

Pond Surveys of St. Martin: 2006 Report

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Introduction

St. Martin is one of the few islands in the mostly dry region of the eastern Caribbean containing expansive wetlands, making it critical habitat for transient, over-wintering, and resident waterbird species. This habitat is used as nesting grounds by the Snowy Plover (*Charadrius alexandrinus*), listed as a species of extremely high priority by the U.S. Shorebird Conservation Plan. Other species of highest regional priority observed on St. Martin include American Oystercatcher (*Haematopus palliatus*), Wilson's Plover (*Charadrius wilsonia*), and Stilt Sandpiper (*Calidris himantopus*). Waterbirds on St. Martin face many potential impacts including: (1) chronic human-caused disturbances to roosting, foraging, and nesting birds, (2) exotic predators, (3) oils spills, (4) contaminants, and (5) inadequate management of "high quality" public lands, that should be made more available to migratory and resident waterbirds (Brown and Collier 2001; Brown and Collier 2002; Brown and Collier 2003; Hunter *et al.* 2001). Over 90% of the total population of waterbirds that use St. Martin's wetlands are neo-tropical migrants (Brown and Collier 2001; Brown and Collier 2002). During the winter months, the remaining intact wetland areas are teeming with shorebirds, marshbirds, and ducks.

Habitat on St. Martin is highly variable. The coastline is generally surrounded by uplifted reef, interspersed with small pocket beaches. From the coastline, moving inland over the transitional flatlands, the island gives way to shallow pockets, in which salt ponds, lagoons, and salt flats exist. Covering approximately a fifth of the island's lowland areas, wetlands provide important breeding and wintering sites as well as critical migratory stopovers for waterbirds (Brown and Collier 2001; Brown and Collier 2002; Brown and Collier 2003; Ecovision 1996). The lowland areas quickly progress to the thickly forested, steep mountains of the interior of the island, which act as watersheds feeding the wetlands. Four wetland habitat types exist on St. Martin, mangrove pond, salt flat, lagoon, and inter-tidal, supporting 82 species of waterbird including 48 neotropical migratory species (Brown and Collier 2001; Brown and Collier 2002; Brown and Collier 2003; Raffeale *et al.* 1998).

The most extensive wetland habitats are the ponds, which generally have deep centers (>1meter) and shallow margins (<30cm). The ponds, historically, were fringed with mangroves and had large expanses of open water in the centers (Ecovision 1996; Howard 1991). Through time, many of these mangrove forests have been destroyed, both by human development and hurricanes. Small portions of mangroves are still present in a few ponds. Without mangroves, the pond's gradually sloping edges, which provide vital foraging and roosting habitat for waterbirds, have been reduced to perhaps a quarter of what they once were (Brown and Collier 2001; Brown and Collier 2002; Brown and Collier 2003; Ecovision 1996).

The wetlands of St. Martin are a vital resource for migrant and resident waterbirds. The wetlands are home to mangroves, which provide shelter for roosting and nesting birds. Mangrove stands, which include red mangrove (*Rhizophora mangle*), black mangrove (*Avicennia germinans*), white mangrove (*Laguncularia racemosa*), and buttonwood (*Conocarpus erecta*), have been severely decimated during the twentieth century on St. Martin (Howard 1991). Depending on water depth, the ponds also shelter populations of fish, mollusks, and small invertebrates, which provide the diet for most birds of the ponds.

Species of high concern using these areas include Stilt Sandpiper and Greater Yellowlegs (*Tringa melanoleuca*) (Brown and Collier 2001; Brown and Collier 2002; Brown and Collier 2003; Hunter *et al.* 2001). Water grasses are also present and provide nutritional value to such species as Caribbean Coot (*Fulica caribaea*), American Coot (*Fulica Americana*), and Common Moorhen (*Gallinula chloropus*).

Salt flats on St. Martin play a vital role to foraging migratory and over-wintering shorebirds. These areas provide a wide-expanse of shallow water from which waterbirds forage for fish, mollusks, and small invertebrates. These salt flats are the winter residence for many species of high concern including Black-bellied Plover (*Pluvialis squatarola*), Wilson's Plover, Semipalmated Sandpiper (*Calidris pusilla*), and Short-billed Dowitcher (*Limnodromus griseus*) (Brown and Collier 2001; Brown and Collier 2002; Brown and Collier 2003; Hunter *et al.* 2001).

Lagoon habitat covers a large area of St. Martin. The Simpson Bay Lagoon, which covers approximately a fifth of the island, is the largest lagoon on the island. This lagoon plays an important role in the yachting industry of the island and subsequently experiences significant pollution. The Simpson Bay Lagoon was, at one time, heavily fringed in mangroves. Over the last twenty-five years the mangroves within Simpson Bay Lagoon have been removed by for development (Semsamar 1995; Ecovision 1996). The other large lagoon on the island, Etang de Poisson, is still heavily fringed in mangroves and consequently is widely used by migrating waterbirds for both foraging and roosting. Due to the pristine nature of Etang de Poisson, the lagoon has been given protection as a Nature Reserve by the French Antillean government.

Finally, small pockets of inter-tidal areas exist along the shorelines of the island. These areas are not heavily influenced by tidal fluctuations; as such fluctuations are minimal in the Caribbean region. The inter-tidal areas, although small in size, provide vital foraging habitat for the American Oystercatcher, Semipalmated Plover (*Charadrius semipalmatus*), and Ruddy Turnstone (*Arenaria interpres*) (Brown and Collier 2001; Brown and Collier 2002; Brown and Collier 2003). The inter-tidal areas are one of the most endangered habitats on St. Martin. As these areas lie along the coastline, they compete directly with oceanfront developers who wish to turn these areas into restaurants and hotels.

Objectives

The purpose of St. Martin pond surveys is: (1) To determine which species are currently using the wetlands; (2) To assess environmental threats for each wetland; (3) To document relationships between birds and their environment at each site; (4) To start a base-line avifaunal database, which can be used for long-term planning; (5) To start a base-line water-quality database.

Methods

Surveys of wetlands on St. Martin were conducted on 14 January 2005. All ponds on the island were surveyed. Gallion and Great Salt Pond were too large to accurately survey in entirety; therefore, sub-plots were designated within these larger ponds. These sub-plots were chosen based on high densities of avifauna, as well as greater diversities of vegetation and substrate in relation to the rest of the pond.

Surveys of all ponds were conducted from the same designated vantage points each week. Universal Transverse Mercator (UTM) points were taken for each observation point with a handheld Geographical Positioning System (GPS) unit. Surveys were done with a 50-power scope and 10-power binoculars. Biologists surveyed each site and its immediate surroundings, recording the number of birds and their activity. Passerines and raptors were not included in surveys. Wetland surveys should be considered an index only for shorebird and marsh bird populations.

