Grenadines Seabird Conservation Management Plan

Community-based Conservation Management Plan for the Seabirds of the Transboundary Grenadines Archipelago

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Acronyms and abbreviations

CBOs	Community-based Organizations
EPIC	Environmental Protection in the Caribbean
FFI	Flora and Fauna International
GRE	Grenada
IBA	Important Bird Area
IUCN	International Union for Conservation of Nature
MPA	Marine Protected Area
NGOs	Non-governmental Organization
SCIENCE	Science Initiative for Environmental Conservation and Education
SIOBMPA	Sandy Island Oyster Bed Marine Protected Area
SusGren	Sustainable Grenadines Inc.
SVG	Saint Vincent and the Grenadines
TCMP	Tobago Cays Marine Park
USAID	United States Agency for International Development
USFWS Service	United States Fish and Wildlife

Species

AUSH	Audubon's Shearwater
BRBO	Brown Booby
BRNO	Brown Noddy
BRPE	Brown Pelican
BRTE	Bridled Tern
LAGU	Laughing Gull
MABO	Masked Booby
MAFR	Magnificent Frigatebird
RBTR	Red-billed Tropicbird
RFBO	Red-footed Booby
ROST	Roseate Tern
ROYT	Royal Tern
SOTE	Sooty Tern
WTTR	White-tailed Tropicbird

Executive Summary

More than thirty percent of seabird species worldwide are at risk of extinction, with seabirds being declared one of the most threatened groups of vertebrates worldwide. Conservation of seabirds is an international challenge due to their wide-ranging movements spanning political borders, their tendency to nest on remote islands and their relatively secret lives at sea. Transboundary cooperation is often required to effectively prioritize conservation strategies and manage common threats, such as invasive species, poaching and protection of important areas, required to ensure healthy populations of wide-ranging species, such as seabirds (Wolf et al. 2006).

The transboundary Grenadines archipelago hosts twelve breeding species of seabirds, numbering in the tens of thousands, on islands, rocks and cays situated on the shallow (<100m) Grenada Bank, between the mainlands of the nations of Grenada and St. Vincent and the Grenadines. Studies have shown that some of the breeding colonies in the Grenadines qualify for international (3) and regional (18) Important Bird Area (IBA) status, due to harbouring >1% of the global or regional population of a species (Lowrie et al 2012). Due to their remoteness and inaccessibility, islands in the archipelago collectively represent one of the last remaining refugia in the Caribbean for nesting seabirds.

Historically, seabirds and their remote island habitats in the Grenadines have received very little protection and monitoring, and an overall inaction to enforce protective legislations, such as poaching or removal of fauna from protected areas. Despite several important breeding islands being declared Wildlife Reserves, or lying within marine protected areas, these are effectively “paper parks” where seabirds are concerned. Monitoring and enforcement are complicated by the remoteness, inaccessibility, weather, availability of personnel and resources, and weak protective legislations on both sides of this transboundary seabird hotspot. While Saint Vincent and the Grenadines have legally designated protected areas on many seabird breeding islands throughout their Grenadines, there are currently none in the Grenada Grenadines that feature seabirds or their habitat.

Worldwide, populations of seabirds have declined dramatically, with estimates of up to a 70% loss since the 1950s (Paleczny et al. 2015), while declines in tropical areas are believed to be much higher (Schreiber and Lee 2000). Seabirds worldwide are experiencing a complex and poorly understood crisis, which is the culmination of threats on land, in the air and in the sea. Many species only return to land for a couple of months per year to breed and raise chicks and otherwise lead relatively secret lives at sea for the remainder of the year. Some are highly migratory and travel through areas where they are afforded little to no protection. Development of new technologies, such as tracking devices, have enabled researchers to learn more about seabird lives at sea, as knowledge previously was almost exclusively limited to their nesting colonies during breeding seasons.

The overall goal of this conservation plan is to propose a framework of strategies to conserve and manage seabird populations and their island habitats throughout the Grenadine archipelago, while promoting non-extractive economic opportunity within local communities, as well as environmental education and/or the ability to participate in conservation and management programs. Given the remoteness of many of the seabird islands, complexity of access, and sociocultural relationships to seabirds (e.g. harvesting) a successful

conservation approach must adopt multiple strategies to encourage seabird preservation. Currently, the primary sector of society in both nations that are using seabirds are fisherfolk, who use them to find fish, navigate, and understand weather patterns, while some additionally continue to exploit them for consumption at levels that are likely unsustainable. Each seabird species and colony have their own suite of threats, such as invasive species, poaching, and/or periodic burning of vegetation, requiring a customized approach.

This Conservation Plan additionally proposes to establish a coalition of community-based seabird monitors complemented by governmental agencies with the authority for enforcement, overseeing seabird management within island groups. Such a co-management approach is recommended in areas where human elements, such as seabird exploitation and livestock grazing, strongly influence conservation and management (van Halewyn and Norton 1984). Enforcement and monitoring in the future could much benefit from alternative technologies, such as drones and remote cameras. These technologies would not serve to replace local bird monitors but rather to complement, while additionally providing a means to monitor other species and activities (e.g. sea turtles, illegal drug trade, human trafficking). Interdepartmental collaborations, such as between Forestry, Fisheries, National Parks and Coast Guard, could also improve island access and capacity to enforce regulations in remote areas.

Purpose and Objectives

The overall goal of this community-based seabird conservation plan is to provide a framework which governmental departments, non-governmental agencies (NGOs), community-based organizations (CBOs), academic institutions and individuals can implement to preserve healthy populations of seabirds and sustained biodiversity on uninhabited islands in the Grenadines, while benefitting local communities. This report was prepared through consultation with a wide range of stakeholders throughout Grenada, the Grenadines and Saint Vincent. It is a conservation plan which is intended to be adaptive and representative of the stakeholders involved in seabird management in the Grenadines.

The objectives of this management plan are to provide recommendations for:

1. Research
2. Conservation and management
3. Education and outreach
4. Monitoring and enforcement

Vision

The vision for this transboundary, community-based seabird conservation management plan is to protect and preserve breeding seabird populations and their nesting habitat in the Grenadines, while providing communities with opportunities for environmental education, participation, training, and non-extractive alternative / supplemental incomes.

Regional and Global Context

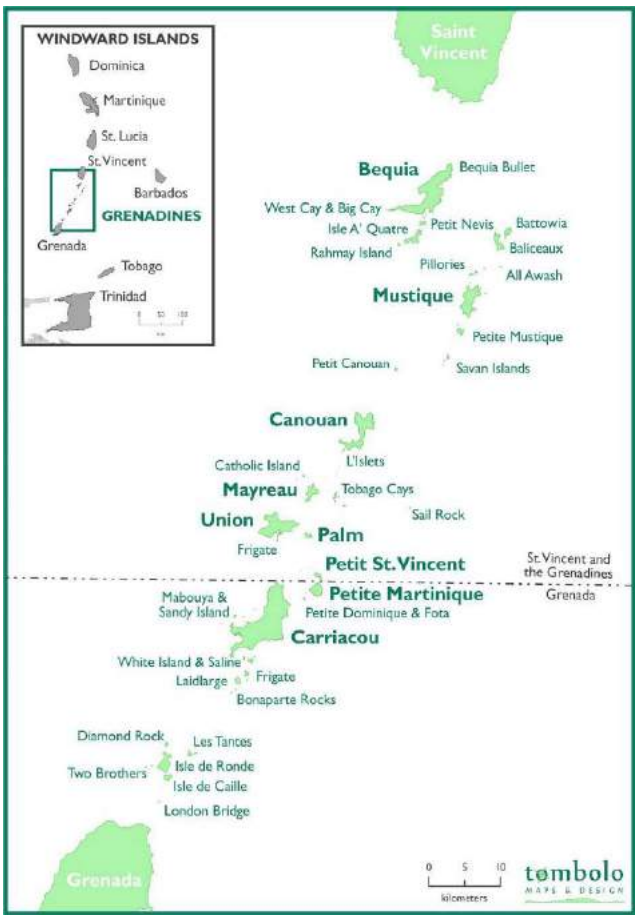
Van Halewyn and Norton (1984) in their review of Caribbean seabirds and colonies listed the Grenadines as an "extremely important" area for breeding seabirds in the entire Caribbean region. In 2009 – 2010 Environmental Protection in the Caribbean (EPIC) conducted a region-wide survey of breeding seabirds throughout the Lesser Antilles, ranging from Anguilla to the southernmost extent of Grenada (Lowrie et al. 2012). Prior to this survey, almost nothing was known about the contemporary status of breeding seabirds in the Grenadines, with most information existing only from historical records. The EPIC "Seabird Breeding Atlas of the Lesser Antilles" revealed that the Grenadines archipelago is the most important area for breeding seabirds in the entire Lesser Antilles, with three colonies meeting global international bird area (IBA) status, and 18 regionally significant (Table 1). Saint Vincent and the Grenadines is the only nation in the entire Lesser Antilles to support two globally significant populations (Red-footed Booby and Red-billed Tropicbird at Battowia), while Grenada supports one (Red-footed Booby at Les Tantes). "Significance" is defined by a nation harbouring at least 1% of the global or regional population of a species. The demise of any global or regional colony could have ramifications for an entire species. While Saint Vincent and the Grenadines was nominated as the most important nation in the Lesser Antilles, Grenada was nominated as the fourth. Both designations however are due to the burgeoning seabird colonies in the Grenadines, providing rationale for a conservation strategy that employs a transboundary approach. In the same study, widespread and extensive poaching of seabirds, their chicks and eggs was regarded as the primary threat in both nations – a threat which was not seen to be as alarming in other nations. Despite their global and regional significance, many of the colonies in the Grenadines remain unprotected, while those that are officially protected are not monitored or patrolled for enforcement of regulations.

Table 1. Global/Regional important seabird colonies in the Grenadines and protected status

Country	Name of Island	IBA	Species	Protected Status
SVG	Battowia	Global	RFBO, RBTR	Wildlife Reserve
SVG	Battowia	Regional	LAGU, BRBO, RBTR, RFBO	Wildlife Reserve
SVG	Petit Canouan	Regional	SOTE, RBTR	Wildlife Reserve
SVG	Pillories	Regional	AUSH	None
SVG	Petit Mustique	Regional	LAGU	None
SVG	Dove Cay	Regional	LAGU	None
GRE	Les Tantes (East)	Global	RFBO	None
GRE	Diamond Rock	Regional	RBTR, BRBO, RFBO, LAGU	None
GRE	Frigate Island	Regional	AUSH, RBTR, LAGU	None
GRE	Les Tantes (West)	Regional	RFBO	None
GRE	Diamond Rock + Les Tantes	Global	RBTR, BRBO	None
GRE	Les Tantes + Brothers/Sisters (Upper and Lee Rock)	Regional	RBTR, BRBO	None

Scope and Limitations

This community-based conservation management plan includes the Grenadines archipelago, extending from southern mainland Saint Vincent (13.13°N) to northern mainland Grenada (12.21°N) and is inclusive of all inhabited islands and uninhabited islands, islets, rocks and cays in the transboundary Grenadines of the Grenada Bank. In addition, several islands to the east and south of Grenada extending south of 12.21°N are mentioned.



There are more than 80 volcanic-origin islands, islets, rocks and cays in transboundary Grenadine islands, situated on the Grenada Bank, of which 9 are inhabited. The St. Vincent Grenadines consist of approximately 48 uninhabited islands, while Grenada consists of approximately 41 (Lowrie et al. 2012). Seabirds nest almost exclusively on uninhabited islands, although not all of these uninhabited islands contain seabird colonies. Where nesting occurs on inhabited islands or mainlands, they typically occur in inaccessible areas, such as cliffs or rocky outcrops facing the sea.

The Grenadines archipelago, although divided politically, is presented here as a distinct ecological unit. The overwhelming majority of seabird colonies exist throughout these islands, on the Grenada Bank, with very few breeding seabirds present on the Grenada or Saint Vincent mainlands (Lowrie et al 2012). In addition, the islands in the archipelago are more biologically, culturally and socioeconomically similar to each other than to their respective mainlands.

Figure 1. Map of conservation plan area

Biological Significance of the Grenadines

The Grenadines archipelago is ecologically significant and diverse. Here you will find the largest coral reef system in the eastern Caribbean, a series of seasonal salt ponds, sea grass beds and a large expanse of

mangroves (especially Ashton Lagoon – the largest in all of Saint Vincent and the Grenadines). The Grenadines are biologically productive due to their geographic location. With upwellings occurring along the Grenada Bank, the area is frequented by fish, marine mammals, turtles, seabirds and other marine creatures that rely on this productivity for survival.

The remote Grenadine islands not only provide habitat for nesting seabirds, but also act as biodiversity hotspots, especially where there are no or few invasive species (e.g. goats and rats), providing rationale for protecting entire islands. Biodiversity investigations on offshore islands in the Grenadines are limited, and not all islands have been inventoried for their faunal and floral communities. Several recent "rapid biological assessments" throughout the Saint Vincent Grenadines, focusing on vegetation, insects (ants) and herpetofauna (amphibians/reptiles) were arranged through EPIC and SCIENCE. With the recent discovery of the endemic Union Island Gecko, it is quite plausible that there may exist other endemics or relict populations on these islands, which would also benefit from enhanced protection, monitoring and enforcement. An indication of the Grenadines harboring remnant populations can be found in the Red-footed Tortoise (*Geochelone carbonara*), which is thought to have been introduced to the archipelago by Amerindians; it is now considered to be extirpated from Grenada (Henderson and Berg 2006) yet is not uncommon on many of the Grenadine islands.

Birds

Despite the small sizes of the islands, there are over 120 species of resident and migratory birds who use these islands and surrounding waters for breeding, feeding and resting (Coffey and Ollivierre 2019). More than 54,000 pairs of seabirds nest and raise chicks on the remote, uninhabited islands (Lowrie et al. 2012). Several areas have been identified as Important Bird Areas (IBAs) through the BirdLife International program due to their global significance for avifauna. The endemic Grenada Flycatcher (*Myiarchus nugator*) and various restricted range species (e.g. Antillean Crested Hummingbird) can be found in the archipelago. Seasonal salt ponds provide important feeding and overwintering habitat for many shorebird and waterbird species from higher latitudes. Many different types of birds, such as Scaly-naped Pigeon (*Patagioenas squamosa*) and Carib Grackle (*Quiscalus lugubris*) nest on offshore islands that harbour seabird breeding colonies.

Figure 2. Little Blue Herons and American Oystercatchers nest on uninhabited islands (J. Coffey)

Mammals

Bats are some of the only terrestrial mammals known to be truly indigenous to many islands in the Lesser Antilles. There are at least twelve species of bats in both nations, at least five of which are distributed throughout the Grenadines. These species frequent the offshore islands in the Grenadines, including the seabird colonies. Genoways et al. (2010) indicated for example that the Greater Fishing Bat can be expected to

inhabit any of the Grenadine islands that have small caves or rocky outcroppings. Several species of mammals in both nations are introduced, such as mongoose, and are discussed in more detail in the invasive species section of this report. Evidence from archaeological excavations in Carriacou for example, suggests that guinea pig (*Cavia* sp.), armadillo (*Dasypus* sp.), peccary (*Tayassu/Pecari* sp.), opossum (*Didelphis* sp.) and agouti (*Dasyprocta* sp.) were introduced from South America prior to European contact (Giovas et al. 2011). Other mammalian species such as goat, sheep, donkey, deer and rabbit were introduced after European contact and most of these persist throughout the archipelago today

Marine mammals are also common in the Grenadines. Some are resident while others migrate and are only present for part of the year. Species include humpback whale (*Megaptera novaeangliae*), pilot whale (*Globicephala sp*.), killer whale (*Orcinus orca*), dolphin species (*Delphinus sp*.), and others.

Amphibians and Reptiles

At least 25 species of reptiles and amphibians occur in the Grenadines (e.g. Noonan 2015; Henderson and Berg 2006), some of which are introduced. The Grenada Bank harbours several endemics, such as the Union Island Gecko (*Gonatodes daudini*), anole species (*Anolis aeneus* and *Anolis richardii*) and the IUCN Vulnerable Grenadines Sphaero (*Sphaerodactylus kirbyi;* found on Bequia, Mustique, Petit Nevis, Union, Carriacou and Isle de Quatre) (Powell and Henderson 2011). The Grenada Snake Boa (*Corallus grenadensis*) is a Grenada Bank endemic found in dry scrublands and wet rainforests. It is confirmed on Grenada, Carriacou, Petite Martinique, Bequia, Isle de Quatre, Balliceaux, Mustique, Canouan, Mayreau, and Union Island, but little is known of its distribution on uninhabited islands (Henderson and Berg 2019). Continued development could lead to local extirpations for many of these species. The Red-footed Tortoise (*Geochelone carbonaria*) for example, is thought to be extirpated in Grenada, but occurs on many of the Grenadines, including uninhabited islands such as Frigate Island (GRE), where it is thought to have been introduced by Amerindians.

In addition, several species of marine reptiles (sea turtles) nest on beaches throughout the archipelago, including Green (*Chelonia mydas*), Loggerhead (*Caretta caretta*), Leatherback (*Dermochelys coraica*) and the IUCN critically endangered Hawksbill (*Eretmochelys imbricata*). Some nesting locations are d on offshore islands.

