petit Mustique	**LG LA** The southern coastline was accessible and walked on foot (through thick cacti/devil's stinging nettle). Laughing gulls were present on the SW coastal edge for c. 300m x c. 10m. No GPS for colony boundary, therefore, GPS taken from boat: western UTM taken 80m from land and eastern UTM taken 300m from land. An area by a sandy gully was accessible and a plot of 200m^2 was surveyed. All eggs and nests were counted and an aerial count made. A further Laughing Gull colony was found at the southern tip of the island in grass and low scrub. Two 100m^2 plots were established and eggs, nests counted. Aerial birds above the colony were also counted. No GPS was available during the trip, so the area of the colony was ascertained by foot.	Anchored NE of island. Swam to island.	Strong currents between Petit Cay and Petit Mustique. Thick bush to walk through. One surveyor.
31	Petit Cay	**LG LA** The perimeter of the island was surveyed. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. The top of the island was inaccessible due to dense cacti and crumbling rocks. Sooty Terns, apparently nesting on the top of the island, were counted while in the air.	Swam onto island.	Island should be accessed by kayak/boat in future, due to strong currents. An undercount of birds was likely.
32	Savan Rock North	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Very strong currents (4 - 5kts) between Savan Rocks – hazardous.
33	Savan Main	**W LG** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. The interior of the island was also surveyed for breeding birds.	Anchored near the fishing settlement, west of island.	

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
			Kayaked onto island.	
34	Savan Little	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Very strong currents (4 - 5kts) between Savan Rocks – hazardous.
35	Savan Rock 1	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Very strong currents (4 - 5kts) between Savan Rocks – hazardous.
36	Savan Rock 2	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Very strong currents (4 - 5kts) between Savan Rocks – hazardous.
37	Petit Canouan	**LG LA** A 'cliff habitat plot' of 18x21m composed of boulders, cacti and scrub was surveyed at the first point reached on the island. GPS coordinates were taken from the top and bottom of both sides of the plot. This should be used to extrapolate for Bridle Terns, Sooty Terns and Brown Noddies in the rest of the island perimeter. Island perimeter: 1650x4m. 'Inland habitat plots', patches of boulder, cacti and scrub were found to support breeding Brown Noddies, Bridled Terns, and Sooty Terns. Pot 46 was surveyed for breeding birds. GPS coordinates were taken at the extremities of the plot habitat. Some UTMs were obtained for the other inland habitat plots, however, concern of trampling Sooty Terns when accessing plots meant that most of the measurements were approximated visually. The Data from plot 46 should be used to extrapolate for the remaining area of inland habitat plots. The Sooty Tern colony was surveyed using plots on a transect line across the island. The first plot began 5 m inland from the first Sooty Tern nest encountered. Due to a high density in nests per m^2, a 10 m^2 circular area was used for all surveyed plots and they were spaced 30m apart from the centre of the plot. The second transect started 100m away from the first and the first plot surveyed. Transect 1 method was repeated. The data from the plots should be used to extrapolate the size of the Sooty Tern colony for the island (174,000m2) after the extrapolated cliff habitat plots, inland habitat plots and Laughing Gull colony area have been deducted from the area.	Swam to the island. Boat 'hove to' close to Western edge. Attempts made to tie to island aborted due to back eddies.	The dominant habitat on the island was long (1-2m), tussocky grass. Sooty Tern nests were hidden under it. This made surveying very difficult as eggs, chicks and adults were liable to be trampled. It was also time consuming moving through the habitat. Plots were necessary to prevent harm to the colony and allow a rapid survey. The sea was too rough to allow a circumnavigation, plus the size of the colony, likelihood of disturbance and difficult habitat, meant that measurements for the island were obtained from MaxSea computer programme. Very deep water surrounded the island, allowing the survey boat to manoeuvre very close.