Results/Site Analysis

1. Lowlands Main Pond

Location- Lowlands Main Pond is located on the French Side of St. Martin. The general area of the pond is an exclusive residential area known as “The Lowlands”. The Lowlands Homeowners Association, a group of all the landowners in the area, helps oversee land development issues in the Lowlands. Members of the Lowlands Homeowners Association have expressed interest in both environmental signage and mangrove restoration for the Lowlands ponds.

Habitat- Lowlands Main Pond is the natural drainage for the surrounding hillsides of the area although it is brackish in its water content. The pond is immediately bordered on the west side by a busy dirt road, which partially fills that side of the pond. This road is the main avenue for people traveling to and from all the beaches in the French Lowlands. The north one kilometer of this road is separated from the pond by a 10-meter wide border of mangrove. The south and east sides of the pond are bordered with gravel and rock fill, residue of landscaping from the surrounding properties on those sides. The northeast side of the pond is still undeveloped and is partially covered with mangroves and some water grasses. The north side of the pond is very shallow, is bordered in mud, and is completely void of vegetation. This mud border also connects this pond to the smaller pond in the Lowlands, Lowlands Annex Pond. The Caribbean Sea is 100 meters to the west, and in addition to the road, is separated from the pond by sparse mangrove and scrub vegetation, buildings, and remnants of sand dunes. It appears that before development of this area, the pond was part of a greater mangrove ecosystem, connected to the sea by seasonal dune structures and extensive mangrove forests, which perhaps flooded the dunes, flushing the pond clean.

*(*Note: 77 Red Mangrove seedlings were planted along the northwest margin of this pond in January 2003 by EPIC Biologists.)*

Hazards- The road on the west side of the pond forms a steep barrier that cannot be used by many waterbirds for foraging, roosting, or nesting. The south and east sides of the pond are filled with debris by the residents of the surrounding areas. This debris causes an unnatural barrier for birds that use this area for foraging and roosting. The resort, *La Semanna*, 50 meters west of the pond, pumps raw sewage directly into the pond every month. Dog tracks are often seen in the mud barrier on the north side of the pond. This barrier is a nesting area for birds and dogs could easily destroy eggs and chicks. Mangrove depletion pond-wide has also been severe, allowing banks to erode more easily, increasing siltation and reducing viable habitat.

Avifauna-

Species	High Count	Nests	Chicks
Black-necked Stilt	6		
Greater Yellowlegs	1		
Lesser Yellowlegs	3		
Spotted Sandpiper	6		
Semi-palmated Sandpiper	18		

2. Lowlands Annex Pond

Location- Lowlands Annex Pond is located adjacent to the Lowlands Main Pond and is therefore in the same residential area as Lowlands Main.

Habitat- Lowlands Annex Pond serves as a catchment area for drainage from the surrounding hillsides along with Lowlands Main Pond. The brackish pond is generally less than a meter deep across its entire width. The west side of the pond is bordered in mangroves that create a buffer between the public dirt road, which runs along this side, and the pond. The south side of the pond has a very shallow mud shoreline rising to no more than 30 centimeters above water level, and is vegetated with small hummocks of grass. This shoreline separates Lowlands Annex Pond from Lowlands Main Pond. The east border of the pond is a shallow mud shoreline as well, but is interspersed with small outcroppings of rock. Above the

east shoreline are mangroves, which buffer the pond from the residential area 100 meters east. The north shoreline has extensive mud flats rising no more than a few centimeters above the ponds level, and is subject to flooding during heavy rains. Behind the mud flats are a few residential houses that have been built on the mudflats and been vegetated with non-native grasses. A small island edged in mud and covered in vegetation, is found in the northwest quadrant of the pond and creates a refuge for roosting birds. As with Lowlands Main Pond, it appears before the Lowlands area was developed, the pond might have connected to the sea during periods of flooding or exceptionally high seas, creating an outlet to flush the pond.

Hazards- As with the Lowlands Main Pond, dogs, both feral and tame, using the south side of the pond along the mud flats would certainly be destructive to the birds that nest in the grass hummocks along this stretch. The road on the west side, although bordered by mangroves, creates many disturbances to birds that roost in these mangroves, as the passing of loud vehicles easily flush species from these areas. The north shore mudflats of the pond have already been encroached upon by the development of residential housing and could cause disturbance problems for both roosting and feeding birds in these areas.

Avifauna-

Species	High Count	Nests	Chicks
Great Egret	2		
Snowy Egret	4		
Little Blue Heron	1		
Green Heron	1		
Black-bellied Plover	2		
Semi-palmated Plover	35		
Black-necked Stilt	18		
Greater Yellowlegs	3		
Lesser Yellowlegs	5		
Spotted Sandpiper	2		
Stilt Sandpiper	17		

3. Rouge Pond

Location- Rouge Pond is located on the French side of St. Martin on the northwest corner. Rouge Pond is bordered by both public and private land. Rouge Bay and the Caribbean Sea are located approximately 300 meters north of Rouge Pond.

Habitat- Rouge Pond is primarily a shallow pond (<30cm), with a small area in the middle that appears to be deeper (>1 meter). The substrate along the bottom of the pond is fine silt. The margins of the pond are primarily mud. The shoreline slopes gradually into the pond’s center. The pond acts as a catch basin for the fresh water run-off from the hillsides on the south and west sides of the pond. The west margin of the pond is bordered by a thin mudflat area, which is bordered by mangroves. Mangroves and Sea-grape are the main vegetation surrounding the pond and cover 95% of the ponds border. The north side of the pond is fringed in mangroves. Approximately, 300 meters north of this border is the popular beach Rouge Bay on the Caribbean Sea. The east margin of the pond is overhung with Sea-grape trees. Many dead trees also litter the shallow region of this margin. The south margin of the pond is thinly fringed in mangroves and has a short mud shoreline. Additionally, this side has a busy road that travels along its entire length. The southeast corner of the pond has the most extensive mudflat area and attracts the most birds.

Hazards- The primary hazard to Rouge Pond is human disturbance. The busy road along the south margin along with the popular beach Bay Rouge, surround the pond with much activity. There is a sewer exchange station located in the southwest corner of the pond, which connects local sewer systems to the main French Sewer treatment facilities. No overflow was observed at this station during our visits to the pond, but overflow has been observed at other similar stations located throughout the island. St. Martin’s

sewage treatment plants often malfunction or are overloaded, allowing for the possibility that the Rouge Pond sewer exchange could easily overflow into the pond.