Henderson and Berg (2006) and Daudin and de Silva (2011) note the paucity of information on herpetofauna in the Grenadines, stating that additional species are expected to be added to lists for many of the islands. Daudin and De Silva (2011) warn that unregulated development and tourism threaten the survival of indigenous amphibians and reptiles throughout the Grenadines, while invasive species, such as rats, cats and mongoose are also particularly destructive. Although harvesting of sea turtles has recently been prohibited in Saint Vincent and the Grenadines, Grenada still has an open season. Harvesting of sea turtle eggs and disturbance of nests is illegal in both countries.

Figure 3. Uninhabited islands in the Grenadines are home to many herpetofauna species (J. Coffey)

Insects

Very little is known about the insect fauna throughout the Grenadines, and it is highly understudied. The possibility of endemics is plausible, yet scientists do not have sufficient collections from the Grenadines to evaluate (R. Woodruff pers. comm.). For example, no specimens of ticks/lice, common on seabirds and in seabird colonies have been noted for the islands. In a study of mosquitos on Union Island for example, only two species were known prior to a study in 1992, in which five additional species were noted (Tikasingh and Martinez 1992). Esteves and Fisher (2019) documented a total of 40 distinct species of ants, including investigations on offshore islands, some of which were introduced. Clark (1904) describes various insect types of Saint Vincent, the Grenadines and Grenada, such as butterflies, moths and wasps, noting the geographic presence/absence in their distribution and relative abundance. Insects can have wide ranging impacts on flora and fauna. For example, fire ants pose a threat to seabird chicks and other wildlife. Detailed investigation of insect communities on offshore islands could enhance the conservation value of particular islands and provide further insight into ecological dynamics on uninhabited islands.

Native vegetation

Vegetation diversity studies in the Grenadines have been scarce. Beard (1949) investigated trees, while Howard (1952) conducted general vegetation studies primarily on the larger inhabited islands of the Grenadines. Freid and Glasgow (2015) documented vegetation on smaller, uninhabited islands in the Saint Vincent Grenadines, many of which contained seabird colonies.

Beard (1949) and Howard (1952) noted that almost all Grenadine islands had previously been used for cultivation, and indicated that any exiting forests were secondary. Due primarily to development, Caribbean Seasonally Dry Tropical Forests are critically endangered throughout the Windward islands, including the Grenadines, where they are found in natural states in only a few places (Freid and Glasgow 2015). Islands with domestic animals (e.g. goats and sheep), of which many exist in the Grenadines, show an overall reduction in plant biodiversity. Some seabird species are particularly sensitive to vegetation cover and type, such as Magnificent Frigatebirds, Red-footed Boobies, and Brown Noddies which nest primarily in trees and shrubs. Magnificent Frigatebirds are known to only nest at one site in both nations, in a ghut on Battowia containing large trees. Audubon's Shearwater, which is a burrowing species, is likely to be found in areas where it can burrow amongst root systems.

Seabirds

Seabirds are the only organisms worldwide to have conquered land, air and water. There are approximately 350 species of seabirds worldwide, ranging from the high Arctic to Antarctica and everywhere in between. They are the most conspicuous type of marine wildlife and reach into the most remote areas of earth, yet remain one of the least understood types of birds. Seabirds are top predators in the marine food chain and both contribute to and rely upon healthy marine ecosystems for survival. As such, they are important indicators

of oceanic health and productive fisheries. They are ecological connectors and circulate nutrients between the land and sea through their guano. Their guano acts as a "fertilizer" and enhances coral reef growth in the immediate vicinity of the colonies, which in turn benefits fish and fisheries (Graham et al. 2018). Seabirds are particularly important to maritime cultures worldwide, including the Grenadines, and used by humans for nutrition, finding fish, understanding weather patterns, navigating and as topics of superstition and folklore.

Despite the wide diversity of seabird species worldwide, they share common characteristics which limit their ability to recover from threats and disturbances. Seabirds are generally long-lived and start breeding later in life than most birds. Many of them mate for life and most raise only one chick per year. Although they rely on the sea for survival, all seabirds must return to land to breed and raise their young. They have evolved to nest and raise chicks on islands, rocks and cays that are void of predators, and are particularly susceptible to introduced/invasive species. Many seabirds show nest-site fidelity - returning to the same islands upon which they were hatched to rear their own young, demonstrating inflexibility in site preference and suitability. Many seabirds are "colonial" nesters, with breeding populations on a single island ranging from several pairs to over a million. At colonies, they are "chemical and physical engineers" to their surrounding habitats, capable of influencing amount and type of vegetation cover (Ellis 2005). Birds nesting in colonies are likely able to collectively identify predator presence earlier, while an individual is less susceptible to predation amongst a large group. In addition, some species display group defense tactics, such as mobbing, which deter predators (Burger and Gochfeld 1994).

Despite their versatility, populations are deteriorating rapidly worldwide, with up to 70% decline since the 1950s (Paleczny et al. 2015), while declines in tropical areas thought to be much higher. These declines are overwhelmingly attributed to human activity, whether direct or indirect. As such, they are not only one of the most threatened types of birds, but one of the most threatened vertebrates worldwide (Croxall et al. 2012).

Species Profiles

Breeding Species

Of the 22 species known to nest in the Caribbean (van Halewyn and Norton 1984), 12 species breed in the Grenadines (Lowrie et al 2012; EPIC unpublished data). Three of these colonies are globally significant and 18 are regionally significant, meaning they host at least 1% of the species' population. Demise of these colonies would have consequences for both global and regional populations. Each of these species is described below. The bird's name is provided as the common name, scientific name, and local names.

Audubon's Shearwater (*Puffinus lherminieri,* Way-She-Go, Wedderigo, Plane Wing)

Audubon's Shearwater is the only species of shearwater common to the West Indies. Though highly pelagic, this shearwater returns to islands in the Grenadines to breed and raise chicks in a 60 – 90 cm long burrow. The Audubon's Shearwater is locally known as *Way-she-go* referencing a tendency to dive deep for long periods of time in search of food, and *Plane Wing*, describing straight and narrow wings that enable it to glide just above

the ocean surface. At colonies, shearwaters are generally nocturnal and therefore infrequently observed close to land. They are highly vocal near their colonies at night. Offshore fishermen readily recognize Audubon's Shearwater as a species that is commonly observed at sea and often commonly associated with schools of fish, such as tuna, and sargassum. Despite recently being described extirpated as a breeder from the Grenadines (Lee 2000), this species is known to nest at a minimum of 9 (6 SVG / 3 GRE) locations in the Grenadines (Lowrie et al. 2012), although population estimates are not available. It may additionally be found at historic nest sites on Bonaparte Rocks, Green Island, Sandy Island, Labaye and Diamond Rock (GRE) (Frost et al. 2009), and Petit Canouan (SVG) (FFI pers. comm. 2019). In his review of birds in the West Indies, Bond (1956) indicated that they are "especially numerous" in the Grenadines and van Halewyn and Norton (1984) indicated that the majority of the breeding population of this species is likely in the southern Lesser Antilles and Tobago. This species shows high nest-site fidelity and breeds on islands that are either completely or near-completely free of terrestrial predators (Lee 2000). They have delayed maturity and begin breeding at approximately eight years old. Dried skins of Audubon's Shearwater were formerly sold in Grenada at the market and anecdotal accounts suggest they have been harvested in recent years (Wells 1886). Adults, chicks and eggs were traditionally collected elsewhere in Caribbean, including in pre-Columbian times (van Halewyn and Norton 1984). Skins of pre-fledgling birds were known to be dried or salted and sold at markets (Lee 2000). Both parents tend to the egg or chick, with shifts in attendance lasting 8 – 10 days each. An assessment of the population of Audubon's Shearwater in the Grenadines would contribute significantly to knowledge of this species in the entire Caribbean region. Lee (2000) indicated that the priority for this species in the Caribbean is an inventory of breeding sites and referred to it as one of the most understudied species of seabirds worldwide. It is the only burrow-nesting seabird species in the Grenadines, and preservation of habitat requirements is essential for the survival of this species.

Population Estimate: Not available

Breeding Islands: **GRE** – Frigate Island, Rose Island, White Island; potentially Bonaparte Rocks, Sandy and Green Island, Labaye and Diamond Rock; **SVG** – Big Cay, Pigeon Island, Small/Middle/Big Pillory, Catholic Island; potentially Petit Canouan (FFI pers. comm. 2019)

Nesting habitat: 60 – 90 excavated burrow, rocky crevice or under boulders on islands that are absent, or nearly absent from terrestrial predators (Lee 2000)

Clutch size: 1

Seasonality: Reported and/or collected all months except August and January; breeding may occur between March-May (Frost et al. 2009) or Nov-Apr (van Halewyn and Norton 1984), eggs found in Grenadines in March and chicks in May (Lowrie et al. 2012)

Figure 4.Audubon's Shearwater (Jay Gilliam, Macauley Library ML166927571)

White-tailed Tropicbird (*Phaethon lepturus*, Truphit)

White-tailed Tropicbirds are the smaller and lesser abundant of two tropicbird species in the Grenadines, and have only been recorded in the St. Vincent Grenadines. They are more common in the Western Caribbean. They breed at four locations in the Grenadines and are locally referred to as "Truphit" and elsewhere as Paille en Queue ("Straw in Tail") and Bosun Bird. The southernmost breeding location recorded for this species in the entire Lesser Antilles is on Union Island, while all

Figure 5.White-tailed Tropicbird (John Sullivan, Macaulay Library ML186798451)

other recorded breeding locations in the 2009 – 2010 EPIC Atlas occurred near to or on mainland Saint Vincent. White-tailed Tropicbirds are typically only seen near land during courtship rituals and nesting, and otherwise remain at sea. Nesting is on remote cays or inaccessible cliffs on mainlands.

Population Estimate: Not available
Breeding Islands: **SVG** – Duvernette, Isle a Quatre, Old Woman's Point, Union Island (Bloody Head)
Nesting Habitat: Rocky crevice, hole in sea cliff or under boulders; lay egg directly on ground
Clutch size: 1
Seasonality: Year-round resident; egg laying in Caribbean may be between February and July (van Halewyn and Norton 1984); eggs in Grenadines in April (Thayer 1925)

Figure 6. White-tailed Tropicbird on nest (Kevin Seymour Macaulay Library ML17900016)

Red-billed Tropicbird (*Phaethon aethereus*, Truphit, Pelantji, Queen Bird, Tunabird)

Red-billed tropicbirds are present throughout the Grenadines and are the more abundant of two species of tropicbirds in the archipelago, although they are the least abundant tropicbird elsewhere in the Caribbean. It has been recorded breeding at more than 25 locations in the Grenadines and in the Caribbean is more common in the eastern region. Red-billed Tropicbirds raise chicks in rocky crevices. Some colonies in the Grenadines are globally significant, most notably Battowia (SVG) and Diamond Rock (GRE). Adults and their chicks and eggs continue to be harvested (van Halewyn and Norton 1984, Sustainable Grenadines Inc. 2014). They are sometimes referred to by Grenadians as "Queen Bird", referencing their preference to consume this species (Lowrie et al. 2014). Red-billed Tropicbirds are larger than White-tailed Tropicbirds and can therefore outcompete them for suitable nest sites.

Population Estimate: Not available
Breeding Islands: **GRE** – Bird Island, Diamond Rock, Isle de Ronde, Les Tantes, London Bridge, Upper Rock/Lee Rock, Bonaparte Rocks, Frigate Island, Laid Large, Mabouya, Mushroom, Petite Dominique, Rose Island, Saline Island; **SVG** – Bequia, Big Cay, Isle a Quatre, Pigeon Island, All Awash, Battowia, Bullet Cay, Church Cay, Brooks Rock, Petite Mustique Pillories, Rabbit Island, Savan Island, Savan Rocks, Catholic Island, Petit Canouan
Nesting Habitat: Rocky crevices
Clutch size: 1
Seasonality: Year-round resident; known to nest approximately between November and April in Caribbean region; Devas (1943) reports evidence of nesting in April to May in SVG, while others have observed in August (Frost et al. 2009); nesting has also been observed February and March in the Grenadines, with both eggs and large chicks observed at same time (J. Coffey pers. obs.); this species is not observed as frequently September to November, suggesting a potential lapse in an otherwise year-round breeding season (J. Coffey, pers. obs.)

Figure 7. Red-billed Tropicbird on nest (J. Coffey)

Magnificent Frigatebird (Frigate, Man O'War, Scissors, Seaso)

While not recorded breeding in EPIC 2009 – 2010 surveys, follow-up investigation in 2019 resulted in the discovery of a sizeable breeding population on Battowia (SVG) of approximately 100 nests, although the entire island was not surveyed (J Coffey, pers. obs. 2019). Both males and females are typically observed near St. Vincent, Bequia and Mustique, while farther south males are infrequently observed (J. Coffey, pers. obs.). When foraging they are typically segregated by sex. Magnificent Frigatebirds previously nested at Diamond Rock (GRE), although no records have been confirmed in recent years (e.g. Wells 1887). This species has a particularly lengthy incubation (50 – 60 days), nesting (150 – 207 days) and post-fledging period and therefore they do not raise one chick each year as it may take up to 18 months for a chick to reach independence. Males are thought to breed annually, with females breeding every other year. Lindsey et al. (2000) indicate that this is likely one of the most threatened species of seabirds in the entire Caribbean, given that it nests in low numbers in only a few locations. Development and storms are amongst the major contributors to declines of frigatebirds in the Caribbean and colonies are particularly sensitive to human disturbance. Frigatebirds rely primarily on fish and squid, although they have been observed taking Sooty Tern (*Onychoprion fuscatus*) nestlings, sea turtle hatchlings and may eat eggs and young of their own species from disturbed nests. Van Halewyn and Norton (1984) indicated there was less than 25 breeding sites in entire Caribbean, while Lowrie et. al (2012) found only four in the Lesser Antilles (now known to be 5; J. Coffey pers. obs.). Throughout the Caribbean, eggs and chicks have been collected while adults are caught in fishing nets and occasionally shot (van Halewyn and Norton 1984). Fisherfolk in the Grenadines may harm and/or kill frigatebirds caught in nets, and in some cases subsequently consumed (J. Coffey, pers. comm.). Some consider them as a pest given their tendency to steal bait and fisheries catch, and therefore on occasion they are purposefully caught and harmed (J. Coffey, pers. comm.). Follow-up investigations to determine their breeding population and colony extent at Battowia are highly recommended, as well as to determine any nesting presence in the Grenada Grenadines.

Population Estimate: Not available
Breeding Islands: **SVG**: Battowia; **GRE**: previously at Diamond Rock; potentially two other locations in Grenadines
Nesting Habitat: Trees and shrubs; other areas nest in mangroves
Clutch size: 1
Seasonality: Year-round resident; observed nesting in December, some with eggs and full-sized chicks (J. Coffey, pers. obs.); typically begin nesting October to January in most of Caribbean (Lindsey et al. 2000); egg-laying in Caribbean extends from August to April with peak in November and February (van Halewyn and Norton 1984)

Figure 8. Magnificent Frigatebirds on nests at Battowia (J. Coffey)

Masked Booby (*Sula dactylactra*, Booby)

Masked Booby is the largest and least abundant of three booby species in the Grenadines. While known to previously nest at several locations in the archipelago, it was recorded at only one location in 2009 – 2010 with a population estimate of six breeding pairs at Brooks Rock (SVG). In March and May 2019, three adult Masked Boobies were observed near Diamond Rock (J. Coffey, pers. obs.) and in June a single juvenile was in the same area, suggesting a potential remnant breeding population in the Grenada Grenadines. They

Figure 9. Masked Booby adult and chick (J. Coffey)

were previously thought to nest on Battowia Bullet (SVG), All Awash (SVG) and Diamond Rock (GRE). The Masked Booby nests in small numbers at only four locations in the entire Lesser Antilles, rendering this a species of concern in the region highly vulnerable to consequences of threats and disturbances. Any sites where this species is reported breeding should be prioritized for protection. Follow-up investigations of nesting reports near Battowia/Bullet recommended.

Population Estimate: 6 breeding pairs (Lowrie et al. 2012)
Breeding Islands: **SVG** - Brooks Rock; **GRE** – Extirpated?
Nesting Habitat: Bare rock/sand or a small collection of stones and/or plant material directly on ground
Clutch Size: 1 – 2 eggs; only one chick raised
Seasonality: Year-round resident; pairs reported breeding on Brooks Rock March to May.

Brown Booby (*Sula leucogaster*, Booby, Sea Diver, Dive Bird)

Brown booby is the most frequently observed booby species in the Grenadines due to its tendency to frequent populated harbours and rest on man-made structures, such as boats and masts, and is also the most widespread booby throughout the Caribbean. As such it is the most likely of the booby species to encounter land-based pollution, such as pesticides and oil, whereas other booby species tend to forage farther out at sea. This species nests at approximately 17 sites in the Grenadines. Booby species, including Brown Boobies, are subject to exploitation of chicks and eggs in the Grenadines for both nutrition and as a perceived aphrodisiac.