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
		One small laughing gull colony was found on the island (in addition to a few nests within the Sooty Tern colony). A transect of 24x2m (284m2) was walked through the middle of it. All nests, eggs and adults flushed were counted. UTM coordinates were taken at the colony extremities. Red-Billed Tropicbirds were recorded during the land survey as they flew around and over Petit Canouan. Possible AONs were noted as they made attempts at landing.		
38	Canouan	**W LG LA** The north and west coastline and southwestern coastline were surveyed on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. The southeastern island was also surveyed on foot.	Anchored in Rameau Bay. Paddled the dinghy onto the island.	It was not possible to survey the entire coastline as the northern area is private; owned by the Four Seasons Hotel chain. The hotel barred the surveyors from entering.
39	Dove Cay	**W LG LA** An initial water based survey of Dove Cay was used to locate nests of Bridled Terns and Laughing Gulls that were nesting on the cliff sides. The island was then surveyed from land to determine the number of laughing gull and bridled tern nests and eggs that had not already been surveyed from the boat. Due to the low density of laughing gull nests, breeding activity within a 400 m^2 circular plot was recorded. Three plots were set up based on the stratification of vegetation type: the first plot in low grasses, the second in cacti and bush and the third on cliff and barren ground. UTM coordinates were taken for the colony extremities which extended across the island. The plots should be extrapolated for the entire area of the island.	Anchored to the W of the island. Swam onto the island.	Habitat areas should be mapped on return survey in 2010.
40	Canouan Baleine	**LG LA** A complete island count of nests and eggs was carried out, with all adults flushed also counted. Breeding Bridled Terns were also counted on the entire island.	Swam to the island from boat.	Bad sea urchins and crashing waves on rocks, not ideal for swimming. A complete LG and LA provided a 'K' value for the number of breeding laughing gulls to the number of non-breeding Gulls.
41	Sail Rock	**W** Circumnavigated on the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. As well as recording aerial Sooty Terns, five $10m^2$ plots were		

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
		estimated from the survey boat and the number of adults counted. The Sooty Tern colony area was estimated as 1400m2 from surveys and photos.		
42	Palm Island	**W** Surveyed N coast by sail boat and kayaked W and S coast. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.	Anchored west of island.	Private Island. Hotel over entire island.
43	Palm Island, Pelican Rock	**W** Surveyed from kayak. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.	Anchored west of Palm Island.	
44	Union Island	**W LG** Surveyed West and South coast from the survey boat. Surveyed South coast on foot. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.	Anchored in Clifton Harbour. Paddled dinghy to island.	
45	Union Island Frigate Island	**W LG** Surveyed from Union Island and from the survey boat. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.	Accessed by foot from Clifton Harbour and while sailing past.	
46	TCMP Catholic Island	**LG LA** The entire island was searched on foot. The entire coastline was circumnavigated. All birds showing breeding behaviour (on nests, AONs or when flying, including when flushed) were recorded.	TCMP motor boat dropped surveyors close to island.	Three surveyors.
47	TCMP Ellen Rock	**LG LA** The island was first circumnavigated to ascertain likely breeding habitat. The entire island was searched on foot. All birds showing breeding behaviour (on nests, AONs or when flying, including when flushed) were recorded.	TCMP motor boat dropped surveyors close to island.	Three surveyors.
48	TCMP Pelican Cay	**W** Breeding Brown Noddies and Brown Pelicans on Pelican Cay were surveyed from the boat during a circumnavigation of the rock. Sea rough and attempt not to flush Pelicans, also easy to view island from boat.	TCMP motor boat.	Three surveyors (plus two marine park staff).
49	TCMP Baradal	**LG LA W** The island was circumnavigated by kayak. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. The island was also surveyed on land by following trails.	Anchored E of Jamesby. Kayaked to island from boat.	Three surveyors.
50	TCMP Jamesby	**LA LG B** A full island count of nesting seabirds was carried out. In addition to nests and eggs, aerial counts of adults were recorded from	Anchored E of Jamesby. Swam to	Three surveyors.