Avifauna-

Species	High Count	Nests	Chicks
Black-necked Stilt	2		
Spotted Sandpiper	0		

4. Cupecoy Pond

This wetland was completely filled in by early 2005 in preparation for a major resort. We no longer will survey this area.

Location- Cupecoy Pond is located on the French/Dutch border on the southwest corner of St. Martin. The pond is adjacent to the southwest terminus of the large Simpson Bay Lagoon.

Habitat- Cupecoy Pond is the catch basin for water running off the hills on the west and east shores and, due to its close proximity to Simpson Bay Lagoon, has salt-water intrusion via ground water. The south shores of the pond are thickly bordered by mangroves that blend with scrub habitat as one moves south away from the pond towards the sea. A very busy paved public road is located 50 meters from the south shores and continues running along to the west of the pond. The immediate shoreline is shallow mud. The west shores are bordered by a thin grove of mangroves and a larger stand of scrub. The water level here is deep, creating a steep barrier between the shore and the pond. The area surrounding the west side of the pond is fenced and gated, and a few small houses are located northwest of this area, along the shores of Simpson Bay Lagoon. The north shore of the pond is sparsely vegetated with mangrove and is predominantly a 20-meter wide mud barrier between Simpson Bay Lagoon and Cupecoy Pond, rising no more than a few centimeters above the waters level. During periods of heavy rains or storm surge, Simpson Bay Lagoon and Cupecoy Pond most likely are connected. Due to this seasonal connection as well as the popular use of Simpson Bay Lagoon for recreational boating, trash often ends up in Cupecoy Pond, littering its shores. The east shore of the pond is bordered mainly in scrub habitat and its shoreline is abrupt, dropping off immediately to deeper waters. The habitat above the east shore is the most undeveloped along the pond, with scrub habitat covering many acres before meeting a paved public road and a few houses. One-hundred meters southwest of the pond is one of the islands most popular beaches, Cupecoy Beach, separated from the pond by scrub habitat, a paved public road, and a small dirt parking lot.

Hazards- The seasonal overflow of the Simpson Bay Lagoon into Cupecoy Pond creates a trash build-up in the pond. As more trash lines the shores of the pond, less habitat is available to feeding birds that require the shallow water of the near shore. The trash also creates a barrier to sediment runoff created by water draining off the surrounding hillsides. As sediment builds up behind the trash, the shoreline becomes steep; creating habitat that is unsuitable to foraging water birds. The lack of mangroves increases the rapid decline of near shore foraging habitat for birds. As sediment flows toward the shore, there are no substantial filtration systems in place to slowly disseminate the substrate properly into the pond. The popularity of nearby Cupecoy Beach has led to plans to develop the surrounding areas into a large resort complex, similar to that of the Maho Reef resort. The development of this resort would certainly threaten the Cupecoy Pond in many ways; if not completely destroy its ecological viability.

5. Millenium Inter-tidal Area

Location- Millenium is not a pond but an extensive inter-tidal area. Inter-tidal areas are rare on St. Martin due to both geologic and development factors. The Millenium inter-tidal area is located on the south

shore of St. Martin, between Maho Bay and Burgeaux Bay. The Caravanserii Beach Resort Complex is immediately north of the area and a restaurant was recently built on the west quarter of the inter-tidal zone.

Habitat- The Millenium inter-tidal area is located adjacent to the Caribbean Sea, and is affected daily by the rise and fall of the sea tides. The rock making up the inter-tidal area is a sandstone reef that has been uplifted to a level no more than 2-meters above mean sea level. The terrain is gently undulating, creating areas for tide pools to form, as well as areas that are most always free of water. Each tide pool varies in its size, depth, and proximity to the sea. At low tide, the zone of available habitat stretches 50-meters wide and half a kilometer long. The north edge of the zone is bordered by a large cement sea wall protecting the Caravanserii Resort. The west quarter of the zone was recently built upon. A restaurant along with its pool/bar and artificial climbing wall now occupies what was previously tide pool habitat. A cement walkway and gazebo, stretches 25 meters south of the restaurant across the inter-tidal zone.

Hazards- Development is by far the largest hazard associated with the Millenium inter-tidal area. The Caravanserii Resort was built on the northern portion of the area and consequently filled in that portion with sand to level the terrain for development of condominiums. A large cement sea wall was also placed between the inter-tidal zone and the resort. This resort undoubtedly filled in a vast roosting area for shorebirds and seabirds. The restaurant presents a hazard not only for its development on top of the west portion of the inter-tidal area but for the disturbance it has on birds that continue to use the existing portion of the inter-tidal zone. The restaurant has business continually throughout the day and into the night, associated with this is loud music, constant movement of people on and around the inter-tidal area, and accumulation of debris in the inter-tidal zone people inevitably leave behind. All of these factors are a major disturbance to birds that are attempting to both roost and feed in this area. A decline of birds using the Millenium inter-tidal area was noted during the year 2001-study period, as the restaurant was built and opened for business.

Avifauna-

Species	High Count	Nests	Chicks
Magnificent Frigatebird	1		
Black-bellied Plover	13		
Wilson's Plover	17		
Semi-palmated Plover	106		
Ruddy Turnstone	12		
Sanderling	40		
Semi-palmated Sandpiper	31		
Royal Tern	5		

6. Julianna Pond

Location- Julianna Pond is located adjacent to the Princess Julianna International Airport, on the east side of the southern part of the runway. The pond appears to be a remnant of a larger pond that was filled in to build the runway. The pond is on airport property.

Habitat- This salt pond is small, no more than 100 meters long by 30 meters wide. It is shallow across its entire breadth. There are remnants of mangrove trees along the entire shoreline, and covering a portion of the southwestern end of the pond. The dead mangroves are split up by small areas of shallow water, where most of the birds were observed feeding and roosting. The northern end of the pond is the most open area, and has sparse grasses along the shoreline. There is little aquatic vegetation in this pond. It appears the water in the pond is supplied by local runoff.

Hazards- The area around the pond is littered with trash and is obviously a trash dump for the local neighborhood and airport as well, as there is a large KLM container lying along the edge of the pond. This trash takes away from potential foraging habitat of the birds. Additionally, this trash could easily be leaking contaminants into the water, contaminating potential food sources of the birds in the pond. The pond is completely fenced off by the airport on one side and by a private residence on the other. This

fencing keeps out dogs that could predate on the birds. Cats have been seen in the area of the pond and would be able to get through the fence, and possibly predate on the birds. Amazingly, disturbance by airplanes landing and taking off does not appear to affect the birds observed in the pond. Possibly, the disturbance limits other birds from using this pond to forage and roost.