Population Estimate: **GRE** – 754 breeding pairs; **SVG** – 624 breeding pairs (Lowrie et al. 2012)
Breeding Islands: **GRE** – Bird Island, Diamond Rock, Les Tantes, London Bridge, Lee Rock/Upper Rock; **SVG** – Bequia, Big Cay, Bullet Cay, All Awash, Battowia, Bullet Cay (Battowia), Church Cay, Brooks Rock, North Savan Rocks, Savan Rocks
Nesting Habitat: On bare ground/rock often lined with feathers, vegetation, bones and sticks
Clutch Size: 1 – 2 eggs; only one chick raised
Seasonality: Year-round resident; recorded breeding almost year-round from February to August (Frost et al. 2009). Halewyn and Norton (1984) indicate this species can nest anytime of the year, but often shows a localized preference in timing of nesting.

Figure 10. Brown Boobies roosting at Anse la Roche, Carriacou (J. Coffey)

Red-Footed Booby (*Sula sula*, Booby)

The Red-footed Booby is the smallest of all booby species, and comes in a white-tailed brown and a white phase in the Grenadines. Hayes (2002) reported that a ratio between white-tailed brown to white in the archipelago is 7.5:1. Red-footed Boobies nest at five locations in the Grenadines – two of which host globally significant colonies (Les Tantes and Battowia). Both nations host the majority of the population of breeding Red-footed Boobies in the entire Lesser Antilles, in few locations. Red-footed Booby chicks and eggs are often subject to exploitation by humans in the Grenadines. After fledging, chicks return to nests to continue being fed by adults for several weeks prior to independence, similar to other species of boobies (Schreiber 2000). As there are few Red-footed Booby colonies in the entire Caribbean, Halewyn and Norton (1984) stated that the demise of any of these colonies could cause major declines in populations. Saint Vincent and the Grenadines

alone harbours almost 70% of the Lesser Antilles population. This species is frequently seen foraging and traveling in the channels between Saint Vincent-Bequia-Mustique (SVG) and Grenada-Isle de Ronde-Carriacou (GRE).

Population Estimate: **GRE** – 2,760 breeding pairs; **SVG** – 6,047 breeding pairs; both nations independently have globally significant colonies of Red-footed Boobies (Lowrie et al. 2012); **GRE** estimate thought to be higher particularly at Diamond Rock (J. Coffey, pers. obs. 2019)

Breeding Islands: **GRE** - Diamond Rock, Les Tantes and Upper Rock/Lee Rock (The Brothers/Sisters); **SVG** – Battowia, All Awash

Nesting Habitat: Trees and shrubs; creates a small nest made of twigs/grasses

Clutch Size: 1 egg

Seasonality: Year-round resident; breeding has been recorded year-round with majority of activity in beginning of the year (Lowrie et al. 2012); evidence presented by Frost et al. (2009) support year-round breeding status

Figure 11. Red-footed Booby on nest (J. Coffey)

Laughing Gull (*Leucophaeus atricilla*, Mauve, Davybird)

Laughing Gulls nest at approximately 25 locations in the Grenadines, with both nations independently reaching globally significant populations. The largest colonies in the entire Lesser Antilles are thought to be at Frigate Island (GRE) and Battowia (SVG). The bulk majority of Laughing Gulls return to the Grenadines for their annual breeding season late in February to early March, with eggs laid typically the first week of May. Laughing Gulls are the only gull species breeding in the Caribbean. Chardine et al. (2000) regard human exploitation of eggs and development as the primary threats to Laughing Gulls in the West Indies, with many nesting sites being abandoned or lost to development. Laughing Gull eggs are harvested from many sites in the Grenadines (Lowrie et al 2012, Sustainable Grenadines Inc. 2014). This species does not exhibit as strong nest-site fidelity as many other seabirds. Van Halewyn and Norton (1984) suggest that during non-breeding season, Laughing Gulls concentrate over continental shelf waters from Panama to the Guyanas.

Figure 12. Adult Laughing Gulls (J. Coffey)

Population Estimate: **GRE**: 3,274 pairs (1.5% of global population); **SVG**: 2,736 breeding pairs (1.2% of global population)

Breeding Islands: **GRE**: Bird Island, Conference Island, Glover Island, Diamond Rock, Isle de Caille, Les Tantes, Upper Rock/Lee Rock, Frigate Island, Mabouya, and Mushroom; **SVG**: Battowia, Little Savan, Petite Mustique, Pillories, Rabbit Island, Canouan Baleine, Catholic Island, Dove Cay, Petit Canouan

Nesting Habitat: Directly on ground or in a scrape or hollow of vegetation; occasionally under trees, shrubs and/or amongst grasses and cacti

Clutch Size: 2 – 4 eggs
Seasonality: Return to Grenadines approximately end of February to early March; courting occurs in March/April; eggs typically laid by first week of May; bulk of population departs Grenadines by September; generally absent from Grenadines September to February

Figure 13. Laughing Gull eggs (J. Coffey)

Brown Noddy (*Anous stolidus*, Noddy, Foo, Mwen)

Brown Noddies are a widespread and abundant breeder throughout the entire Caribbean. In the Grenadines they can be found nesting at more than 40 sites. Egg collecting previously occurred within Tobago Cays Marine Park, where they nest in abundance, and continues to occurs at other locations in the archipelago. Elsewhere in the Caribbean, Brown Noddies are known as "Eggbird", similar to Sooty Terns, given their popularity amongst egg collectors. Many fisherfolk in the Grenadines describe the importance of observing noddies to find fish. Other than egging, noddies are vulnerable to invasive species (e.g. rats), weather events affecting their habitat, disturbance and development.

Population Estimate: **GRE**: 96 breeding pairs; **SVG**: 529 breeding pairs (Lowrie et al. 2012); population estimates believed to be much more, particularly in the Sandy Island Oyster Bed MPA (SIOBMPA) and Tobago Cays Marine Park (TCMP), potentially as a result of protection (J. Coffey, pers. obs. 2011-2019). Some other colonies, such as White Island (GRE), were previously known to be much higher (Frost et al. 2009).

Breeding Islands: **GRE**: Bird Island, Telescope Rock, Diamond Rock, Isle de Caille, Les Tantes, London Bridge, Upper Rock/Lee Rock, Bonaparte Rocks, Frigate Island, Little Mel, Mushroom, Rose Island, Saline Island, Sisters Rocks, White Island; **SVG**: Big Cay, Isle a Quatre, Pigeon/Rahmay Island, West Cay, All Awash, Battowia, Bullet Cay, Church Cay, Brooks Rock, Petit Cay, Petite Mustique, Pillories, Rabbit Island, Savan Island, Savan Rocks, Baradal, Catholic Island, Jamesby, Petit Canouan and Sail Rock

Figure 14.Brown Noddies at nest in Tobago Cays (J. Coffey)

Nesting Habitat: Both ground and tree-nesting; trees, shrubs, mangroves; bare rock, sparsely vegetated ground; nests in trees usually constructed from twigs, leaves, seaweed occasionally with items such as corals added

Clutch Size: 1 egg

Seasonality: Typically return to Grenadines in the middle of April with eggs by first week of May and first hatchlings in June; departed from Grenadines by October; may nest earlier where they overlap with Sooty Terns, particularly at Petit Canouan

Sooty Tern (*Onychoprion fuscatus*, Eggbird)

Sooty Terns are known as "Eggbird" throughout much of their range, including in the central and northern Grenadines, due to their eggs being extensively harvested. They nest at more than 15 sites in the Grenadines. By far the biggest colony in the Grenadines, and one of the largest in the entire Lesser Antilles, is located at Petit Canouan (SVG), which has reportedly suffered population losses due to harvesting and fires (Lowrie et al. 2012). They are reportedly the most numerous nesting seabird in entire Caribbean, although the highest densities are at just a few locations (van Halewyn and Norton 1984). Fisherfolk from neighbouring islands involved in egg harvest periodically burn off vegetation on the island to facilitate nesting and egg collection, in what has been equated to as a "farming" of seabirds (Lowrie et al. 2012). Large-scale egg collection is noted as the primary threat to this species in the Grenadines, and throughout the entire Caribbean, with eggs in some cases being exploited on a commercial basis, both for nutrition and as a perceived aphrodisiac (van Halewyn and Norton 1984). Persistent egg collection is known to result in Sooty Terns nesting in less preferred locations, such as amongst dense cactus which fisherfolk claim entangles and kills adults and chicks. Assessments of the burning activity, egg collection/distribution and nesting impact of invasive grasses on Petit Canouan are highly recommended as areas of investigation for seabirds in the Grenadines. Nest-site fidelity is known to be very strong in Sooty Terns (Saliva 2000a). Given its notoriety as an island frequented for seabird exploitation, enforcement needs to be strengthened at Petit Canouan.

Figure 15. Sooty Terns (Greg Hertler - Macaulay Library ML208543261)

Population Estimate: **GRE**: 65 breeding pairs; **SVG**: 43,181 breeding pairs (Lowrie et al. 2012)
Breeding Islands: **GRE**: Bird Island, Upper Rock/Lee Rock, Frigate Island, Sisters Rocks, **SVG**: Big Cay, West Cay, All Awash, Bullet Cay, Church Cay, Petit Cay, Pillories, Savan Rocks, Petit Canouan, Sail Rock
Nesting Habitat: Level or gently sloping ground; exposed areas with little to no vegetation
Clutch Size: 1 egg
Seasonality: Typically return to Grenadines in the middle of April with eggs by first week of May and first hatchlings in June; departed from Grenadines by approximately September; may nest earlier in some locations such as Petit Canouan (J. Coffey pers. comm.); in the Caribbean they can arrive at their nesting locations by February (Saliva 2000)

Bridled Tern (*Onychoprion anaethetus*)

Bridled Terns are similar in appearance to Sooty Terns, yet nest in less density throughout the Grenadines. They can be found at more than 25 sites throughout the archipelago. While juveniles are quite different, adults can be distinguished from Sooty Terns by their dark gray coloration (as opposed to black), nesting habitat and vocalizations. Van Halewyn and Norton (1984) note that this species nests in small aggregations instead of high-density colonies. Because they nest in cliff holes, under boulders and other difficult to access areas, it is thought that they are much less susceptible to egg collection. Despite this, they are likely also called "eggbird" due to their similar appearance to Sooty Terns, and likelihood that their eggs are collected if encountered. Given their similar adult appearance, surveyors may confuse Bridled and Sooty Terns, and therefore data for

both species is sometimes inaccurate, particularly where observers are inexperienced.

Population Estimate: **GRE**: 87 Breeding pairs; **SVG**:174 breeding pairs (Lowrie et al. 2012)
Breeding Islands: **GRE**: Bird Island, Conference Island, Telescope Rock, Diamond Rock, Les Tantes, London Bridge, Upper Rock/Lee Rock, Frigate Island, Little Mel, Mushroom, Rose Island, Sisters Rocks; **SVG**: Big Cay, Syrup Cay, Petit Cay, Petite Mustique, Pillories, Rabbit Island, Baradal, Canouan Baleine, Catholic Island, Dove Cay, Ellen Rock, Jamesby, Petit Canouan
Nesting Habitat: Rocky crevices/holes, under boulders, overhanging ledges, very thick vegetation; usually breed in association with other seabirds, such as Sooty Terns
Clutch Size: 1 egg
Seasonality: Typically return to Grenadines in the middle of April with eggs by first week of May and first hatchlings in June; departed from Grenadines by approximately September

Figure 16. Bridled Tern adult and juvenile at Sisters Rocks (J. Coffey)

Roseate Tern (*Sterna dougallii*)

Roseate Terns nest at more than 10 locations in the Grenadines. They may change nesting locations during the breeding season, from a different site on the same island to a totally different island, possibly due to disturbance, predation and other factors. This species has suffered drastic declines across its range, due to various factors such as egging, development of and disturbance to nesting areas (particularly sandy beaches) and invasive species. The Caribbean population of Roseate Terns is listed as "Threatened". Conservation efforts should focus on eliminating threats in known nesting areas. Due to their small size, Roseate Tern chicks and eggs may fall victim to a wider array of predators, such as terrestrial crabs (Gochfeld et al. 1994). This species is known to readily adapt to using artificial nest sites such as nest boxes (Saliva 2000b).

Population Estimate: **GRE**: 98 breeding pairs; **SVG**: 75 breeding pairs (Lowrie et al. 2012)
Breeding Islands: **GRE**: Mainland Grenada, Bird Island, Bonaparte Rocks, Fota, Little Mel; **SVG**: Bequia mainland, Isle a Quatre, Milligan Cay, Church Cay, North Rocks, Pillories, and Ellen Rock. Previously known to nest on other islands, such as Green Island (GRE) and Lee Rock (GRE)
Nesting Habitat: Rocky substrate, bare ground, grassy tufts, open sandy beaches (not commonly in Grenadines); little to no vegetation is added to the nest
Clutch Size: 1 –3 eggs; most Caribbean populations thought to lay only one egg
Seasonality: Typically return to Grenadines in the middle of April with eggs by first week of May and first hatchlings in June; departed from Grenadines by approximately September

Figure 17. Roseate Tern adult and juvenile at Mabouya (J. Coffey)

Common non-breeding species

Brown Pelican (*Pelecanus occidentalis*, Gwangoje, Pelican)

Brown Pelicans can be found throughout the Grenadines year-round, although, they are most prevalent near Union Island and Carriacou. Their numbers have climbed significantly in the past ten years, particularly in the Sandy Island Oyster Bed Marine Protected Area (SIOBMPA) where they roost and feed in high numbers (J. Coffey pers. obs.). The closest breeding locations for Brown Pelicans are on nearby islands off Trinidad and Venezuela. Their breeding colonies are particularly susceptible to human disturbance (Collazo et al. 2000).

Figure 18. Brown Pelicans in SIOBMPA (J. Coffey)

Royal Tern (*Thalasseus maximus,* Catbird)

The Royal Tern is the largest species of tern in the region and is present year-round in the Grenadines. Although not recently recorded breeding in the archipelago, it may nest nearby, such as islands off Martinique. Individuals with "begging" chicks were observed September to November near Carriacou (J. Coffey pers. obs. 2019). They are thought to have previously nested in the Grenadines archipelago, although records are not sufficiently documented. It is likely that a high proportion of the Royal Terns in the Grenadines may originate from North American colonies, particularly during the winter (Frost et al. 2009).

Figure 19. Royal Tern (J. Coffey)

Common Tern (*Sterna hirundo*) and Sandwich Tern (*Thalasseus sandvicensis*)

Sandwich Tern nesting status in the Grenadines is uncertain. Although there is minimal evidence, reports suggest they may be an occasional locally breeding resident. In 2004, researchers reported flightless chicks near Carriacou (Frost et al. 2009). Mixed flocks of Sandwich Terns and other species were observed in the Tobago Cays in October 2011 and near Carriacou in October 2019. Common Terns are considered a rare migrant and have been observed throughout the Grenadines at various times throughout the year. Both species nest farther north in the Lesser Antilles, such as islands off Martinique and sightings may be augmented by birds originating from North American colonies.

Figure 20. Mixed tern species at Petit Tabac (J. Coffey)

Vagrants and visitors

Species that have been recorded on one or few occasions:

- Pomarine Jaeger *Stercorarius pomarinus*
- Parasitic Jaeger *Stercorarius parasiticus*
- Lesser Black-backed Gull *Larus fuscus*
  A single immature Lesser Black-backed Gull was observed on Union Island in November 2011 and on Carriacou in 2019, both by J. Coffey.
- Black-headed Gull *Chroicocephalus ridibundus*
- Ring-billed Gull *Larus delawarensis*
- Black Noddy *Anous minutus*
- Large-billed Tern *Phaetusa simplex*
- Gull-billed Tern *Gelochelidon nilotica*
- Black Tern *Chlidonias niger*
- Forster's Tern *Sterna forsteri*
- Least Tern *Sternula antillarum*
- Black Skimmer *Rynchops niger*
- Manx Shearwater *Puffinus puffinus*
- Wilson's Storm-Petrel *Oceanites oceanicus* / Leach's Storm-Petrel *Oceanodroma leucorhoa* (Mother Carey, Jesus Bird, Tide Bird); Fishermen in the archipelago are very familiar with storm petrels. It is unknown which species is more frequently observed. Van Halewyn and Norton (1984) indicated that Leach's Strom Petrel (*Oceanodroma leucorhoa*) occurs regularly in eastern Caribbean in spring, while a study off Guadeloupe discovered that the Wilson's Storm Petrel was the most frequently observed storm petrel (Levesque et al. 2005). In March 2019, six unknown storm petrels were observed at dusk in the channel between Grenada and Isle de Ronde by J. Coffey while Wells (1886) documented a Wilson's Storm Petrel near Grenada.

Figure 21. Lesser Black-backed Gull with two Laughing Gulls on Union Island (J. Coffey)

Species that have been reported but records unsubstantiated:

- Sooty Shearwater *Ardenna grisea*
- Great Skua *Stercorarius skua*
- South Polar Skua *Stercorarius maccormicki*
- Long-tailed Jaeger *Stercorarius longicaudus*
- Black-legged Kittiwake *Rissa tridactyla*
- Bonaparte's Gull *Chroicocephalus philadelphia*
- Great Black-backed Gull *Larus marinus*
- Caspian Tern *Hydroprogne caspia*
- White-winged Tern *Chlidonias leucopterus*
- Cory's Shearwater *Calonectris diomedea*

Island Inventory by Group

The island inventory provided here follows Lowrie et al. 2012 designations, for a total of seven island groups with one exception – Bequia islands have been grouped with Battowia islands, instead of Saint Vincent, for practical monitoring purposes and geographic rationale (Bequia and Battowia islands are on the Grenada Bank).