No	Island	Outline Method	Access/ Anchorage	Difficulties/comment
		different points on the island when flushed from their nests. Audubon Shearwater broadcast by the island from the survey boat.	island from boat.	
51	Mayreau	**W LG B** South and west coast surveyed form survey boat. East coast walked on foot. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded. Audubon Shearwater broadcast by the island from the survey boat.	Anchored Upper Bay and Saline Bay. Swam and paddled dinghy to island.	Three surveyors.
52	Petite St. Vincent Mopion	**W** Sailed down west side of islands. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Low lying. Much boat traffic. Little potential breeding habitat.
53	Petite St.Vincent Punaise	**W** Sailed down west side of islands. All birds showing breeding behaviour (on nests, AONs or when flying) were recorded.		Low lying. Much boat traffic. Little potential breeding habitat.
54	Petite St. Vincent	Kayaked to the island, and walked island perimeter.		One surveyor.

Appendix II

Table 1. Summary of survey methods used on Grenada and the Grenadines.

Note: Islands listed in order surveyed. **W**- Water-based survey of all visible birds, **LG**- Land Ground survey (count of birds on the ground by foot/bicycle) **LA**- Land Aerial survey (count of birds flying above by foot/bicycle) **B-** Audubon Shearwater Broadcast.

No.	Island	Outline Method	Access/ Anchorage	Difficulties/comment
1	Petit Dominique	**W** Circumnavigated on survey boat	N/A	Strong currents.
2	La Baleine	**W** Viewed whilst circumnavigating Petit Dominique.	N/A	Very low lying rock.
3	Fota	**W** Circumnavigated on survey boat	N/A	Strong currents.
4	Petit Martinique	**LG/LA** Walked island perimeter	Anchored in Albert Bay, dinghy onto island.	N/A
5	Jack A Dan	**W** Circumnavigated on survey boat.	N/A	N/A
6	Sandy Island	**W** Viewed N coast from survey boat.	N/A	N/A
7	Mabouya	**W&LG** Complete search of island birds/ nests/ crevices. Viewed N & W coast from survey boat.	Anchored SW of island, swam to island	N/A
8	The Sisters Rock Little, Carriacou	**W** Sailed around two islands (not through middle)	N/A	Strong currents between islands.
9	The Sisters Rock Large, Carriacou	**W** Sailed around two islands (not through middle)	N/A	Strong currents between islands.
10	Carriacou	**W&LG/LA** Sailed down W coast to Hillsborough, around Sandy, Mabouya, Sisters to Tyrell Bay. Cycled island perimeter.	Anchored in Hillsborough (anchor slipped) and Tyrell Bay.	Good access on bike/walking along coast- goat trails.
11	Little Mushroom	**LG** Searched island for seabirds.	Swam to island. Survey boat hovered to W of island.	Some current. Thick cacti on top of island impenetrable- but no seabirds within.
12	Mushroom Island	**W & LG** Circumnavigated island by survey boat. Complete search of island birds/ nests/ crevices.	Anchored to SW. Swam to island.	Accessible island, some steep cliffs.
13	White Island	**W& LG** Surveyed N area by survey boat. Walked island perimeter (bar N section).	Anchored N of Saline Island. Kayaked to SE of island.	Most of island sandy beach with mangrove- accessible. N section steep inaccessible cliffs- cannot walk around. Kayaked waves onto island.
14	Saline Island	**W &LG** Surveyed N beach. Viewed N, E & S shore from survey boat.	Anchored N of island. Swam onto N side of island.	
15	Cassada Rock	Assessed through binoculars from afar.	N/A	Small, low island. Could not access