Avifauna-

Species	High Count	Nests	Chicks
Yellow-crowned Nightheron	1		
Black-bellied Plover	2		
Black-necked Stilt	20		
Lesser Yellowlegs	4		
Spotted Sandpiper	1		

7. Fresh Pond

Location- Fresh Pond is located within the Philipsburg city limits in Dutch St. Martin. The Great Salt Pond is located less than a kilometer north of Fresh Pond. Belair Pond is located approximately 3 kilometers south of Fresh Pond.

Habitat- Brackish Fresh Pond is surrounded on all shores by both roads and buildings. There are mangroves providing a natural barrier between the roads and the pond itself. These mangroves were planted by the Nature Foundation of Sint Maarten, a local non-profit organization. A few years ago, the pond was dredged to act as a water catchment basin for the Great Salt Pond overflow during heavy rains. Debris from the dredging was placed in the center of the pond, creating two small sandy islets. Over the past year, the islands have slowly re-vegetated. The south edge of the pond is fringed in mangroves and drops abruptly into the deep water in the center of the pond. The southwest corner of the pond is also vegetated with mangroves. The mangroves give way to tall water grasses that provide foraging areas for some species of birds. The west border is fringed in tall mangroves that provide roosting habitat for egrets and herons. There are grasses along this border between the mangroves and the pond. The north margin has grasses that provide little barrier between the pond and the adjacent road. A large tree along the northern margin provides habitat for nesting and roosting egrets.

Hazards- During March 2002, there was a large fish die-off in Fresh Pond associated with low oxygen levels in the water. The lack of water exchange between ponds and the sea creates a low oxygen environment. A more open exchange of flow between Fresh Pond and the Caribbean Sea would promote a healthier environment. The urban surroundings of the pond lead to multiple abuses of the pond, the most obvious of which is the rampant dumping of trash into the pond. The less obvious abuse is the illegal dumping of sewage into the pond, by both nearby residents as well as septic system collecting companies who sometimes dump full truckloads of raw sewage into the pond rather than deal with the costs of legal dumping. Regular trash clean-up campaigns are carried out by the Sint Maarten Pride Foundation, a local non-profit organization. The recent re-planting of mangroves along the margins of the pond and the addition of fountains to aerate the pond were a positive step towards the re-vitalization of the pond. Additional planting of mangroves and better water aeration would further restore the pond environment.

Avifauna-

Species	High Count	Nests	Chicks
Pied-billed Grebe	5		
Magnificent Frigatebird	5		
Brown Pelican	2		
Great Egret	8	6	

Snowy Egret	6		
Cattle Egret	119	64	12
Green Heron	1		
Green-winged Teal	1		
White-cheeked Pintail	4		
Ruddy Duck	52		
Ring-necked Duck	7		
Common Moorhen	4	2	
American Coot	16		
Caribbean Coot	15		
Lesser Yellowlegs	2		

8. Fresh Pond South

Location- Fresh Pond South is located adjacent to Pond Fill/Philipsburg on the south side of St. Martin. The pond is an extension of Fresh Pond and is located between Fresh Pond and Great Bay Beach. A channel on the south end of the pond overflows into the Great Bay during heavy rains. A fountain is located in the center of the pond, aerating the water within the pond.

Habitat- This brackish pond, along with the connected Fresh Pond, is the only location with this high percentage of fresh water on the island. The pond is deep throughout, making it suitable for diving birds. The pond was dredged in 1999 and the dredged soil was piled into the center of the pond making a small islet. The islet has grown over with vegetation, making it a suitable and safe location for nesting and roosting birds. The south margin of the pond is grown over with mangroves and contains good roosting and nesting habitat. The southeast margin of the pond is thinly fringed in mangroves and contains large numbers of roosting Snowy Egrets and Cattle Egrets. The southwest side of the pond borders against a paved road and is vegetated with short grasses. Additionally, there is a significant growth of aquatic plants along this edge of the pond.

Hazards- The primary hazard to this pond is pollution. Additionally, there are reports that people dump raw sewage, reducing oxygen in the pond. The proximity to both roads and houses make disturbance a major issue. Most birds use the islet in the center of the pond or the remote east side of the pond to forage, roost, or nest. Predation on both adult birds and chicks is a concern as dogs and cats were seen near the pond on all visits and mongoose and rats were seen near the pond during most visits.

Avifauna-

Species	High Count	Nests	Chicks
Pied-billed Grebe	2		
Great Egret	5		
Snowy Egret	17		
Cattle Egret	22		
Yellow-crowned Nightheron	1		
Ruddy Duck	9		2
Sora	1		
Common Moorhen	6		3
American Coot	7	1	
Caribbean Coot	5		1

9. Belair Pond

Location- Belair Pond is located on the south coast of Dutch St. Martin. The pond is connected to the sea via a channel formed annually by a combination of high seas and an overflowing pond. The pond is no longer connected to the Great Salt Pond but was a natural run-off area for excess water in the Great Salt Pond.

Habitat- The Fresh Pond is a catchment for fresh water run-off from the surrounding hillsides as well as a catchment basin for salt-water overflow from the Great Salt Pond. The brackish pond is shallow along the west shoreline and deep throughout the rest of the pond. Recently, the Nature Foundation of Sint Maarten, completed a mangrove restoration project along the north and northwest shores. The largest mudflat area is found along the north shore and this area also has an extensive bed of water grasses. The re-introduced mangroves spread along the west shore and thin out towards the deeper water of the southwest end. Scrub habitat makes up the majority of the vegetation on the hillside above the west shore. Most of the hillside above the west shore is undeveloped. The south shore is partially bordered by scrub brush and mangrove trees. The shore drops steeply into the pond, creating a barrier to most wading birds that might otherwise use this area for roosting and foraging. On the south side of the south shore is the Belair beach and, beyond that, the Caribbean Sea. The southwest corner of the pond has a small outlet to the sea, where water can drain from the pond. This outlet is a few meters higher than level of the sea and therefore there is no direct flow from the sea into the pond. The outlet itself is vegetated with mangroves. A paved main road is located along the east shore of the pond. A residential area is located on the side of the road opposite the pond. The eastern shoreline is sparsely vegetated and is mostly a barren dirt lot that provides a border between the pond and the road. The shoreline here also drops steeply into the pond, hindering its use as a roost or feeding area. The lot and the road appear to dissuade many birds from using this side of the pond, as well. The depth of the overall pond attracts many swimming and diving birds, including waterfowl and seabirds.