Table 2. Grenadines island inventory by group

Country	Island Group	Islands
Grenada	Grenada Mainland and Inshore Islands	• Bird Island • Conference Island • Glover Island • Telescope Rock • Labaye Rock • Sandy Island* • Green Island* • Sugarloaf Island*
	Grenada North Islands / Isle de Ronde	• Diamond Rock • Isle de Caille • Isle de Ronde • London Bridge • Les Tantes (East, West, North and South) • Upper Rock and Lee Rock (The Sisters/Brothers)
	Carriacou Islands / Petite Martinique	• Carriacou Mainland • Bonaparte Rocks • Large Island • Rose Rock • Fota • Petite Dominique • Frigate Island • White Island • Saline Island • Mushroom (GoCola) • Petit Cola • Little Mel / Little Mushroom • Mabouya • Sandy Island • Sisters Rocks (Large and Small) • Jack A-Dan
Saint Vincent and the Grenadines	Canouan, Sail Rock and TCMP	• Baradal • Jamesby • Petit Tabac • Petit Bateau • Petit Rameau • Bloody Head (Union Island) • Canouan Baleine / Small L'Islet • Catholic Island • Dove Cay / Big L'Islet • Ellen Rock / Round Cay • Pelican Cay / Flat Cay • Jondell • Petit Canouan • Sail Rock • Craby Rock
	Mustique and Savan Islands	• Pillories (Big, Small and Middle) • Brooks Rock / Big Brooks • North Rocks / Little Brooks • Wilks Cays • Savan Island / Big Savan • Little Savan • Savan Rocks • North Savan Rocks • Petit Cay • Petite Mustique • Rabbit Island
	Bequia and Battowia Islands	• All Awash • Battowia • Bullet Cay • Church Cay • Bequia Mainland • Bequia Bullet • Syrup / Chirrup Cay • Big Cay • West Cay • Isle a Quatre • Pigeon / Rahmay Island • Petit Nevis • Middle / Whale Cay
	Saint Vincent	• Duvernette • Milligan Cay • St. Vincent Mainland (Old Woman's Point)

*Not surveyed in Lowrie et al. 2012 study

1. Grenada Mainland and Inshore Islands

Figure 22. Sandy Island, Grenada (J. Coffey)

The only inhabited island in this group is the Grenada mainland, with over 100,000 human residents. Green, Sugarloaf and Sandy Island were not surveyed in the 2012 EPIC seabird breeding atlas. Sandy Island was visited in August 2019 and found to have a thriving breeding colony of Laughing Gulls (J. Coffey pers. obs.). This colony however has been found to be inundated with plastic pollution, and some of the Laughing Gull nests occurred amongst piles of plastic debris. Historical and anecdotal sources indicate Audubon's Shearwater nesting presence on Labaye Rock, Bird Island, Green Island and Sandy Island (e.g. Wells 1902). While harvesting of seabird chicks and eggs was previously documented on these islands, current extent of activities is unknown. Tourists and locals frequent Sandy Island for day trips.

Breeding Seabirds: Minimum of seven species; Laughing Gull, Bridled Tern, Brown Booby, Brown Noddy, Red-billed Tropicbird, Roseate Tern, Sooty Tern. Audubon's Shearwater may continue to nest in this island group but not recently reported.
Significance: Unknown; not all islands have been officially assessed in recent years
Invasives: Unknown
Ownership: Sandy, Green and Sugarloaf islands all privately owned; Glover Island ownership unknown.
Protected Areas: Proposed Levera marine protected area, which includes Sandy, Green and Sugarloaf Island.

Figure 23(A/B). Grenada mainland and inshore islands (Google Earth 2020)

2. Grenada North Islands / Isle de Ronde Archipelago

In 2009, the Protected Areas System Plan for Grenada listed this group of islands as a priority site for protection (Turner 2009). In 2019, a draft management plan was developed for a proposed MPA encompassing this group of islands, including provisions for terrestrial areas and invasive species through a UNDP / GEF grant (G. Serra, pers. comm.). Seabirds are a key biological component of these islands which host globally and regionally significant populations. More than 1% of the world's Red-footed Boobies are found breeding in these islands. These islands additionally supported the largest Magnificent Frigatebird roosts, which are thought to have previously bred on Diamond Rock, although there's no recent documented instances of nesting (Lowrie et al. 2012). A nesting population of Frigatebirds on Diamond Rock may be possible. Human presence is low, with a seasonal settlement of fisherfolk on Isle de Ronde who are also involved in small-scale agriculture (G. Serra, pers. comm.). Other persons originating primarily from St. Patrick, Grenada venture to this island group to fish. Seabirds continue to be harvested from Les Tantes, Diamond Rock and the Sisters/Brothers (Upper and Lee Rock). Lowrie et al. (2012) reported dead Magnificent Frigatebirds entangled in ropes on Diamond Rock and Upper/Lee Rock. In addition, piles of discarded seabirds, including tropicbirds and boobies were observed at Les Tantes East. A fisherman was observed at Les Tantes West carrying a bucket, thought to be for seabird egg/chick harvesting, while two dozen decapitated Brown Booby chicks were found in the same area several days later (Lowrie et al. 2012). Observers report that the single fisherman harvested 39% of Brown Booby chicks present on the island. These islands have been exploited for seabirds, their chicks and eggs for many years so current populations may be depressed by hunting pressures. There is not currently any significant seabird presence on Isle de Caille or Isle de Ronde, which have opossum/manicou, and possibly mice, cats and dogs (G. Serra, pers. comm). Finally, coral reefs are reported to be very healthy, likely influenced by the high abundance of nesting seabirds and spillover effects from deposited guano (G. Serra, pers. comm.). The globally significant colonies were not reported in Rusk (2008) Grenada Important Bird Areas in the Caribbean, nor were any Grenadine islands considered in that report. Unfortunately, data on the sheer magnitude of breeding seabirds on these islands, and their regional/global importance was non-existent at that time. Rusk (2008) did, however, call for further investigation of seabird colonies.

Figure 25. Grenada North Islands / Isle de Ronde Archipelago (Google Earth 2020)

Figure 24. Red-footed Boobies nesting on Diamond Rock (J. Coffey)

Breeding Seabirds: At least seven species - Bridled Tern, Brown Booby, Brown Noddy, Laughing Gull, Red-billed

Tropicbird, Sooty Tern, Red-footed Booby

Significance: One colony of Red-footed Boobies on Les Tantes (East) of global importance. Diamond Rock and Les Tantes combined host globally important colonies of Red-billed Tropicbirds and Brown Boobies. Les Tantes (West) hosts a regionally important colony of Brown Boobies, while Diamond Rock hosts regionally important colonies of Red-billed Tropicbirds, Brown Boobies, Red-footed Boobies and Laughing Gulls. Les Tantes and Upper/Lee Rock (Sisters/Brothers) combined host regionally important colonies of Red-billed Tropicbirds and Brown Boobies.

Figure 26. Brown Boobies roosting on Lee Rock (J. Coffey)

Invasive Species: Goats present on Diamond Rock (J. Coffey pers. obs.), Les Tantes (Collier 2014) and potentially Isle de Ronde. Rat photographed on Lee Rock (Wayne Smart pers. comm.) and rodents anecdotally reported on Isle de Caille (Collier 2014). Cats and rabbits previously on Isle de Ronde – current status unknown. Opossum reported on Isle de Ronde (e.g. Borroto-Paez and Woods 2012; Lowrie et al. 2012).

Figure 27. Goat presence on Diamond Rock (J. Coffey)

Ownership: Les Tantes, Isle de Ronde and Isle de Caille are privately owned islands, while Diamond Rock, Upper/Lee Rock and London Bridge are likely government-owned. Currently a large-scale resort development on Isle de Ronde is under consideration (G. Serra, pers. comm.).

Protected Areas: Isle de Ronde Archipelago marine protected area is currently under review.

3. Carriacou Islands / Petite Martinique

Carriacou and Petite Martinique are the only inhabited islands in this group. Seabirds breed on several of the islands surrounding Carriacou and Petite Martinique, most of which are privately owned. Seabird carcasses observed on Frigate Island were believed to have perished by gunshot, while adult birds have additionally been observed dead and entangled in ropes (e.g. Collier 2014). Frigate Island is one of the most imminently threatened islands in the Grenadines due to high abundance of goats, seabird harvesting, disturbance, development and periodic burning. In July 2019, observers documented a burning event on the island, thought to have been initiated to clear vegetation for goat harvesting (J. Coffey pers. obs.). Egg collection, particularly of Laughing Gulls, occurs on Frigate Island, Mushroom and others annually in early May. Many of the species nesting in this island complex are not present in the archipelago year-round and, therefore, seabird harvesting is time-sensitive. Periodic poisoning of Laughing Gulls in Tyrell Bay on Carriacou has also occurred since they are often thought of as a pest. Large numbers of Laughing Gulls gather in Tyrell Bay, both prior to and after nesting, likely given proximity to nesting colonies at nearby islands, particularly Frigate Island – their largest colony in the entire Lesser Antilles. Despite the establishment of the Sandy Island Oyster Bed Marine Protected Area (SIOBMPA) in 2010, there are currently no provisions in the management plan considering breeding seabirds, nor detailed information on species, abundance or timing. Given the emphasis on corals and coral gardening within this MPA, combined with seabird role in fertilizing reefs, it is recommended that the

management plan and monitoring strategy be updated to include seabirds. The four islands that are contained within the marine protected area include Sandy Island, Mabouya, and Sisters Rocks. All except Sandy Island currently have populations of breeding seabirds. The SIOBMPA has in recent years seen a dramatic increase in Brown Pelican presence, which are present year-round (J. Coffey pers. obs.). Seabird monitoring in the MPA area could inform upon marine health and be used as a tool for public support of MPAs. Audubon's Shearwater is present on at least three islands in this group.

Breeding Seabirds: Seven species - Audubon's Shearwater, Bridled Tern, Brown Noddy, Laughing Gull, Red-billed Tropicbird, Roseate Tern, Sooty Tern.

Significance: Regionally important colonies of Audubon's Shearwater, Laughing Gull and Red-billed Tropicbird on Frigate Island; Frigate Island hosts the largest colony of Laughing Gulls in the Lesser Antilles. Audubon's Shearwaters had not been reported from the Grenada Grenadines since the 1950s, which may additionally nest on Bonaparte Rocks. SIOBMPA hosts the highest number of feeding/roosting Brown Pelicans in both nations.

Invasive Species: Goats present on Frigate, Large and Mabouya islands, with a potential population on Saline Island. One resident of a nearby island previously put several goats on Mushroom, which were quickly removed by other locals. The high abundance of goats is causing severe erosion on Frigate Island. There are anecdotal reports of rodent presence on White and Sandy Island. Large Island was additionally reported to have sheep, donkeys, and chickens in the past (Howard 1952) and could account for the lack of current seabird presence. White Island also previously had a presence of goats.

Ownership: The majority of islands with breeding seabirds in this group are privately owned. Government owned islands include those within the SIOBMPA (Sisters Rocks, Mabouya, Sandy Island), Jack-A-Dan and Fota. Despite being within a designated MPA, development proposals continue to be received for Mabouya. Ownership of Petite Dominique is unofficially disputed between government and private entities. Frigate, White, Saline and Large Island are privately owned.

Protected Areas: Sandy Island Oyster Bed Marine Protected Area (SIOBMPA), encompassing Sandy, Mabouya and Sisters Rocks; Southern Carriacou Islands proposed marine protected area under review

Figure 28. Carriacou Islands and Petite Martinique (Google Earth 2020)

Figure 30. Brown Pelicans are common in the SIOBMPA (J. Coffey)

Figure 29. Goats cause severe erosion and seabird disturbance on Frigate Island (J. Coffey)

4. Canouan, Sail Rock and TCMP

Inhabited islands in this group consist of Canouan, Mayreau, Union Island, Palm (Prune) Island and Petit St. Vincent. Petit Canouan is the most important island in this group and indeed one of the most important in the entire archipelago. This island has over 40,000 pairs of breeding seabirds of at least five different species. In addition, Audubon's Shearwater may nest, totalling six species (FFI, pers. comm. 2019). Extensive egging activity has been documented at Petit Canouan, which is also periodically burned to facilitate egg collection, particularly of Sooty Tern eggs. Laughing Gull eggs are procured from Dove Cay, with reports of fisherfolk attempting to sell to researchers (Lowrie et a. 2012). Goats are no longer present on Petit St. Vincent due to eradication efforts from resort owners. Many migrating and overwintering birds roost on Petit Tabac (e.g. Royal Tern, Common Tern and Sandwich Tern). Baradal is one of the main islands visited by tourists in the Tobago Cays Marine Park, primarily due to resident feeding sea turtles which are a major attraction for the park. There is a population of nesting seabirds on this island, which consists of Brown Noddy and Bridled Tern. While 2009 – 2010 surveys recorded only 8 pairs of Brown Noddies on Baradal, more recent surveys suggest more than 100 pairs nest on this island (J. Coffey pers. obs. 2011-2019; EPIC unpublished data). Despite this island being protected, disturbance from human presence likely affects nesting seabirds, as well as potential opportunistic predation by iguanas. Jamesby also has sizeable populations of Brown Noddies and Bridled Terns. Egg collecting was historically a popular activity in the Cays. Petit Rameau has a small population of goats (J. Coffey, pers. obs.). Morpion does not have any nesting seabirds, but is likely a site for resting and feeding seabirds and shorebirds for at least part of the year. This small sand cay is occasionally submerged in high tides. Catholic Island, Round Cay and Flat Cay are more diverse in types of nesting seabirds

Figure 31. Islands within the Canouan, Sail Rock and TCMP group (Google Earth 2020)

than in the Cays, notably with nesting Audubon's Shearwater. More recent surveys by EPIC in 2019 indicate all seabird nesting islands in this archipelago have more breeding seabirds than documented in 2009 – 2010 surveys (J. Coffey pers. obs.; EPIC 2019 unpublished data). Many of the islands in this group are contained within the Tobago Cays Marine Park, however, seabirds are not well featured in the management and monitoring plan for the park. Similar to the recommendation for SIOBMPA, seabirds within this island group could contribute to a positive public perception of MPA success for the Tobago Cays Marine Park, and also diversify attractions featured within the park. Increased education and awareness of burning and egging at Petit Canouan as well as enforcement of existing laws is highly recommended.

Breeding Seabirds: Nine breeding species – Audubon's Shearwater, Bridled Tern, Brown Booby, Brown Noddy, Laughing Gull, Red-billed Tropicbird, Roseate Tern, Sooty Tern, and White-tailed Tropicbird.

Significance: Petit Canouan has the most breeding seabirds in both nations and is designated as a BirdLife International Important Bird Area (IBA), along with the Ashton wetlands on Union Island. The most southerly recorded White-tailed Tropicbird colony in Lesser Antilles is on Bloody Head, Union Island. Active Audubon's Shearwater nests were found on Catholic Island during 2009 – 2010 surveys – the only island in Lesser Antilles where active nests were discovered during the two-year effort (Lowrie et al 2012). Dove Cay has a regionally important colony of Laughing Gulls.

Invasive Species: Goats present on Petit Rameau, invasive grass species on most of Petit Canouan.

Ownership: All islands within the TCMP, Sail Rock and Petit Canouan are government-owned. Palm Island and Petit St. Vincent are privately managed.

Protected Areas: Tobago Cays Marine Park / Marine Reserve / Wildlife Reserve, Catholic Rocks / Island Wildlife Reserve, Petit Canouan Wildlife Reserve, Sail Rock Wildlife Reserve, Petit St. Vincent Marine Conservation Area, Union Island/Palm Island Marine Conservation Area. Canouan Marine Conservation Area does not encompass any seabird colonies.

Figure 32. Sooty Terns nest in high density on Petit Canouan (J. Coffey)

Figure 33. Brown Noddy nesting in Tobago Cays (J. Coffey)

5. Mustique and Savan Islands

Mustique is the only inhabited island in this island group, and is privately managed by the Mustique Company. There is a fishing village on the island which consists of fisherfolk originating primarily from Bequia. The only recent confirmed breeding site for Masked Boobies in both nations is within the conservation area surrounding Mustique. The Pillories were nominated as most the important

Figure 34. Masked Booby near Mustique (J. Coffey)

islands in the nation by Lowrie et al. (2012), due to supporting seven species of seabirds, including Audubon's Shearwater, and would benefit from being further being declared as a Wildlife Reserve. Many of the islands surrounding Mustique that are outside of the conservation area are subject to regular exploitation of seabird eggs during nesting season.

Breeding Seabirds: Nine species - Audubon's Shearwater, Bridled Tern, Brown Booby, Brown Noddy, Laughing Gull, Masked Booby, Red-billed Tropicbird, Roseate Tern, and Sooty Tern.

Significance: Brooks Rock is the only confirmed nesting location for Masked Booby (*Sula dactylatra*) in both countries, and one of only four confirmed locations in the entire Lesser Antilles (Lowrie et al. 2012). The entirety of Mustique Island is designated as a BirdLife International Important Bird Area (IBA). Petit Mustique has a regionally important colony of Laughing Gulls. Pillories have the most species in the entire nation, including Audubon's Shearwater.

Invasive Species: Goats are present on Petite Mustique, Pillories, and Savan Island, with reports of cats and dogs present at a fishing camp on Savan.