No.	Island	Outline Method	Access/ Anchorage	Difficulties/comment
				from survey boat due to reefs. No signs of breeding seabirds.
16	Frigate Island	**LG/LA**. Walked island perimeter- searched low cliffs crevices/ledges. Complete count of BRTE & SOTE. Aerial counts and plots for LAGU.	Anchored W of island. Swam onto E side of island.	Extrapolate LAGU plots for most of island. Rainstorm, lightning rendered surveys difficult (i.e. could not use binoculars) and fewer birds in air. May have missed BRTE/SOTE. Thick cacti- very difficult survey conditions.
17	Large Island	**W** Circumnavigated island on survey boat.	N/A	Private Island. Sign saying, 'Keep Out'.
18	Rose Island	**W** Circumnavigated island on survey boat.	N/A	Bad weather- could not access island. If conditions good could access. Strong currents. Unsurveyed/Incorrect maritime survey data.
19	Bonaparte Rocks	**W** Viewed islands from survey boat.	N/A	Unable to survey close to rocks due to rough sea, currents and weather. Difficult surveying island / ascertain whether birds *breeding.* Unsurveyed/Incorrect maritime survey data.
20	Little Bonaparte	**W** Viewed islands closely from survey boat.	N/A	Moved closer to rocks for better view of birds, when boat ran aground. Unsurveyed/Incorrect maritime survey data. Danger- submerged rocks. Rough sea and weather.

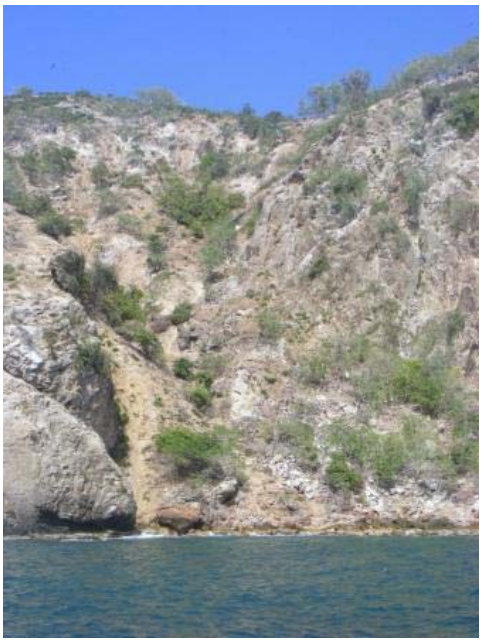
Appendix III

Figure 1. A selection on photos of islands within St. Vincent and the Grenadines.

Battowia and Church Cay from Baliceaux (Lowrie, 2009)

Church Cay, Battowia (Lowrie, 2009)

Bullet Cay, Battowia (Northern Ghut) (Lowrie, 2009)



Battowia, Ghut 1- Extrapolation Ghut (Lowrie, 2009)

Petit Canouan Sooty Terns and high grass habitat- majority of island (Lowrie, 2009)

Petit Canouan showing inland scrub habitat patch (Lowrie, 2009)

Sail Rock, North-West side (Lowrie, 2009)

Brooks Rock, Mustique (Lowrie, 2009)

The Pillories (middle), Mustique (Lowrie, 2009)

Ellen Rock (foreground), Catholic Island (background), Tobago Cays (Lowrie, 2009)

Savan Rocks (Lowrie, 2009)

Figure 2. A selection of photos of islands within Grenada and the Grenadines.

Diamond Rock looking from the North (Lowrie, 2009)

Les Tantes: Tantes, West (foreground) Tantes, East (background) Tantes, North (low lying, left) from Diamond Rock (Lowrie, 2009)

London Bridge, with Green Island behind to left & Sugar Loaf behind to right (Lowrie 2009)

Bonaparte Rocks (Lowrie, 2009)

Frigate Island, Laughing Gull colony (Lowrie, 2009),

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Glover Island (Lowrie, 2009)

Rose Island (Lowrie, 2009)

The Sisters, Grenada. Taken from Diamond Rock
with Grenada island in the background (Lowrie, 2009)

Appendix IV

List of acronyms used in this report.

AON – Apparently Occupied Nest

EAG –Environmental Awareness Group (Antigua)

EPIC –Environmental Protection In the Caribbean

IBA - Important Bird Area (designated by Birdlife International)