Hazards- No fish die-offs were observed during 2004, yet during both 2001 and 2002 Belair Pond was the site of fish die-offs. The causes of death were inconclusive, but thought to be due to lack of oxygen in the pond. Historically, the pond flushed seasonally into the Caribbean Sea via the channel created in part by storm surge from the sea and flooding of the pond by the Great Salt Pond overflow. This mechanism is no longer in place due to the channeling of the Great Salt Pond waters elsewhere and the build-up of silt on the ponds bottom which has raised the pond's water level. The re-introduction of mangroves into the pond is a great step towards the revitalization of a natural ecosystem in the pond. The south and east shores of Belair Pond could also be improved by the planting of mangroves. Both of these shorelines drop abruptly into deep water, making them unavailable as foraging habitat for shorebirds. Trash build-up is heavy on the east shoreline as well. The heavy use of both the paved road and the dirt parking lot lead to the dumping of more trash than usual into the Belair Pond.

Avifauna-

Species	High Count	Nests	Chicks
Pied-billed Grebe	7		
Snowy Egret	5		
Cattle Egret	1		
White-cheeked Pintail	4		
Ruddy Duck	95		
Common Moorhen	9	3	1
American Coot	3	1	
Caribbean Coot	6	1	
Spotted Sandpiper	1		

10. Great Salt Pond

Location- The Great Salt Pond is a large saltwater pond on the south east side of Dutch St. Martin. The pond is bordered on all sides by downtown Philipsburg and its suburbs. The pond was once widely used for the production of salt and many artifacts of this salt-production era remain, most notably the rock walls throughout the pond. The immense size of the pond led us to split it into zones. Two of these zones, Great Salt Pond Plot and Great Salt Pond Philipsburg Plot, were surveyed weekly.

Hazards- The main hazard to the entire Great Salt Pond is the build-up of debris in the pond. The sources of the debris are many and include household trash deposited commonly by the residents of St. Martin, industrial waste deposited by local companies, and trash from the Dutch waste facility. The waste facility is located on the Great Salt Pond’s northern edge and has slowly filled in the pond southwards, until it has reached its current location, having filled almost a quarter of the ponds acreage. As the pond is constantly filled with waste from all of these sources, important foraging, roosting and nesting habitat is lost to the birds of the island. The complete removal of all vegetation, including mangroves, leaves no natural protection against erosion. The loss of all native vegetation, including mangroves, surrounding the pond has left a major void in the ecosystem. Not only were the major natural filtration systems destroyed, but vital nesting and roosting habitat was lost for the birds of the island. Its immense size and connection to other ponds make Great Salt Pond one of the most ecologically important ponds on the St. Martin.

10a. Great Salt Pond Plot

Location- Great Salt Pond plot is located on the northeast side of the Great Salt Pond.

Habitat- The Great Salt Pond is the natural drainage basin for all the surrounding hillsides. The east side of the pond is bordered by a small mud flat area, which drops off quickly into deeper water. Immediately east of this border is a very busy paved public road, one of the main thoroughfares into Philipsburg. The corners of the plot, between the east shore and the north and south shores contain small mudflat areas, thinly fringed in grass. The majority of the north, west, and south borders are rock wall remnants of the salt production era. Two other rock walls run north and south down the center of the pond. The edges of the rock walls run into shallow water that quickly becomes deep. All shorelines have been completely cleared of their native mangroves and grasses.

Avifauna –

Species	High Count	Nests	Chicks
Brown Pelican	1		
Green Heron	1		
Tri-colored Heron	1		
Snowy Egret	8		
Green-winged Teal	1		
White-cheeked Pintail	22		
Blue-winged Teal	3		
Common Moorhen	14		
American Coot	2		
Black-bellied Plover	21		
Black-necked Stilt	120		
Greater Yellowlegs	2		
Lesser Yellowlegs	10		
Spotted Sandpiper	1		
Ruddy Turnstone	17		
Stilt Sandpiper	3		

10b. Philipsburg Plot

Location- Philipsburg plot is located on the southeast side of the Great Salt Pond.

Habitat- The Great Salt Pond is the natural drainage area for all the surrounding hillsides. The east edge of the pond is bordered by a steep short rise that meets a busy paved public road. The road is a main avenue into Philipsburg. The water depth drops steeply from this edge of the pond, and is vegetated in low grasses. The northeast corner of the plot is covered in shallow water with exposed mudflats on the perimeter. There is a small amount of grass covering this area. The north border, as well as the west and south borders, are rock wall remnants from the salt production industry. The rock walls rise from approximately three to thirty centimeters above water level. There is little vegetation in or around the plot and all mangroves have been removed.

Avifauna-

Species	High Count	Nests	Chicks
Great Blue Heron	8		
Great Egret	2		
Snowy Egret	77		
Cattle Egret	250		
White-cheeked Pintail	7		
Common Moorhen	31		
Black-bellied Plover	5		
Black-necked Stilt	113		
Greater Yellowlegs	1		
Lesser Yellowlegs	12		
Spotted Sandpiper	3		
Ruddy Turnstone	6		
Lesser Black-backed Gull	5		
Royal Tern	13		
Black-headed Gull	2		
Mute Swan	1		

11. Gallion Pond

Location- Gallion Pond is located within the French Nature Reserve on the east side of the island in French St. Martin. The pond is fifty meters west of the Atlantic Ocean, thirty meters north of the Gallion beach area, and is 25 meters northeast of Fish Pond. The surrounding area is primarily used for beach recreation at both the popular beaches of Gallion and Orient Bay.

Habitat- The entire Gallion Pond was not surveyed due to its large size. Therefore, an index plot was chosen in the eastern half of the pond, which well represents the pond as a whole. The south shore of the plot is a gently descending shoreline of mixed salt/sand flat. The south side of this shoreline is a salt tolerant grass bed. The east shore is lined in mangroves. The shoreline here gradually enters the pond as well, although the substrate is mud. Further east of the mangroves, a small sandstone rock hill creates a barrier between the Atlantic Ocean and the pond. The north shore is lined with mangroves and creates a barrier between the pond and a public dirt road that connects Gallion beach with Orient Bay beach. Along the west end of the north shore is a twenty-meter length of sand/salt flats that connect two sections of mangrove. The west end of the index plot is a low rock wall that connects the south and north shores. The wall apparently was built to aid in the process of salt extraction from the pond at one time. The rock's edge drops abruptly into the pond, although the water level here is less than a meter deep. There are two small sandy islands located in the east end of the plot. Both islands are vegetated with mangrove and are edged thinly with sand flats. The pond is uniformly shallow across its entirety. Mangrove seedlings were planted within the plot by the French St. Martin non-profit Youth in Action, in 2002.