Ownership: Mustique Company owns Mustique Island and has instated a conservation zone 1,000 yards from the shoreline, encompassing some nearby islands, including Brooks Rock.

Protected Areas: Mustique Marine Conservation Area and Savan Islands Wildlife Reserve

Figure 35. Mustique and Savan Islands group (Google Earth 2020)

6. Bequia and Battowia Islands

Bequia is the only inhabited island within this island group. Bequia regularly receives cruise ship tourism during the winter months. Although Battowia is privately owned, it is a government designated Wildlife Reserve. Reports of artifacts found on this island indicate that it was likely an important island in the past for Amerindians. Both the biophysical and historical/cultural value of Battowia strengthen the need for protection and enforcement on this island. Seabird adult, chick and egg harvesting is a frequent year-round activity occurring on Battowia. It is further severely degraded by goats and there are anecdotal reports of mice. Despite several efforts to determine rodent presence on the island, this has not yet been confirmed. Goats have eliminated much of the vegetation below two meters high. Balliceaux reportedly belongs to the same owner of Battowia, who has entered into an agreement with the government for protection due to its national significance for the Garifuna people. There are a couple of shelters constructed on this island and it has also been severely eroded by goats and other domesticated animals. Researchers have observed piles of dead seabirds on Balliceaux believed to have been cooked there after harvesting from adjacent Battowia (Lowrie et al. 2012). Pigeon/Rahmay Island has rats and is severely eroded by goats. Locals indicate that seabirds have been declining on and around this island in recent years. Isle a Quatre is suspected for invasive species other than goats (FFI, pers comm. 2019). Harvesting occurs on many of the islands where there are breeding seabirds, especially Battowia. West Cay is in close proximity to Bequia and subject to exploitation, despite being owned by the St. Vincent National Trust. Efforts should be made to remove/reduce goat presence, particularly on Battowia and address seabird harvesting activities.

Breeding Seabirds: 10 species - Brown Booby, Brown Noddy, Laughing Gull, Red-billed Tropicbird, Red-footed Booby, Roseate Tern, Sooty Tern, Magnificent Frigatebird, White-tailed Tropicbird, Audubon's Shearwater

Significance: Battowia is likely the most important seabird colony in the entire Lesser Antilles due to two globally significant populations (RFBO and RBTR), potentially harbouring the highest density of Red-footed Boobies in the entire Caribbean (Lowrie et al. 2012), and hosts the only recently confirmed Magnificent Frigatebird colony south of Antigua (J. Coffey pers. obs. 2019). Big Cay and Pigeon/Rahmay Island have Audubon's Shearwater presence. Battowia and All Awash Islands are designated as BirdLife International Important Bird Areas.

Invasive Species: Goats are present on many islands, such as Battowia, Balliceaux, Small Pillory, Pigeon/Rahmay Island, etc.; rodents are present on Pigeon/Rahmay Island (FFI pers. comm. 2019); there is a potential rodent (mice) presence on Battowia (Collier et. al. 2012); rabbits, deer, donkeys and sheep are reported to be historically present on Battowia (Howard 1952).

Ownership: Big Cay and West Cay are owned by St. Vincent National Trust; Battowia, Balliceaux, Isle a Quatre and Petit Nevis are privately owned.

Protected Areas: Battowia, Big Cay, West Cay, Pigeon/Rahmay Island, Isle a Quatre and All Awash are designated as Wildlife Reserves.

Figure 36. Bequia and Battowia Islands group

Figure 38. Magnificent Frigatebirds nesting on Battowia (J. Coffey)

Figure 37. Battowia has two globally important seabird colonies (Google Earth 2020)

7. Saint Vincent Mainland and Inshore Islands

The largest inhabited island in this group is the Saint Vincent mainland, with over 100,000 people. Young Island is a private resort island located within the South Coast Marine Conservation Area. There are few suitable seabird nesting sites around the Saint Vincent mainland and the species abundance and diversity are reflected as such. Seabird nesting has only recently been recorded at Fort Duvernette, Milligan Cay and Old Woman's Point. Notably, three of these locations have nesting White-tailed Tropicbirds, which are highly uncommon in the rest of the Grenadines. The abundance of Red-billed Tropicbirds in the rest of the Grenadines and competition for suitable nesting space may partially account for their low numbers in the Grenadines. Seabirds nesting at Duvernette and Old Woman's Point are likely exposed to an abundance of predatory and non-predatory invasive species, such as rats. White-tailed Tropicbirds are therefore the only species currently found nesting at these two sites, due to their tendency to nest in inaccessible areas on steep, rocky cliffs. All three sites are additionally situated in close proximity to much human activity, both domestic and generated by tourism. Milligan Cay is reported to have been exploited for seabird eggs. The status of seabirds there since establishment of the new airport in 2017 is unknown.

Breeding Seabirds: White-tailed Tropicbird, Bridled Tern, Brown Noddy, Roseate Tern
Significance: Three White-tailed Tropicbird nesting sites
Invasive Species: With these sites so close to the mainland, with one site located on the mainland, seabirds are exposed to many invasive species existing there, including both mammalian predators (cats, dogs, rodents, mongoose, etc.) and non-predatory mammals (goats, sheep, etc.); Cattle Egret is reported to roost on Milligan Cay
Ownership: Duvernette is owned by Saint Vincent National Trust, Milligan Cay is a government-owned Wildlife Reserve.
Protected Areas: South Coast Marine Conservation Area, Milligan Cay Wildlife Reserve, Young Island Wildlife Reserve

Figure 40. Saint Vincent mainland and inshore islands group (Google Earth 2020)

Figure 39. White-tailed Tropicbird (John Sullivan, Macaulay Library ML186798451)

Human Dimension of Seabirds

Seabirds have been important to the culture and economy of people in the Grenadines since the islands were first populated. Archaeological sites have revealed their bones, beaks, feathers and talons or items, such as ceramics, crafted in the image of seabirds. One such example is a drum recovered during the construction of Argyle International airport which is thought to be made from the pouch of a Brown Pelican beak (K. Martin, pers. comm.). Amerindian inhabitants practiced a maritime culture and subsisted on a diet largely originating from the sea, which included seabirds. It is also believed that the seabirds and/or their island colonies held spiritual significance to Amerindians in the Grenadines, as they have and continue to in many indigenous cultures (Fewkes 1914, Coffey and Ollivierre 2019).

Perhaps the most important value of seabirds to people in the Grenadines is assisting fisherfolk to find fish, in both coastal and offshore areas. Fisherfolk who observe the types of seabirds present in feeding flocks can often predict the associated types of fish. In a study by Grant (2007) in Grenada, 98% of fisherfolk agreed that the presence of birds indicated presence of fish, with many setting lines near flocks of seabirds. Larger, pelagic seabirds, such as booby species, can indicate tuna or mahi mahi, as both the seabirds and the fish have similar prey items, such as flying fish (Coffey and Ollivierre 2019; Grant and Berkes 2007). Other seabirds, such as Laughing Gulls and tern/noddy species can indicate presence of baitfish. Many fisherfolk have an understanding of the diet of seabirds, which in some cases has helped them set traps to catch seabirds at sea (Coffey and Ollivierre 2019).

Seabirds provide seafarers with important clues for navigation, with some seabirds preferring to remain coastal, while others may be found far out at sea. Seabird behaviour varies both with time of day and time of year. Some seabirds will make day trips away from colonies while nesting or raising chicks, sleeping at the colony overnight, while others will make multi-day trips. When not nesting or raising chicks, some species remain at sea for several months at a time. An understanding of seabird species, associated behaviour and seasonality can assist with navigation.

Changes in weather are also thought to be foreshadowed by certain seabirds, particularly Magnificent Frigatebirds (*Fregata magnificens*). It is said that Magnificent Frigatebirds will fly over land or change flying height when there is bad weather approaching or that they will disappear during a rain (Coffey and Ollivierre 2019). This species in particular relies on thermals in air currents for traveling and lacks waterproof feathers that are present in most other seabirds. Their susceptibility to changes in weather or extreme events dictates their response to such occasions.

Seabirds are also a source of folk beliefs. One such example is of fisherfolk stating that sightings of storm petrels predict negative events, such as deaths (Coffey and Ollivierre 2019). Seabirds are often represented in art, such as murals in restaurants and bars, throughout the archipelago. Eggs of many species have been considered an aphrodisiac, both in the Grenadines (Coffey and Ollivierre 2019) and elsewhere (Burger and Gochfeld 1994), with some eggs being preferentially selected for such applications. Harvesting of seabirds in the Grenadines continues to be extensive and is discussed throughout this plan.

Legal Framework

Seabird protection in Saint Vincent and the Grenadines and Grenada falls primarily under the authority of the Forestry Departments, while other departments are guided by legislation that contains provisions applicable to seabirds, such as National Park, Fisheries and Land Planning. Forestry Departments in both nations are limited by staff and resources, such as boats/funds to manage seabird breeding colonies. Therefore, no monitoring or enforcement of regulations protecting seabirds from threats such as poaching or grazing of animals in protected areas occurs in either nation.

Interdepartmental collaborations and partnerships with external agencies and non-governmental organizations could supplement these deficiencies. Governmental departments that may assist with seabird protection include Fisheries, National Parks, Land Planning, and National Trusts. Marine protected areas, such as the Tobago Cays Marine Park and Sandy Island Oyster Bed Marine Protected Area, could oversee seabirds in their jurisdictions, as they have staff trained in monitoring and enforcement of resources and access to boats. The Grenadines Network of Marine Protected Areas is well organized as a forum for these MPAs to discuss and address seabird issues, and has a role in protecting seabirds given their transboundary cooperation on coral reef and coastal ecosystem management.

The following section provides a brief overview of environmental legislations applicable to seabird conservation and management in both Saint Vincent and the Grenadines and Grenada. This list is not exhaustive or holistic, and is intended to be an introduction only. An analysis of the legal frameworks in both countries for protection of seabirds and their island habitats is highly advised, including recommended updates / amendments to existing legislation. Given that many of the offshore islands in the Grenadines are privately owned, both countries require strategies for conserving and preserving natural resources on private property and respective arrangements with landholders.

Saint Vincent and the Grenadines

1. Wildlife Protection Act (1987)

Seabirds and their chicks, eggs and nests are fully protected from harvesting and disturbance under section 13 of the Wildlife Protection Act. In addition, any person found in possession or control of, or offering for sale a seabird or part thereof is guilty of an offence against this Act. Initial violations are subject to a fine of 2,000 dollars, while repeat offences are liable to a fine of 4,000 dollars and a year imprisonment. Revocation of firearms licenses are subject to any offence.

In enforcing the Act, Wildlife Protection Officers may confiscate any items and equipment believed to have been used to enable the violation, such as firearms, boats, vehicles and dogs, and have the right to search persons, vehicles and properties with certain provisions, and seize any live, deceased and/or part of any seabird.

Wildlife Reserves established under the Wildlife Protection Act of 1987 are to be managed as natural areas and any land within a Wildlife Reserve may not be granted, devised, leased or sold. Wildlife Reserves may be established on private land in cooperation with the land owner. Seabirds, their chicks, eggs and nests must not

be damaged or disturbed in Wildlife Reserves. Additionally, livestock and domestic animals are not permitted to be brought to or released into a Wildlife Reserve. Firearms, fires, damage to vegetation and cultivation are also prohibited. An offense is punishable by 2,000 dollars and a subsequent/repeat offense is subject to a fine of 4,000 dollars and imprisonment for one year.

This Act being has not yet been applied to protect seabirds in the nation. Similarly, Wildlife Reserves have been established to protect seabird colonies, but no enforcement of regulations has occurred. Seabirds, and other birds, in this Act require amendments for appropriate common, Latin and local names.

2. National Parks Act (2010; amended from 2002) and Marine Parks Act, 1997

The responsibility of the National Parks, Rivers and Beaches Authority is to advocate and promote conservation and to enable use of natural resources for recreation and tourism. This department is also responsible for ensuring permanent protection of species and habitats, especially species that are rare, endangered, endemic, and also of representative habitats required to sustain such populations. The National Parks department can act as a liaison between various departments and also act as a conflict resolution body between such stakeholders as fisherfolk and the tourism sector in the context of national parks. They are also the primary department responsible for the establishment of national education programs relating to conservation. Within this Act, marine national parks can be established, which contain islands and adjacent waters and include both living and non-living things within the park area. Owners of private land can apply to have their land considered to be a national park. Within national parks, there is to be no removal or damage to flora/fauna, destruction of or disturbance to wildlife, setting of fires, releasing or grazing of livestock, construction, cultivation of crops, amongst other regulations set forth.

The Marine Parks Act allows for the establishment of Marine Parks and an associated Board that govern activities within a marine area, including adjacent land and wetland areas. The regulations set forth in this Act protect all flora and fauna within a Marine Park, and provide guidance for the activities that may or may not be carried out in such areas.

3. Forest Resource Conservation Act (1992)

The Forest Resource Conservation Act, amongst other statutes, contains a provision for maintenance of biological diversity. The Minister can declare any area of Crown land to be a forest reserve for the preservation of flora and fauna, within which no land can be granted, devised or sold. The Forestry Department is the responsible authority to prosecute offenders to this Act. In consultation with the Land Planning Board, the Minister may also declare any Crown or private land to be a conservation area based on various rationale. This Act also oversees a Conservation Fund, which may be used to purchase private lands, educate about conservation programs and cover expenses related to conservation efforts. The Minister may additionally stipulate regulations, such as prohibition of livestock grazing, fires, recreational activities and preservation of areas of ecological/scientific value.

4. Fisheries Act (1986)

The Fisheries Act allows for establishment of marine reserves for the protection of flora and fauna, and their respective habitats, in certain areas. In addition, marine reserves may be established to preserve the beauty of areas and promotion of scientific research.

5. The Saint Vincent and the Grenadines National Trust Act (1969)

The National Trust Act establishes a body enabled to acquire and hold land and to locate and restore areas of beauty, including marine areas, and to conserves and protect flora and fauna in these areas. It is also the mandate of the Trust to educate the public on historic and natural resources of SVG and to collect and allocate funds associated with their objectives. The SVG National Trust holds several properties, including Big Cay and West Cay, which are seabird breeding areas.

6. Mustique Company Limited Act (2002)

The Mustique Company Act establishes a conservation zone covering the entirety of Mustique, including beaches and marine areas extending 1,000 yards from the shoreline. This Act therefore protects several islands adjacent to Mustique, including Brooks Rock, which is the only known nesting site for Masked Boobies in both nations. All flora and fauna in this zone are protected and activities such as fires are prohibited.

Table 3. SVG Protected Areas (Note: Grenadines only relevant to seabirds)

Wildlife Reserve	Marine Conservation Area	Marine Protected Area / Park
• Young Island • Milligan Cay • Northern end of Bequia beyond Industry Point • Big Cay and West Cay • Isle de Quatre • Pigeon / Rahmay Island • Battowia • All Awash • Savan Islands • Petit Canouan • Catholic Rocks / Catholic Island • Tobago Cays / Tobago Cays Forest Reserve • Sail Rock • Palm / Prune Island	• South Coast Marine Conservation Area • Bequia Marine Conservation Area • Isle de Quatre Marine Conservation Area • Mustique Marine Conservation Area • Canouan Marine Conservation Area • Union Island/Palm Island Marine Conservation Area • Petit St. Vincent Marine Conservation Area	• Tobago Cays Marine Park

Grenada

1. Birds and other Wildlife Act (1957)

This Act provides exclusive protection to seabirds, and prohibits exploitation of seabirds, their chicks, eggs and nests, not by being specifically mentioned, but by not being included in the Second Schedule which outlines seasons and species to be exploited. In addition, exportation of seabirds and their parts thereof, is prohibited. Offences are punishable by a fine not exceeding 100 dollars. This Act has never been applied in any cases of

seabird harvesting. An update to this Act is much needed, including listing correct common, Latin and local names in the second schedule.

2. Wild Animal and Bird Sanctuary Act (1928)

This Act refers only to the establishment of Grand Etang Forest as a wild animal and bird sanctuary and prohibits harm towards or removal of species in the sanctuary, amongst other activities, such as carrying firearms. This Act does not protect seabirds or their island colonies.

3. Forest Soil and Water Conservation Act (1949)

While this Act is primarily aimed towards protecting forests and forestry, there are provisions which may benefit seabirds and their habitat. This Act establishes a Forestry Department and a policy which includes protection of "forest" areas required to preserve natural and undisturbed habitat for native flora and fauna; it gives the Forestry Department the responsibility to initiate and encourage research necessary to implement the forest policy. The Governor-General is tasked with the responsibility of establishing Forest Reserves on Crown land, in which no land shall be sold, granted or devised. Although this Act provides the Governor-General with the power to establish protected reserves on private land, none of the provisions apply to the protection of wildlife or their habitat. Two avenues could be reserve establishment on private land "for the prevention of soil erosion", and/or "for the … proper management of lands whereon trees are growing and which are not under permanent agricultural cultivation". In addition, the Minister is permitted to make regulations inside of protected forests, including pasturing/trespass of livestock and setting fires, and others relating to the provisions set forth in the forest policy. An owner of private land may also volunteer their property to be a forest reserve, for conservation of "natural resources". Furthermore, this Act prohibits fires, grazing or trespassing of livestock, and clearing and cultivating of Crown land, subject to a fine of 3,000 dollars or six months imprisonment. Such provisions may prove useful to seabird colonies on Crown land, particularly Diamond Rock where goats have been introduced. Livestock in protected areas can be seized by authorities, such as Forest Officers. Additionally, any materials and/or equipment used to commit forest offences can be seized. Seabird habitat may be protected under this Act under the definition of "forest produce", which is ascribed to all types of vegetation and parts thereof.

4. National Parks and Protected Areas Act (1990 – 91)

The Government may establish National Parks on Crown land, or with private land that has been leased, purchased or donated for protection and preservation. Such purpose may specifically be for the preservation of flora and fauna upon such land. National Park land belonging to Government cannot be sold, leased, disposed of, settled, used or occupied. Provisions within this Act allow the Minister to make regulations pertaining to preservation of flora and fauna, prohibition of hunting/shooting, prohibition of squatting and trespassing, prohibition of fires, prevention of introduced species, such as livestock, regulation and control of development/construction. National Parks Development Fund can generate revenue from visitors transiting through/near seabird colonies declared National Parks. Forest Officers and/or other authorities may search persons and/or properties in possession of flora and fauna in National Parks and seize items and property. Any hunting or trapping of seabirds and/or destruction of habitat in a National Park or contravention to any other regulations established is considered an offence which is liable to a fine of 2,000 dollars and six months imprisonment. The terrestrial areas of Diamond Rock, Lee Rock and Upper Rock, as Crown land, should be prioritized for consideration of National Park status given their importance to breeding seabirds.

5. Physical Planning and Development Control Act 2002

This Act is intended to guide development and land-use in Grenada. With regards to seabirds and their island colonies, several statutes are relevant. Firstly, the Act is intended to protect the natural and cultural heritage of Grenada, and can allocate land for conservation. In addition, there is a provision for Environmental Impact Assessment in cases where the development would significantly affect the environment. Per the Second Schedule, seabirds may be considered under requirements for environmental assessments under "any costal zone development" and "any development of wetlands, marine parks, national parks, conservation areas, environmental protection areas or other sensitive environmental areas", or depending upon which type of development is proposed. Non-governmental organizations (NGOs) and other departments, such as environmental, must be consulted in preparation of plans. Furthermore, this Act establishes a Natural and Cultural Heritage Advisory Committee, which may declare sites as environmental protection areas and restrict development accordingly.

6. Fisheries Act / Marine Protected Area Regulations 2001

Marine Parks, Marine Reserves and Marine Sanctuaries are the three types of Marine Protected Areas (MPAs) in Grenada, established to protect breeding grounds and habitat of flora and fauna of aquatic life. The goal of MPAs is to promote scientific study and research within their boundaries and promote natural beauty as well as sustainable use. Taking or destroying any flora or fauna is prohibited in protected areas, as well as releasing domestic or non-native flora and fauna species. No dumping of waste, including bilge water, is permitted.

Table 4. GRE Protected Areas (Note: Grenadines only relevant to seabirds)

Marine Protected Area / Park
• Sandy Island Oyster Bed Marine Protected Area (SIOBMPA) • Levera (Proposed) • Isle de Ronde Archipelago (Proposed) • South Carriacou Islands (Proposed)

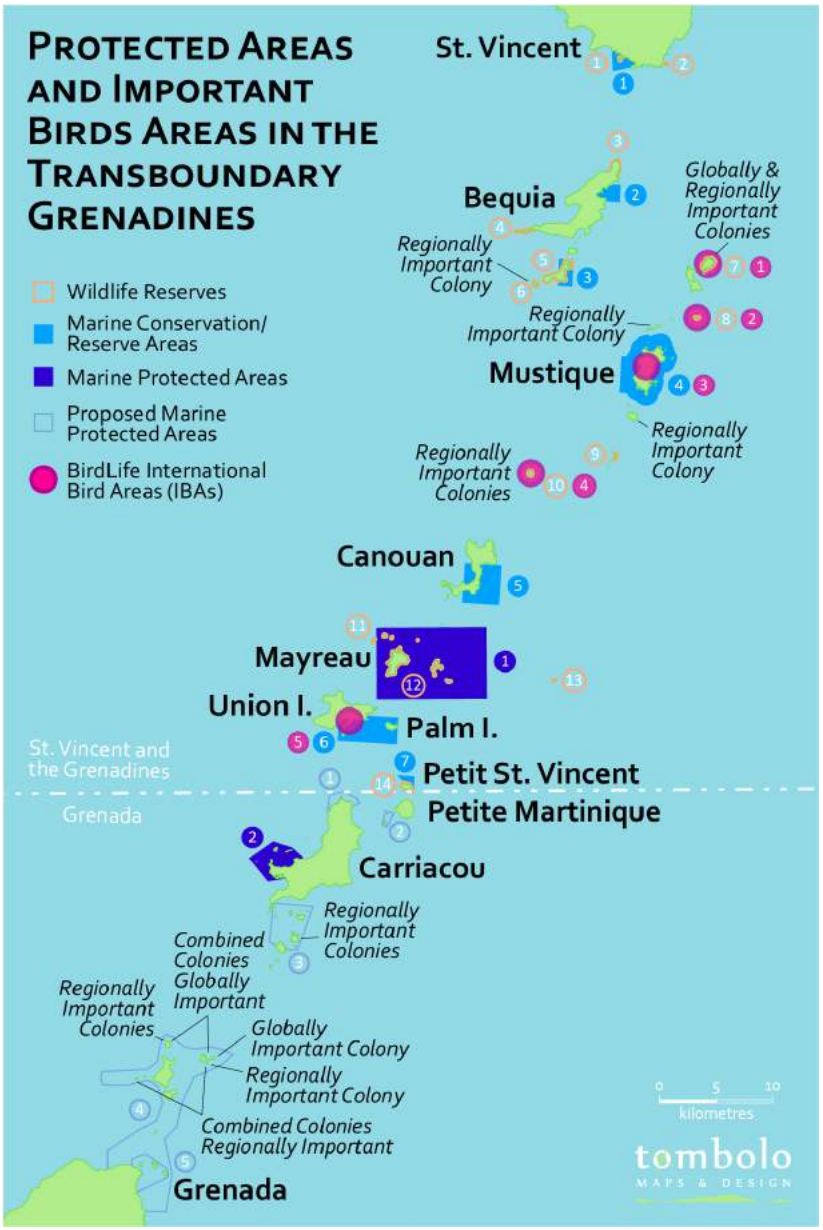


Figure 41. Protected and important bird areas in study area

Table 5. Protected and important bird areas

Wildlife Reserves
1. Young Island 2. Milligan Cay 3. Northern end of Bequia beyond Industry Point 4. Big Cay and West Cay 5. Isle de Quatre 6. Pigeon / Rahmay Island 7. Battowia 8. All Awash 9. Savan Islands 10. Petit Canouan 11. Catholic Rocks / Catholic Island 12. Tobago Cays / Tobago Cays Forest Reserve 13. Sail Rock 14. Palm / Prune Island
Marine Conservation/Reserve Areas
1. South Coast Marine Conservation Area 2. Bequia Marine Conservation Area 3. Isle de Quatre Marine Conservation Area 4. Mustique Marine Conservation Area 5. Canouan Marine Conservation Area 6. Union Island/Palm Island Marine Conservation Area 7. Petit St. Vincent Marine Conservation Area
Marine Protected Areas
1. Tobago Cays Marine Park 2. Sandy Island Oyster Bed Marine Protected Area
Proposed Marine Protected Areas
1. North Carriacou 2. Petite Mustique 3. South Carriacou Islands 4. Isle de Ronde Archipelago 5. Levera Islands
BirdLife International Bird Areas
1. Battowia 2. All Awash 3. Mustique 4. Petit Canouan 5. Ashton Lagoon and Mangroves

Threats and Disturbances

Harvesting

Widespread and large-scale harvesting of seabird eggs and chicks was regarded as the primary threat to seabird conservation and driver of modern-day and historical declines in the Caribbean in a global assessment of seabirds (van Halewyn and Norton 1984). The authors indicated that egg collecting occurs amongst all 22 species in the region, with chicks and adults of certain species also harvested. Van Halewyn and Norton (1984) for example, state that Magnificent Frigatebirds were taken for consumption throughout the Caribbean, caught in fishing gear and shot and killed for recreational and medicinal purposes. Similarly, Burger and Gochfeld (1994) characterize hunting of seabirds in the Caribbean as "moderate-heavy", with egging activities being "heavy". Van Halewyn and Norton (1984) listed exploitation of seabirds, habitat destruction and disturbance as the most pressing threats to seabirds in the Grenadines, while Lowrie et al. (2012) supported this claim. Harvesting of seabirds, their chicks and eggs continues to be extensive in the Grenadines.

Evidence of historical harvesting in the archipelago is found in early written records of sailors, explorers and naturalists. For example, Howard (1952) in his study of the vegetation of the Grenadines wrote "Natives of other islands visit Kick 'em Jenny (Diamond Rock) on occasion searching for birds' nests and eggs or hunting the wild goats and chickens which abound on the island… Seabirds of all kinds were disturbed from their resting places and the sailors accompanying me collected both eggs and young birds for food.".

In 2009 – 2010 during the EPIC region-wide survey of breeding seabirds, researchers witnessed harvesting activities firsthand, found evidence of previous harvests (e.g. carcasses) and were offered seabird eggs for purchase. In 2014, the Sustainable Grenadines Inc. conducted a survey of fisherfolk regarding harvesting activities and determined that harvesting activities pose a threat to seabird populations in the Grenadines. Results showed that almost 70% of respondents eat seabird eggs, and 47% eat seabirds. Approximately half of those interviewed admitted to collecting seabird eggs and/or seabirds. The majority of fisherfolk indicated that egg collection primarily occurs between March and June, with a peak in early May (Sustainable Grenadines Inc. 2014; Coffey and Ollivierre 2019), which coincides with the nesting seasons of several species. Despite this practice being common and widespread, few respondents reported selling seabird eggs or chicks, indicating that its importance as a commercial activity is not substantial. Seabird chicks and eggs are additionally viewed as aphrodisiacs in certain Grenadines communities, thought to enhance sexual stamina amongst males (Sustainable Grenadines Inc. 2014; Coffey and Ollivierre 2019). In all studies, Sooty Tern (*Onychoprion fuscatus*) and Laughing Gull (*Leucophaeus atrcilla*) tend to be the preferred eggs for collection, while booby species (*Sula Leucogaster)* are the most preferred juveniles due to their rich meat.

Although the practice has diminished in frequency in other areas of the Caribbean, it is still a common activity that is practiced throughout the Grenadines and adjacent communities on mainland Grenada and Saint Vincent. During fisherfolk consultations in 2019, some participants indicated that seabirds were frequently eaten for Sunday dinners in the past and that egg consumption was a common source of nutrition. Several informants mentioned that they use seabird eggs to bake cakes (EPIC unpublished data 2019). Interviews targeting fisherfolk conducted on several islands throughout the archipelago in 2019 revealed that 52% admitted to harvesting seabirds, their chicks and/or eggs in the past, while only 40% were aware that there are restrictions prohibiting the activity (EPIC unpublished data).

Figure 42. Harvesting participation and knowledge of seabird protection laws throughout the Grenadines (EPIC unpublished data 2019)

Persons involved in harvesting activities typically harvest on islands that are close in proximity to their island of residence, likely due to accessibility and fuel costs. For example, harvesters originating from Sauteurs are more likely to conduct harvesting activities at Diamond Rock and Les Tantes, while persons on Carriacou are more likely to harvest on Frigate Island and Mushroom (Coffey and Ollivierre, unpublished data). This preference for harvesting areas is also associated with certain species and seasonality. While Diamond Rock and Les Tantes host thousands of nesting booby species year-round, Frigate Island and Mushroom host seasonal species, such as Laughing Gulls, which are only present for a portion of the year. As such, harvesters from Sauteurs are more likely to harvest booby chicks year-round at nearby islands, while harvesters from Carriacou are more likely to harvest gull eggs, typically in early May. Similarly, in Saint Vincent, harvesters from Bequia are closely situated near Battowia, which has thousands of nesting booby species year-round, though they also admittedly travel to Petit Canouan for Sooty Tern (*Onychoprion* fuscatus) eggs which tend to be more seasonal. Many of the harvesting activities in Saint Vincent and the Grenadines and Grenada take place in protected areas or on islands that have an abundance of seabirds and therefore meet global/regional IBA criteria. Grenada has not yet established protected areas on their most important seabird colonies, despite their regional and global significance.

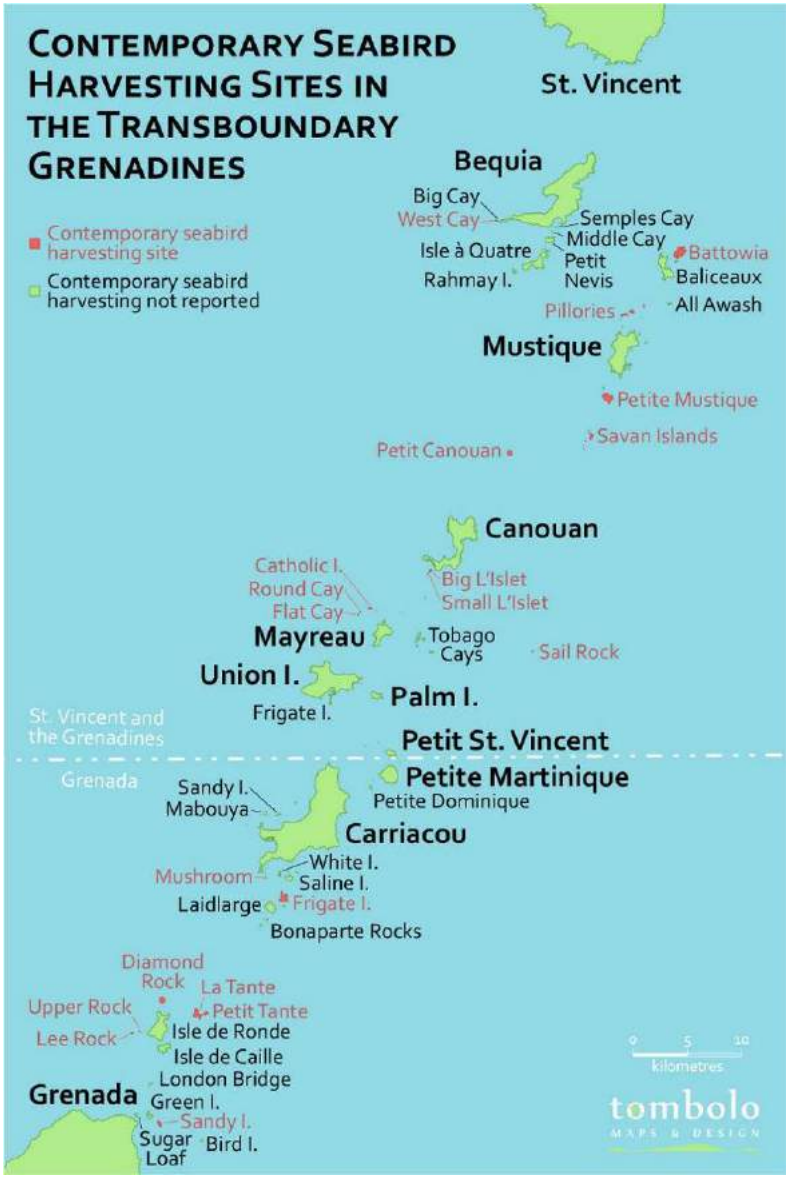


Figure 43. Contemporary seabird harvesting sites in the Grenadines. Note that islands designated as "not reported" does not indicate harvesting does not occur on islands where seabirds are present

Although respondents in surveys believe that harvesting has decreased over the years due to aging population of harvesters, increasing fuel prices and inaccessibility of seabird colonies, it continues to occur likely at unsustainable levels throughout the archipelago. Figure 45 illustrates islands in which respondents in various surveys have reported harvesting (e.g. EPIC 2019 interviews; Coffey and Ollivierre unpublished data).

Figure 44. Eggs harvested from Petit Canouan (Anonymous 2014)

Introduced and Invasive Species

Extinctions and near-extinctions of seabird species worldwide have been predominantly caused by human overexploitation and invasive predators (Burger and Gochfeld 1994). Mass migrations and movements of humans worldwide over many millennia have enabled the transport of species, both purposefully and incidentally, into new regions. Some of these species, such as domesticated goats, sheep and cattle, enabled the survival of human populations as they settled new areas. Others, such as mice, rats and ants were brought by accident on ships.

While an introduced species (also known as alien or exotic) is an animal that has been transported to a new area by humans, an invasive species is an introduced species that is harmful to native flora and fauna. The introduction of non-native species, such as rodents, to seabird nesting islands is a global problem that has resulted in seabird disappearance from many islands. In fact, the destruction by invasive species accounts for half of bird extinctions worldwide over the last five centuries, but is particularly pronounced for seabirds nesting on isolated islands.

Seabirds have evolved to live on remote, predator-free islands and have not developed defence mechanisms to non-native species which can injure and kill adults, chicks and eggs. Introduced species can also alter or destroy the terrestrial habitat which seabirds require to nest and raise chicks and directly compete with other local species for food and habitat.

Figure 45. Contemporary presence of common invasive species in the Grenadines. Note that there may be invasives not represented on this map due to data deficiency.