Hazards- Large pieces of gill-netting were found along the south shore of the pond. It was never seen used, although the nature in which it was left could have very detrimental effects to birds were they to become tangled in it while foraging in and along the pond. Disturbances to birds roosting along the edges of the pond are numerous. Horse trips are led daily along the waters edge and flushed birds from their roosts. Car tracks along the south shore were seen during each survey. The French Antillean police were seen driving along the shoreline on multiple occasions. Due to its proximity to both Gallion beach and Orient Bay beach, people often walk along the shores of the pond. The use of the dirt roads rather than the shoreline of the pond by all of these user groups would greatly reduce the disturbance to the birds of the pond. The development of the Gallion beach or the continued development of Orient Bay would most certainly negatively impact the Gallion Pond ecosystem, with possible issues including the dumping of trash, human and toxic wastes, pond fill, and a continual disturbance to feeding, roosting, and nesting birds of the pond.

Avifauna-

Species	High Count	Nests	Chicks
Magnificent Frigatebird	1		
Great Blue Heron	2		
Great Egret	3		
Snowy Egret	9		
Little Blue Heron	1		
Green Heron	1		
White-cheeked Pintail	3		
Black-bellied Plover	9		
Semi-palmated Plover	17		
Greater Yellowlegs	3		
Lesser Yellowlegs	4		
Ruddy Turnstone	15		
Sanderling	89		
Semi-palmated Sandpiper	22		
Willet	1		
Royal Tern	17		
Belted Kingfisher	1		

12. Orient Pond

Location- The Orient Pond is located adjacent to Orient Beach on the east side of St. Martin. The pond is edged against Gallion Pond on its west side and the Caribbean Sea on its south side. This pond is located within the French Reserve Naturelle des St. Martin.

Habitat- This salt pond is shallow across its entire width. Mangroves surround the entire pond and there are a few small mangrove stands in the center of the pond. Along the north end of the pond, there was a small area of mud flats during late winter. Outside of the thin line of mangroves surrounding the pond, there is a dirt road which surrounds the south, west and north sides. There is a new housing development along the east side. This development has removed mangroves and filled in pond area to increase the area in which houses can be built. This pond has some of the most vital intact mangroves stands on the island.

Hazards- The major threat to this pond is the new first class development along its eastern shoreline. Over the past year developers have begun to remove mangroves from this side of the pond, filled the areas in with dirt and begun to build houses on it. It appears from the continued removal of this pond's mangroves, that the developers may fill the entire pond in for houses. The removal of mangroves reduces habitat for foraging, roosting, and nesting. This pond is one of a few locations where the regionally threatened species Snowy Plovers and Least Terns (*Sterna antillarum*) nest during summer months. Additionally, mammalian predators dogs, cats, and mongoose were observed during every visit to this

pond. Runoff from the dirt road along most of the pond, spills into the pond, clouding the water and restricts aquatic plant growth.

Avifauna-

Species	High Count	Nests	Chicks
Brown Pelican	5		
Snowy Egret	8		
Great Blue Heron	1		
Little Blue Heron	2		
Tri-colored Heron	3		
Green Heron	3		
Green-winged Teal	4		
White-cheeked Pintail	25		
Blue-winged Teal	51		
Northern Shoveler	2		
West Indian Whistling Duck	1		
Sora	5		
Common Moorhen	6		
American Coot	2		
Black-necked Stilt	417		
Greater Yellowlegs	12		
Lesser Yellowlegs	22		
Stilt Sandpiper	13		
Short-billed Dowitcher	55		

13. Cul-de-Sac Pond

Location- Cul-de-sac Pond is located on the northeast side of St. Martin. The pond borders against Orient Beach on the north end. The pond is on private property.

Habitat- This large pond has a deep center and shallow margins. The shallow areas cover most of the pond and during the late winter a large mud flat developed across the east side of the pond. There is very little vegetation along this pond, and it is mainly a salt flat/mud flat area. There are rocks along the southern margin of the pond. A rock wall, a remnant of the salt production era, leads out from the north shoreline towards the center of the pond, disappearing into deeper water.

Hazards- The main hazard in this area would be predation on birds by mammals. There is little shelter in which the birds could hide. Sewage runoff into the pond is a problem as well. During all surveys in 2003, raw sewage was seen running from the houses on the north side into the pond. Sewage treatment on the French side of the island is a major problem, and pumping sewage directly into ponds seems to be a short term solution. Silt runoff from the dirt road and parking lot along the north margin drains directly into the pond, inhibiting growth of aquatic vegetation.

Avifauna-

Species	High Count	Nests	Chicks
Brown Pelican	130		
Great Blue Heron	1		
Great Egret	22		
Snowy Egret	64		
Cattle Egret	2		
White-cheeked Pintail	3		

Black-necked Stilt	12		
Greater Yellowlegs	8		
Lesser Yellowlegs	5		
Spotted Sandpiper	1		

14. Grand Case Pond

Location: The Grand Case Pond is located on the northeast side of St. Martin. The town of Grand Case is along the north and western borders, while there are roads along the northeast and south sides. The Grand Case Airport runway extends into the pond. We have split the pond into two sections, Grand Case Airport Pond and Grand Case Bay Pond.

Hazards- Disturbance is the major issue at the Grand Case Airport Pond. Small planes constantly take off and land at the airport. Construction is underway to enlarge the runway to accommodate large jet airplanes, which will most likely increase the current disturbance levels. The most serious issue with the enlargement of the airport would be the filling in of the pond itself for increased parking for both cars and planes, similar to the fate of the Flamingo Pond on Dutch St. Martin. The roadway along the southern shoreline also is major disturbance to roosting birds. Additionally, the litter build-up along the edge of the roadway ends up in the pond, clogging roost areas with debris and polluting the pond with toxins.

14a. Grand Case Airport Pond

Location- The Grand Case Airport Pond is located on the south side of the Grand Case Airport runway, in French St. Martin. The Pond is located less than a kilometer south of the Caribbean Sea. Grand Case Airport Pond also backs up to the north side of the busy road separating the town of Grand Case and the Orient Beach complex.

Habitat- The shallow pond is brackish. Along the east shoreline is a large mud flat area that partially floods during the rainy season. The mud flat is bordered on its east side by mixed mangroves and scrub brush. The north shoreline has a shallow mud border that is fringed in scrub brush. Ten meters south of this edge is the busy runway of the Grand Case Airport. This northern edge gradually drops towards the deeper water in the center of the pond. The west shoreline is rocky along its length with small areas of scrub brush. On the western side of this margin lies the village of Grand Case. The south shoreline has a small margin of mudflat vegetated with mangroves along its entire length. Additionally, the pond has a series of wooden poles located at various point within the pond's center. There is also a rock wall along the southern shoreline that runs in a triangular pattern.