Prior to human habitation in the Caribbean, seabird populations thrived by nesting on predator-free island havens, which provided them both with the nesting habitat and protection required to nest and raise their chicks. For example, the only native mammals naturally present on the seabird islands were bats, while all other mammal species, such as mice, rats, cats and goats were brought by humans.

Invasive species can interrupt the entire food web and productivity of ecosystems. Seabirds are ecological connectors, and their guano transfers nutrients between the ocean and the land to improve the growth of plants on the island as well as coral reefs surrounding their colonies**.** When invasive species reduce seabird populations, they consequently reduce the health of islands and surrounding waters, including coral reef and fisheries productivity.

The very characteristic that makes seabirds vulnerable – their tendency to nest on isolated island colonies – is also their biggest chance for recovery, allowing conservation efforts to be focused and contained. Eradication of invasive species from seabird islands has proven to be a successful seabird conservation strategy in many locations worldwide (Lavers et. al. 2010). One such success story involves Redonda, a sister isle of Antigua and Barbuda, which had become infested with rats and feral goats. Within a short time of rat and goat removal from Redonda, native vegetation began to flourish and many species of reptile and seabird began to rapidly recover (Daltry et. al. 2012). Eradication of introduced mammals has become a major component of seabird recovery programs worldwide.

Livestock and domestic animals

Within the Grenadines, feral goats are a particularly harmful invasive species and are present in many important seabird colonies, such as Diamond Rock, Frigate Island, and Battowia. Goats are abundant on offshore islands, where they are introduced to graze and develop into feral populations. These goats contribute significantly to erosion by eating vegetation that holds soil in place. The displaced soils can then wash into the sea, smothering and killing surrounding reefs which fish need to survive. Goats can also scare seabirds off their nests, leaving chicks and eggs exposed to the hot tropical sun. In as little as a few minutes, an egg or young chick can perish from exposure, while unprotected chicks and eggs can also be trampled by grazing animals. Disturbance caused by humans who visit the islands to harvest goats can also have a devastating effect on colonies. On occasion, goat harvesting may also occur in sync with seabird egg/chick harvesting, with resource users taking the opportunity to exploit both at the same time.

Figure 46. Goats have caused severe erosion on Frigate Island (J. Coffey)

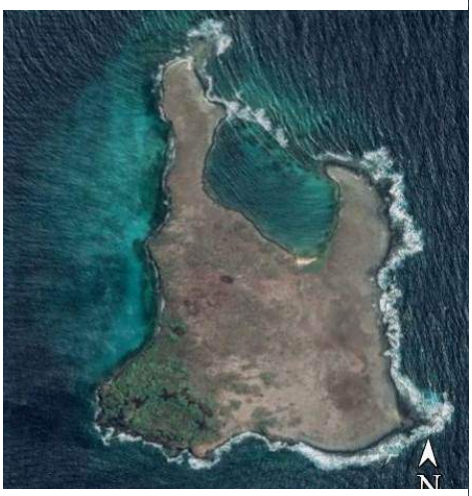


Figure 47. Frigate Island vegetation cover diminished by overgrazing (Google Earth 2020)

In their botanical assessment of Grenadine islands Freid and Glasgow (2015) stated that prevention and elimination of goats from islands is a top priority for vegetation conservationists and that islands with goats and sheep show reductions in plant biodiversity. Goat presence on Pigeon/Rahmay Island (SVG), for example, has caused depletion of vascular plants and severe erosion, while on Battowia they have

mostly eliminated vegetation under two meters high. Although goats were not recorded on Petit Rameau by Noonan (2015), they were recorded in subsequent visits, and may have either been introduced after initial investigations or overlooked (Freid and Glasgow 2015, J. Coffey pers. observation). In the Grenada Grenadines, Frigate Island suffers from overgrazing of goats, with extensive erosion evident even from satellite images.

Cats and dogs are present throughout the Grenadines. Cats have on occasion been released on offshore islands, such as Isle de Ronde (GRE) and Savan Islands (SVG). Cats can kill seabirds and their chicks, as well as many other native species such as lizards and reptiles. On Mayreau, for example, cats have been attributed to the near disappearance of the ground lizard or Zagada (*Ameiva ameiva tobagana*) and reduction in native snakes (Daudin and de Silva 2011). Mustique has implemented a cat control program to preserve native biodiversity. Dogs are also often brought to offshore islands, such as for hunting purposes or by residents/tourists. There was also an historical rabbit and deer presence on Battowia and potentially rabbits on Isle de Ronde (Howard 1952). Both can drastically alter and reduce vegetation and result in disturbance to other species when hunted.

Rodents, mongoose and opossums

While inhabited islands in the Grenadines are known to have rodents, such as rats and mice, their presence on offshore islands and seabird colonies is unknown. Several efforts and a variety of methods have been made on offshore islands to determine rodent presence, which can prey directly upon seabird adults, chicks and eggs (e.g. Collier 2014; FFI pers. comm, etc.). One rodent was photographed on Lee Rock (GRE) using a motion activated camera (Wayne Smart pers. comm.). Anecdotal accounts indicate that rodents may be present on Isle de Caille, White and Sandy Island (GRE). Although anecdotal accounts have also indicated there may be rodents (mice) present on Battowia, efforts to document presence have not confirmed. Rats are the most widely introduced mammals on islands worldwide and have decimated many bird populations, particularly seabirds.

Mongoose (*Herpestes sp.*) were introduced on many islands throughout the Caribbean and are present on Saint Vincent and Grenada. The Grenada Dove (*Leptotila wellsi*) has become critically endangered partially due to predation by mongoose on the Grenada mainland. Mongoose have driven declines in birds and reptiles throughout island ecosystems in areas where they are invasive and have also been known to predate turtle eggs and incubating adult seabirds. Mongoose are not currently present on any of the Grenadines' inhabited or offshore islands. Henderson and Berg (2006) indicate that the introduction of mongoose to additional islands should be avoided at all costs due to their ability to drastically reduce native species, such as reptiles and birds. Mongoose would not just have a devastating effect on seabirds in the archipelago but also other wildlife such as native herpetofauna.

Anecdotal information of opossum (*Didelphis sp.*) / manicou is listed for at least one offshore island, Isle de Ronde, which is not currently a significant breeding island for seabirds. While some believe that it is a native species, others support the theory that it was introduced by Amerindians prior to European contact. Regardless, their presence on offshore islands in the Grenadines is not universal and they are not known to be present on islands with significant seabird breeding populations. Given their tendency to predate birds and eggs, it is likely they would decimate colonies if introduced to breeding islands.**Error! Reference source not found.**

Vegetation

There are many introduced species of vegetation in the Grenadines. Though their overall effect on seabirds is unknown, much seabird habitat has been lost, such as through land clearing and cultivation of non-native species. Informants throughout the Grenadines believe that vegetation, such as cacti and razor grass, may be a limiting factor to seabird nesting (Sustainable Grenadines Inc. 2014). One such island in which an introduced species of vegetation has become invasive is *Panicum maximum* on Petit Canouan. *Panicum maximum* is also reported on other islands, including Isle de Ronde, Tobago Cays and Mustique (Howard 1952). Fisherfolk visiting this island in the past have purposely set fires in an apparent effort to clear vegetation to facilitate harvesting of Sooty Tern (*Onychoprion fuscatus*) eggs – an act that is prohibited by the Wildlife Act of 1987. Several fisherfolk have indicated that they believe the overgrowth of these grasses causes injury and mortality for nesting seabirds, and believe they are helping the seabirds to nest by burning (L. Culzac, pers. comm. 2019). Further investigation on the effects of this invasive species on nesting birds is recommended. Freid and Glasgow (2015) attribute burning activity as preventing native vegetation from regenerating and promoting the spread of the invasive grasses. Howard (1952) stated that much of the natural vegetation of the Grenadines had been decimated due to cultivation and demands of a growing population on forests for fuel, with a high proportion of pan-tropical species and few endemics.

Figure 48. Invasive grasses cover the majority of Petit Canouan (J. Coffey)

Predation

Predation by native species is not considered a major impact to seabird populations, although they do have the potential to reduce or eliminate populations which have suffered declines through other factors (Burger and Gochfeld 1994).

Reptiles

Fisherfolk indicated that they have observed the ground lizard (*Ameiva ameiva*) (locally known as Zagada) eating seabird eggs, while another informant observed iguanas (*Iguana iguana*) predating seabird eggs (Lowrie et al 2012). There are several species of indigenous snakes through the Grenadines, at least one of which has been documented predating a land bird (Henderson 2019). Their abundance and distribution in seabird colonies in the Grenadines is not well known, and there are no documented cases of predation on seabirds, their chicks or eggs, despite occurrences elsewhere (Burger and Gochfeld 1994).

Fish

Documented cases of fish predation upon seabirds is rare and thought to be infrequent (Burger and Gochfeld 1994). There are no official records existing for the Grenadines. J. Coffey observed a Laughing Gull unable to lift off the surface of the water and seemingly being held by a fish in Port Louis, Grenada in 2019, although the gull eventually escaped.

Invertebrates

Invertebrates, such as land crabs, have been documented predating small seabird chicks (Burger and Gochfeld 1988). Esteves and Fisher (2019) conducted a study on ant diversity on 13 of the Saint Vincent Grenadines which documented 40 native and invasive species of ants in the region. Of the 13 islands surveyed 7 are known seabird nesting colonies. One ant found on all seven seabird colonies is a native species of Tropical Fire Ant (*Solenopsis geminata*) that is known to be attracted to hatching seabirds and has been observed causing harm to seabird chicks and turtle hatchlings in other areas, such as Hawaiian islands (USA) and Ashmore Reef (Australia), where they are invasive (Bellio et al. 2007, Plentovich et al. 2008). Tropical fire ants have additionally been observed attacking adult seabirds on nests. Although this ant species is native to the Caribbean, it has spread worldwide due to human commerce. Of the ants described for the Grenadines, it is the species most likely to invade disturbed habitats, such as developed areas. Although other native ants typically keep this ant population in balance, populations tend to thrive in disturbed habitats, such as agricultural areas or those that have been burned. As such, islands that undergo or have already undergone major transformations (e.g. Petit Canouan which has been routinely burned in the past) may experience an overabundance of this species and associated harm to nesting seabirds. The majority of Grenadine islands have been vastly altered due to historical agricultural activities. Pesticides are also known to reduce other ant communities and allow for the dominance of the Tropical Fire Ant. It is unknown if any of the seven invasive ant species identified in the study have any effect on nesting seabirds. Ants are often overlooked as a major cause of mortality to seabird nestlings and further investigation may be necessary.

Figure 49. USFWS / Hakai Magazine

Birds

According to Burger and Gochfeld (1994), some of the major avian predators in seabird colonies in the Caribbean include Magnificent Frigatebirds, Cattle Egrets, and Laughing Gulls. The Caribbean Barn Owl (*Tyto alba*) may also predate seabirds or chicks in colonies in the Grenadines. Tern species have been known to abandon colonies that have been populated by gulls (Burger and Gochfeld 1994). Ruddy Turnstones (*Arenaria interpres*) have been known to predate seabird eggs, such as terns and gulls (Crossin and Huber 1970; Brearey and Hilden 1985). Raptors, such as Peregine Falcons (*Falco peregrinus*), can hunt seabirds both at colonies and at sea and have been observed at colonies in the Grenadines, such as Frigate Island and Diamond Rock (GRE) (Collier 2014; J. Coffey pers. obs.).

Indigenous Mammals

There is debate over the origins of several of the mammals in the Grenadines, such as opossum species, and whether they naturally occurred in the archipelago or if they were brought by Amerindians prior to European contact. Nevertheless, seabird colonies are typically void of terrestrial mammals, except for bats. There are at least 12 species of bats known to the Grenadines, which are truly indigenous mammals to these islands. The bats in the Grenadines are primarily insectivores and frugivores, while one species is a piscivore – none of which consume seabirds (Genoways e al. 2010).

Habitat Destruction and Development / Loss of Nesting Habitat

Development of areas and offshore islands in the Grenadines often occurs without proper planning or consideration of environmental impact. Consideration of seabirds and their associated habitat should be integrated into any environmental impact assessment structure and assessments should be required specifically in areas where seabirds are known to nest. Arrangements can be sought with private landowners who own title to sensitive areas. Discussions on land management and development could allow both nations to cooperate on transboundary wildlife and habitat protection for sensitive species and areas, such as seabirds and uninhabited islands. Protection of a seabird island subsequently benefits many other species that inhabit the same island, and promotes biodiversity.

Disturbance

Levels of disturbance vary between islands throughout the archipelago. Some uninhabited islands with seabirds, such as White Island (GRE) and Petit Bateau in the Tobago Cays (SVG) are popular sites for recreational activities, including camping and barbeque, including commercial operations. Some species of seabirds are sensitive to drone operations. Disturbance during nesting season can be particularly harmful to breeding seabirds. Studies have shown that disturbance can impact nesting success, particularly in the short term (Burger 1981; Burger and Gochfeld 1994). In some cases, entire colonies of seabirds can fail in a single nesting season due to exposure and predation resulting from disturbance (Wolf et al. 2006). Seabirds can die from exposure and/or stampedes into the ocean or over cliffs. Disturbance can additionally facilitate predation, such as by gulls (Burger and Gochfeld 1994). All efforts should be made to minimize disturbance to seabirds nesting throughout the Grenadines and customized to seasonality of seabirds (i.e. breeding season), which could limit access to breeding colonies at peak breeding season. Tourists and researchers seeking access to certain critical nesting islands should be subject to a permitting

Figure 50. Disturbance by humans can cause significant harm to seabird colonies (J. Coffey)

process. Any tourism development strategy must consider disturbance effects on seabirds in order to be sustainable (Burger and Gochfeld 1993).

Pollution

Pollution affecting seabirds can originate from both land sea sources. Nisbet (1994) states that the effects on seabirds depends on their distribution in relation to the pollutant, at the "sources, dispersal and fates of pollutants in the marine environment". Marine traffic and associated pollution through the Grenadines can be linked to both commercial and private boats. Currently, there are no requirements for boats to have holding tanks (e.g. for sewage) throughout the Grenadines and discharge of waste is not restricted. Discharge of petroleum products, such as bilge water and oil spills, can occur in areas frequented by seabirds. Although there are no major oil extraction or refinery developments in the Grenadines, tankers transit through and deliver oil throughout the archipelago. For example, a recent (February 2020) event in Tyrell Bay, Carriacou where a moorage failed to hold a tanker could have resulted in an oil spill (V. Thomas pers. comm.). Incidents of boats running aground can also result in oil pollution. Any substantial oil spills near seabird nesting colonies can have immediate and drastic effects, causing seabird mortality and reducing nesting success. Recurring discharges could eventually lead to population declines (Nisbet 1994). Insecticides, heavy metals and trace element accumulation are likely not as high a threat to seabirds in the Grenadines compared to other areas.

Despite many islands being uninhabited, traces of human presence are identifiable on all islands, with discarded materials such as garbage and fishing equipment either purposefully disposed or accidentally arriving on remote islands. Plastic pollution is ubiquitous on all Grenadine islands. The islands, islets and cays in this archipelago are all exposed to the open ocean, with the Atlantic Ocean to the east and Caribbean Sea to the west. Plastic pollution and marine debris arrive on the shores of the Grenadines originating both locally and from vast distances, such as Suriname and French Guiana (J. Coffey pers. obs. 2019). Its global impact has been declared by the UN as comparable a threat to the environment as climate change. Many species of marine wildlife have been found to ingest plastic from the marine environment, especially certain types of seabirds. Consumption of plastic items has been shown to decrease body condition in seabirds (Lavers et al. 2014). For those seabirds that do not directly target plastic items, they can still ingest plastic items via their prey, such as through flying fish. Taylor et al. (2016) reported that over 97% of fish gut contents examined from commercially exploited fish in Grenada (e.g. snapper and tuna), contained plastics. Plastics and other marine debris can cause injury which can lead to mortality through ingestion and entanglement. On some islands in the Grenadines, seabirds have been documented nesting amongst plastic debris. Although not yet studied in the archipelago, seabirds in other regions have been known to specifically select pieces of plastics in nest-building (e.g. Brown Boobies) (Lavers et al. 2013). One such case was documents on Baradal (SVG) in which green rope was found in a Brown Noddy (*Anous stolidus*) nest (Collier 2014).

Figure 51. Marine pollution on uninhabited islands in the Grenadines and seabird interactions. (J. Coffey and K. Charles)

Fisheries Interactions

Fisherfolk throughout the Grenadines during consultations discussed seabird interactions with fisheries resulting in both incidental and purposeful catch. Conflicts arise due to seabirds and fisherfolk both relying on fish for survival. Occasionally, seabirds, such as Magnificent Frigatebirds and booby species, will chase baited hooks and get caught. In some cases, the hooked birds will be released alive. However, some view this activity by the birds as a nuisance and may injure or kill seabirds. In one instance an individual admitted to regularly catching seabirds (specifically Magnificent Frigatebird) at sea for consumption as an alternative to fish (J. Coffey, pers. comm.)