Avifauna-

Species	High Count	Nests	Chicks
Pied-billed Grebe	2	1	
Great Egret	1		
Green Heron	1		
White-cheeked Pintail	52		
Common Moorhen	16		

14b. Grand Case Bay Pond

Location- This pond is located adjacent to the village of Grand Case, on the south side. The airport runway separates this section of the pond from Grand Case Airport Pond. There is a paved road running from the Airport to the village, along the north side of the pond.

Habitat- This pond is relatively deep throughout its length. The west end of the pond has a small cove which is shallow, and contains some mud flats. There are two long and thin islands in the center of the

pond which are sparsely vegetated and covered in small rocks. The northeast margin of the pond is edged in mangroves and separates the pond from the road. The airport runway borders the pond on the south side and is covered with short grass along the ponds edge.

Avifauna-

Species	High Count	Nests	Chicks
Great Blue Heron	2		
Muscovey Duck	2		
White-cheeked Pintail	2		
Common Moorhen	20		
Spotted Sandpiper	2		

15. Grand Case Airport Small Pond

Location- This pond is located on the northeast side of the Grand Case Airport. It is close to the larger Grand Case ponds but is separated by a large dirt parking lot on the south side. A paved road runs along the east side. The airport parking lot and buildings are on the south side of the pond.

Habitat- This pond is deep along the west sides and is shallow along its east side. The pond is fringed in mangroves along its west, north and east sides, creating good roosting habitat. The south side is bordered by a dirt lot and the airport buildings. This side of the pond had very few birds. The majority of the birds were observed in the east side of the pond, foraging in the shallow waters of that end of the pond. Aquatic grasses were observed along many portions of the east side of the pond.

Hazards- Disturbance is the main hazard for this pond; due to its close proximity to the airport. Cars pulling into and out of the parking area as well as planes arriving and leaving the airport keep the birds on the far side of the pond from these areas. Mammal predation is most likely an issue with birds here, as both dogs and cats were commonly seen in these areas. Mongoose was seen in this area during one visit and we have been told rats are common in the Grand Case area, although we did not see them during our observations. Dirt runoff from the parking lot into the pond is a problem, as siltation of the pond hinders plant growth.

Avifauna-

Species	High Count	Nests	Chicks
Great Egret	1		
Snowy Egret	1		
Great Blue Heron	1		
Green Heron	1		
White-cheeked Pintail	2		
Common Moorhen	3		
Spotted Sandpiper	1		

16. Grand Case Town Pond

Location- This pond is located on the northeast side of St. Martin. It is located south of the village of Grand Case, among a small housing area. The pond has a dirt road along the east and west sides of the pond. A field is along the south side of the pond. Houses back up to the north side of the pond.

Habitat- The pond is deep through its length, although the southern edge of the pond is not as deep as the remainder of the pond. The slopes along the entire edge of the pond are steep, deterring any shorebirds from these areas. There is aquatic grass growing throughout the pond. Houses are built up to the

edge of the pond along the north side. There is a small gully of water coming off the pond on the west side. This gully is filled with vegetation. There is very little vegetation along any of the margins of the pond.

Hazards- There appears to be many hazards for the birds of this pond. Disturbance appears to be a major hazard, as there is constant construction work on the houses on the north, east and west sides of this pond. The roads getting to these houses border the pond, and keep any bird away from these edges. Mammal predation is a potential problem as dogs, cats, and mongoose were observed during most visits to this pond. Siltation of the pond, through runoff from the dirt roads, is a problem, hindering aquatic plant growth.

Avifauna-

Species	High Count	Nests	Chicks
Pied-billed Grebe	6		
Great Egret	8	24	2
Snowy Egret	47		
Cattle Egret	7		
Muscovey Duck	3		
White-cheeked Pintail	13		
Blue-winged Teal	1		
Common Moorhen	31		
Black-necked Stilt	30		
Greater Yellowlegs	1		
Spotted Sandpiper	7		

17. Friar's Bay

Location- This pond is located on the north side of St. Martin. It is fringed by Friar's Bay Beach on the north side, and by agricultural land to the east, west, and south.

Habitat- This is a deep water pond with one shallow section, the north west end. Most birds were concentrated within this area.

Hazards- The main hazard to this pond would be disturbance by tourists. The largest group of birds was observed roosting within 10 meters of the very popular beach area. Additionally, cows and goats were seen standing long the edge of the pond, and could easily flush roosting birds.

Avifauna-

Species	High Count	Nests	Chicks
Great Blue Heron	1		
Great Egret	1		
Snowy Egret	6		
Common Moorhen	2		
Spotted Sandpiper	1		
Belted Kingfisher	1		

18. Galis Bay

Location- This pond is located on the outskirts of Marigot, on the north side of St. Martin. It is found among a major industrial area.

Habitat- This is a tidal pond that fluctuates in depth based on the tide. A deep section remains in the center of the pond despite the tide.

Hazards- There appears to be industrial run-off from the surrounding businesses. We have observed fish die-offs on multiple occasions. Dogs and cats have been observed along the ponds margin on most visits to the area.

Avifauna-

Species	High Count	Nests	Chicks
Snowy Egret	4		
Black-crowned Nightheron	1		
Common Moorhen	1		
Black-necked Stilt	9		
Lesser Yellowlegs	3		
Spotted Sandpiper	4		
Ruddy Turnstone	2		
Semi-palmated Sandpiper	6		
Least Sandpiper	3		
Short-billed Dowitcher	23		

Discussion

The ponds of St. Martin are one of the islands most important habitats and play a valuable role in the health of the environment. Initially, the ponds are the natural collectors of the islands water, both groundwater runoff as well as rainwater. Secondly, the ponds clean the water through natural filtration systems provided by native mangroves. Finally, the ponds, and associated vegetation, create an environment to which birds are readily attracted to.

Regular population counts, which assess abundance and composition of bird species, are indicators of how successful birds have been foraging, roosting, and breeding. A large number and high diversity of birds, indicate a healthy pond ecosystem and accordingly, a healthy island. If low populations or diversities are found, it is an indication of an ecosystem out of balance, in which case impacts to the environment should be mitigated.

St. Martin is fortunate to have a variety of ponds throughout the island. Although a large environmental disaster might affect all island ponds, it is more likely that problems would arise in an individual pond and the birds of that pond might find refuge in another. Looking at a variety of ponds and comparing their habitats, as well as the population and diversity of birds in each, help us better understand common island-wide issues as well as each ponds individual positive and negative attributes.