Fire

Periodic burning of particular islands occurs and is perceived to be a method of vegetation control. For example, Petit Canouan has been systematically burned for many years, while Frigate Island was recorded to be burned in June 2019 (J. Coffey pers. obs.). Fires can damage and increase competition for nesting habitat, which is particularly inhibiting for species that require specific vegetation for nesting, such as shrub and tree-nesting species (e.g. Magnificent Frigatebird and Red-footed Booby). If done at the wrong time of year, fires can destroy nests, eggs and chicks that are not fledged, resulting in reduced nesting success. Fires can also damage and/or destroy the many other species of flora and fauna that inhabit these offshore islands and cultural resources. Since these islands have been little explored for biodiversity, fires threaten to reduce or eliminate any potential endemics or remnant populations that have not yet been discovered. Fires of this nature are prohibited in Wildlife Reserves in Saint Vincent and the Grenadines, of which many seabird colonies are designated. In Grenada, however, none of the seabird colonies in the Grenadines have been given any legal protection to prevent these fires from occurring.

Figure 52. Many species fall victim to fires on uninhabited islands, including the Red-footed Tortoise pictured on Frigate Island (GRE) (J. Coffey). Seabirds, their chicks, eggs and critical habitat can also be destroyed.

Weather Events and Climate Change

Severe weather events, such as hurricanes, tropical storms, and flooding, can cause injury, mortality, displacement and poor reproductive success, which tend to affect seabirds on a short-term basis. Species' long-term outlook can be questionable once such events continue to occur. Displacement of seabird species can be particularly threatening in cases where there is no alternative breeding site available, as is becoming the case in the Caribbean where development of uninhabited islands is increasing due to population growth and

pressures from industry, such as tourism. For example, a series of intense weather events including hurricanes is thought to have damaged up to 90% of Grenada's forest resources in the past (FAO 2010). Vegetation on Grenadine islands are much more exposed to the elements due to small island sizes and exposure.

Climate change can affect seabird species gradually, and in various ways (e.g. Chambers et al. 2009, Reynolds et al. 2015). Effects upon seabird populations are often not noticeable until much later due to longevity of seabird life spans. For any species that nest on low-lying beaches or cays (e.g. Roseate Tern), nesting habitat could be reduced or lost to sea level rise, while direct mortality and reproductive failure can result from sudden storm surge. In Grenada for example, 1 – 2 meters of sea level rise is predicted to reduce approximately 8 – 16% of sea turtle nesting sites, while simultaneously reducing habitat for other species such as iguanas and shorebirds (Simpson et al. 2010). Climate change can also affect vegetation cover, which may affect those species that are particularly restricted by vegetation requirements, such as tree-nesting species (Magnificent Frigatebird and Red-footed Booby), by limiting nesting space. Resulting range-shifts of species can increase competition for suitable nesting space. Prey availability may also be restricted due to changes in distribution and accessibility. Warmer waters for example can displace pelagic species to cooler waters. Much of the tourism sectors in both nations occurs along coastlines and in some areas tourism activities and associated infrastructure and development are enhancing the vulnerability of ecosystems to climate change. An analysis of how climate change will affect the offshore islands in the Grenadines is needed, such as sea-level rise and areas of habitat lost. Climate change in combination with other threats and stressors can increase cumulative effects on seabird species.

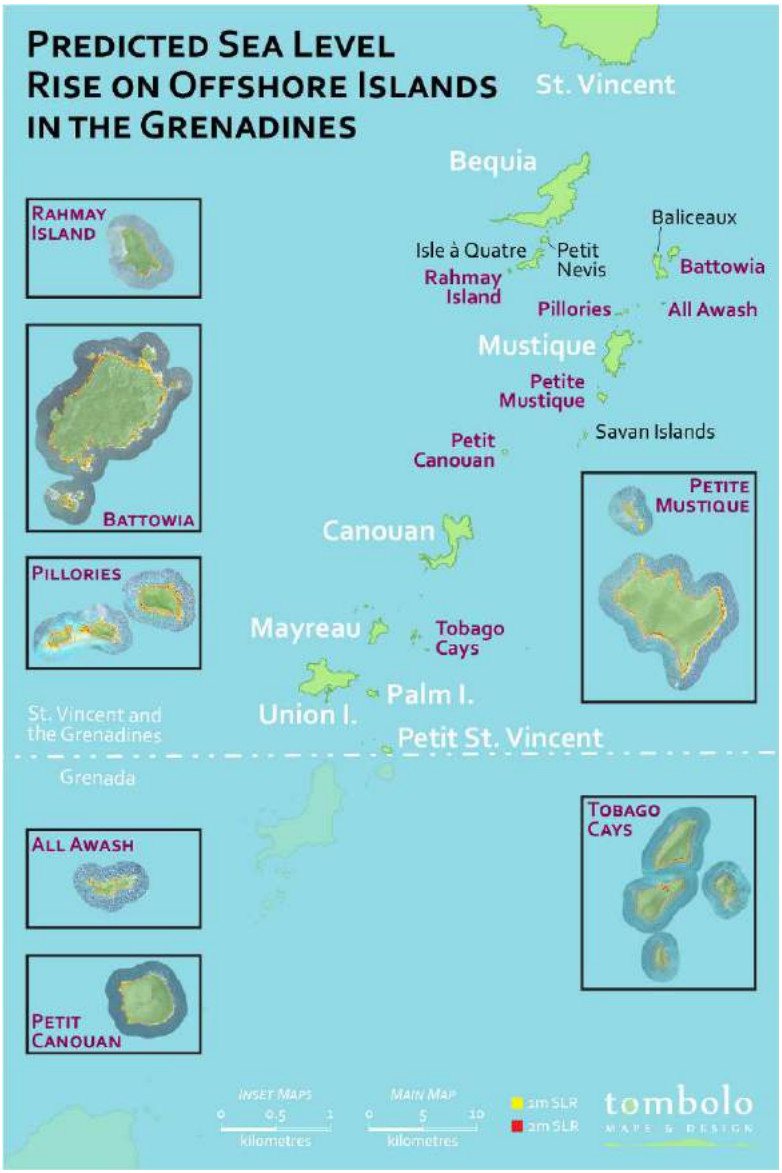


Figure 53. Sea level rise (SLR) of 1-2 meter represented on SVG offshore islands. No similar SLR data exists for Grenada Grenadines.

Burger and Gochfeld (1994) characterized tropical areas as having poor economic development, rapidly growing human populations and dependence on exploitation of wildlife for subsistence. Conservation strategies of seabirds and their island breeding colonies must consider for such demographics where these factors are present. Priority actions should focus on reducing imminent threats, such as seabird harvest, invasive species, disturbance and habitat destruction (e.g. through fires and development). Education and awareness campaigns and programs regarding seabirds and their islands habitats is much needed across all sectors. Given the transboundary nature of seabirds, and the groundwork already established promoting transboundary cooperation in the Grenadines, a wildlife working group addressing common issues is recommended. Increased enforcement and monitoring are required in both nations and could be augmented by NGOs, CBOs and individuals throughout the Grenadines.

The following section was developed by consultation with over 100 stakeholders throughout Saint Vincent, the Grenadines and Grenada. Items are not listed in any specific order but all were identified through this process as activities which would serve to sustain healthy populations of seabirds and protect their island habitats in the Grenadines. Some of these items build upon past and existing efforts and organizations.

Figure 54. Training fisherfolk in seabird monitoring (A. Ollivierre)

Figure 55. Seabird presentations in schools (V. Thomas)

Figure 56. Community outreach (L. Culzac)

Building Upon Past Work

- 2009–2010: Seabird population surveys of Grenadine seabird colonies for Seabird Breeding Atlas of the Lesser Antilles, the first standardized survey of the region, which identified St. Vincent and the Grenadines as the most important island nation for seabirds.
- 2013: EPIC assisted Sustainable Grenadines in developing a stakeholder survey regarding harvest and consumption of seabirds
- 2014: EPIC conducted invasive species surveys at four Grenadine islands. Data also collected on marine pollution accumulation on uninhabited islands in the Grenadines by J. Lavers. J. Coffey and A. Ollivierre of "Birds of the Transboundary Grenadines" collected local knowledge and values for seabirds from residents of the Grenadines and conduct online survey for values of seabirds by seafarers in the Grenadines
- 2015: EPIC partnered with Science Initiative for Environmental Conservation and Education (SCIENCE), based out of St. Vincent, to conduct rapid biological assessments on uninhabited islands and environmental education. J. Coffey ground-truthed local knowledge collected in 2014.
- 2015–2017: EPIC and SCIENCE led training programs for the Grenadines Volunteer Patrol, which works to reduce risks to seabirds and other wildlife in key nesting areas by strengthening community capacity to monitor and advocate for biodiversity conservation.
- 2018: BirdsCaribbean bird guide training program for the Grenadines, enabling participants to economically benefit from seabird conservation.

- 2019: USFWS funded a year-long seabird conservation and outreach project throughout the Grenadines through EPIC. Activities included strengthening the Grenadines seabird monitor program, increasing capacity of enforcement officers, seabird surveys and threat identification, community and fisherfolk sessions, school presentations, government and stakeholder meetings, drone surveys, seabird harvesting interviews, press releases and development of a transboundary community-based conservation management plan for seabirds. "Birds of the Transboundary Grenadines" published, featuring local ecological knowledge collected from residents of the Grenadines – the first avian field guide for both nations. More than sixty copies donated to local schools, fisherfolk, NGOs and government departments.

Figure 57. Carriacou and Grenada participants conduct a seabird survey at Diamond Rock (J. Coffey)

Recommended Activities

Although grouped together, the below activities are recommendations for each nation independently, unless specified otherwise. These recommendations are not presented in order of importance. Where possible, both nations could benefit from shared resources towards common goals in working towards seabird conservation and management in the Grenadines.

Table 6. Research priorities

Research Priorities				
Country	Type	Duration	Department	Notes
SVG, GRE	Updated breeding seabird inventory through Grenadines	0-3 years	Government, NGOs, CBOs, Academia, Individuals	Update from 2009-10 to determine population trends and current population
SVG, GRE	Conduct rodent/invasive species inventory on seabird breeding islands	0-5 years	Government, NGOs, CBOs, Academia, Individuals	Determine priority areas and opportunities for invasive species removal.
SVG, GRE	Seabird telemetry (tracking) study	0-5 years	NGOs, Academia	Requested during several fisherfolk meetings; important for determining marine protected areas, transboundary movements and identifying biodiversity hotspots at sea for marine spatial planning, such as current plan being developed by OECS.
SVG, GRE	Biological Assessments of uninhabited islands	0-5 years	Government, NGOs, CBOs, Academia, Individuals	Mammals, insects, reptiles, birds, vegetation, etc.; With several endemic species throughout the Grenadines, biological assessments of offshore islands would enable identification of any endemics not yet identified, and assist in identifying priority areas.
SVG, GRE	Effects of climate change (e.g. sea level	Long-term	Government, NGOs,	Assessment of predicted climate

	rise) on habitat		Academia	change impacts on seabirds and their island colonies throughout the archipelago, such as sea level rise and vegetation/habitat changes
SVG, GRE	Involve local educational and non-governmental institutions in seabird and Grenadines-specific research	0-5 years	Government, NGOs, Academia (University/College)	Build capacity of local institutions to monitor seabirds and increase interest in the topic.
SVG, GRE	Tourism Feasibility Study	0-5 years	NGOs, Government, Academia, Chambers of Commerce, tourism industry	Necessary to avoid disturbance and abandonment of nesting sites; tourists should not be permitted to roam freely in colonies. Tourism feasibility study to identify seasonality, market, sites, regulations, amenities and training involved to develop seabird-based tourism
SVG, GRE	Review of legislation pertaining to seabird and island colony habitat protection; updates to legislation accordingly (e.g. wildlife acts, land planning). Add seabirds to national biodiversity plans, tourism strategies, coastal management, national parks and protected areas, land development plans, etc.	0-5 years	Government	Specify seabird protection and update consequences for seabird harvesting/egg collecting and trade; restrict access to certain islands during breeding season (including private islands); include provisions for future land development and activities on seabird nesting islands (including private islands)

Table 7. Management actions

Management Actions				
Country	Type	Duration	Department	Notes
SVG, GRE	Invasive species removal	Ongoing	Government, NGOs	Priority placed on government-owned islands, protected areas and Important Bird Areas
SVG, GRE	Update SIOBMPA and TCMP Management Plans to include seabirds	0-1 year	SIOBMPA and TCMP, NGOs	Incorporate seabirds into existing management and monitoring plans
SVG	Secure Tobago Cays Marine Park (Baradal and Jamesby) Brown Noddy nesting colonies from tourist disturbance	Annual	TCMP	Annual and seasonal (mid-April to mid-August); Potential to install temporary exclusion zone and/or install seabird nesting signage
SVG	Develop management visions / plans for key protected areas/wildlife reserves	Ongoing	Government	e.g. Petit Canouan and Battowia
GRE, SVG	Establish additional protected areas/forest reserves on Crown land	0-5 years	Government	Grenada: Diamond Rock, Upper Rock and Lee Rock; SVG: Pillories
SVG	Ensure absolute protection for Brooks Rock to prevent national extirpation of Masked Boobies	Ongoing	Mustique Company	Prevention of disturbance, invasive species, etc.
SVG, GRE	Removal of litter from offshore islands	Ongoing	Landholders, Government, NGOs, CBOs, Academia, Individuals, Volunteer groups	
SVG, GRE	Determine land ownership of uninhabited islands	0-2 years	Government	Facilitate land management activities by identifying owner of sites.

SVG, GRE	Prohibition of setting vegetation-control fires on uninhabited islands	0-3 years		Government-owned islands fully prohibited; Private islands prohibited during seabird nesting seasons.
SVG, GRE	Create a Transboundary Wildlife Working Group	0-3 years	Government, NGOs, Academia, CBOs and Individuals	Seabird conservation units should be formed in each country and together can form a transboundary wildlife working group to discuss and address communal issues, such as those of seabirds which travel into both countries indiscriminately. See recommended structure below.
SVG, GRE	Island Access	0-5 years	Government	Restrict island access to certain islands with permit only or not during breeding season; e.g. Petit Canouan complete prohibition in landing on the island except in emergency/ with permit

Table 8. Recommended structure of Wildlife Working Group

Country	Island	#	Notes
Grenada	Grenada	2-3	Government (Forestry/National Parks/National Trust/Land Planning)/ Tour Operator/ NGO / University/Fisherfolk (Sauteurs)
Grenada	Carriacou	2	Fisherfolk/Tour Operator/MPA
Grenada	Petite Martinique	1	Fisherfolk/Tour Operator
SVG	Union Island	1-2	MPA / NGO
SVG	Mayreau	1	Fisherfolk/Tour Operator
SVG	Canouan	1	Fisherfolk/Tour Operator
SVG	Mustique	1	Mustique Company
SVG	Bequia	2	Tour Operator/Fisherfolk
SVG	Saint Vincent	2-3	Government (Forestry/ National Parks/National Trust/Land Planning)/ Tour Operator/ NGO/ Fisherfolk

Table 9. Education and outreach

Education and Outreach				
Country	Type	Duration	Department	Notes
SVG, GRE	Add seabirds/remote islands and their ecological/sociocultural importance to school curriculum	0-3 years	Government/NGOs	Requested during several fisherfolk workshops
SVG, GRE	Work with landholders to provide information on island resources and promote awareness of threats to species on their property (e.g. effects of grazing goats on seabirds, reptiles, vegetation)	0-5 years	Government/NGOs	Especially Les Tantes (GRE), Frigate Island (GRE), Battowia (SVG)
SVG, GRE	Enhance public awareness of existing legislation on seabird harvest and fires on offshore islands	Ongoing	Government/NGOs	Public Service Announcements (PSAs), signage; must include residents and visitors to the region due to potential tourism effects on seabirds and their

				habitats
SVG, GRE	Promote seabird and offshore island awareness amongst government departments	Ongoing	Government / NGOs	e.g. Forestry, National Trusts, Land Planning, Fisheries, National Parks, Coast Guard, Police; Development of a seabird identification card including eggs for fisheries/forestry officers
SVG, GRE	Work with existing educational institutions (e.g. SGU) to promote awareness of biodiversity in the Grenadines and encourage participation	Ongoing	Government / NGOs / Academia	(e.g. Saint George's University)
SVG, GRE	Continue community outreach presentations	Ongoing	Government / NGOs	e.g. fisherfolk sessions
SVG, GRE	Continue training of Grenadines seabird monitors	Ongoing	Government / NGOs	

Table 10. Monitoring and enforcement

Monitoring and Enforcement				
Country	Type	Duration	Department	Notes
SVG, GRE	Bi-monthly seabird surveys during peak breeding season and one survey per month outside of peak season at each island	Ongoing (Annual)	Government/ NGOs/ Grenadines Seabird Monitors/ SIOBMPA and TCMP/ Community Researchers (Carriacou and Union Island)	Use Grenadines Seabird App to collate data
SVG, GRE	Investigate potential for remote monitoring technology (e.g. drones and wildlife cameras)	0-5 years	Government / NGOs	
SVG, GRE	Dockside seabird egg harvesting checks	Annual	Government (Department of Forestry and Department of Fisheries)	Determine from identified priority communities and seasonality of seabirds

Plan Evaluation

Evaluation of this plan will be necessary to determine performance. Discussions on activities identified above should occur regularly during meetings of the wildlife working group, and other forums such as the Grenadines Network of MPAs, and between government departments. Evaluation of this plan should occur after five years of it being made public under the coordination of the SVG and GRE Forestry Departments as the legal authorities for seabird protection, and in association with relevant departments, agencies and stakeholders.

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