Recommendations

Overall, similar environmental concerns affected all of St. Martin’s ponds.

- Continued habitat restoration, including re-planting mangroves, revegetation of steep shoreline banks in ponds with grasses, and possible re-grading of some steep banks to increase available foraging habitat for small shorebird species.
- Trash and chemical build-up in the ponds is an island wide epidemic. Sint Maarten Pride Foundation is undertaking the huge task of an island-wide clean-up campaign. The Pride Foundation has cleaned many of the ponds, making shorelines more available for foraging birds, as well as increasing the potential that these ponds might provide a stable, healthy environment for both migratory and resident waterbirds.
- Continued water testing must take place to follow long-term trends in water quality in each pond.
- Education programs regarding the ponds must continue in the schools and expand to regular field trips to the pond sites themselves.
- Additional small refuge islands, similar to those in Fresh Pond, should be created in other ponds. These islands should be made of non-toxic, low-silt materials.

The continued restoration and interest in St. Martin's ponds must continue. The habitat that we protect within these ponds is of global importance to many species of concern that depend upon healthy over-wintering areas to build up fat stores for safe migration and future breeding efforts. Likewise, for resident populations of waterbirds, the ponds of St. Martin are the only habitat available. These non-migratory birds require the food provided by healthy ponds and vast amounts of mangrove habitat for successful roosting and nesting areas. The protection of St. Martin's ponds is of the utmost concern to many island environmental groups. The importance of these ponds should be recognized by the local government agencies as well. Many of these ponds, when possible, should be declared "Areas of Critical Environmental Importance", and protected as such. Through continued conservation efforts, by the local governments and non-profits, St. Martin's ponds will again flourish in abundance and diversity.

Bibliography

- Benito-Espinal, E. 1990. Birds of the West Indies. Anse des Lezards, St. Barth, F.W.I.
- Bond, James. 1985. Birds of the West Indies. (Fifth Edition). South China Printing Company, Hong Kong.
- Brown, A.C., Collier, N.S. 2001. Field Season. Environmental Protection In the Caribbean: Annual Report 2000-2001. 46 pages.
- Brown, A.C., Collier, N.S. 2002. Pond Surveys of St. Martin: 2002 Report. Unpublished Report. 29 pages.
- Brown, A.C., Collier, N.S. 2003. Pond Surveys of St. Martin: 2003 Report. Unpublished Report. 35 pages.
- Bryer, M, et al. 2000. Birds of Anguilla and the Outer Islands. Sabbatical report: November 1999 to June 2000. Royal Society for the Protection of Birds.
- Danforth, S.T. 1930. Notes on the birds of St. Martin and St. Eustatius. Auk 47: 44-47.
- Danforth, S.T. 1939. The birds of Saba. Journ. Agr. Univ. Puerto Rico 22: 503-512.
- Ecovision N.V. 1996. The Ponds of St. Martin: Sustainable Development and Management. Private Report for the department of VROM, St. Martin. 64 pages.
- Hoogerwerf, A. 1977. Notes on the birds of St. Martin, Saba, and St. Eustatius. Stud. Fauna Curacao Other Caribb. Isl. 54(176):60-123.
- Howard, R.A. 1974-1989. Flora of the Lesser Antilles. Vols. 1-6 Arnold Arboretum, Jamaica Plain, Massachusetts.
- Hughes, J. 2000. Birds and Potential IBAs in Anguilla. Sabbatical Report: January February 2000. RSPB.
- Hummenlinck, P.W. 1953. Islote Aves, een vogeleiland in de Caraibische Zee. J. West-Indische Gids 33:23-34.
- Hunter, W.C., Collazo, J., Noffsinger, B., Winn, B., Allen, D., Harrington, B., Epstein, M., Saliva, J. 2001. U.S. Shorebird Conservation Plan: Southeastern Coastal Plains-Caribbean Regional Shorebird Plan. U.S. Fish and Wildlife Service, Atlanta, GA. 26 pages.
- Littler, D.S. 1989. Marine Plants of the Caribbean. Smithsonian Institute Press.
- Marshall, Nelson. 1992. Understanding the Eastern Caribbean and the Antilles. Th'Anchorage Publisher, St. Michaels, Maryland.

- National Geographic. 1999. Field Guide to the Birds of North America: Third Edition. National Geographic Society, Washington D.C.
- Peterson, R.T. 1980. Eastern Birds: 4th Edition. Houghton Mifflin Co., Boston.
- Pinchon, R. 1976. Faune des Antilles Françaises: les oiseaux. Second edition. Fort-de- France: [no publisher given].
- Publications of the Foundation for Scientific Research in the Caribbean Region. Obtainable from Secretariat Found. Sci. Res., Inst. Tax. Zool., Plantage Middenlaan 45, 1018 DC Amsterdam, The Netherlands, tel. And Fax: 0205255926.
- Raffaele, H., et al. 1998. A Guide to the Birds of the West Indies. Princeton University Press, Princeton, N.J.
- Rojer, A. 1997. Biological Inventory of St. Maarten. Stichting Carmabi, Curacao.
- SEMSAMAR, Mixte Economy Company of St. Martin. 1995. Pollutions Study of the Simpson Bay Lagoon Island of St. Martin: Summary of the Study-Synthesis and Recommendations. Private report to the Department of VROM, St. Maarten. 56 pages.
- Voous, K.H. 1954. Het ornithologisch onderzoek van de Nederlandse Antillen tot 1951. *Ardea* 41: 23-34.
- Voous, K.H. 1955. The Birds of the Netherlands Antilles. Uitg. Natuurwet. Werkgroep Ned. Ant., Curacao 5: 205 pp.
- Voous, K.H. 1955a. The Birds of St. Martin, Saba, and St. Eustatius. *Studies on the Fauna of Curacao and Other Caribbean Islands* 6: 1-82.
- Voous, K.H. and Koelers, H.J. 1967. Checklist of the birds of St. Martin, Saba, and St.Eustatius. *Ardea* 55: 115-137.
- Voous, K.H. 1983. Birds of the Netherlands Antilles. De Walburg Pers., Curacao. (English Version).
- Vroman, M. 1968. The Marine Algal Vegetation of St. Martin, St. Eustatius, and Saba. *Netherlands Antilles*: [no publisher given].
- Westermann, J.H., 1947. Natuurbescherming op de Nederlansche Antillen, haar ethische, aesthesche, wetenschappelijke en economische perspectieven. *West-Indische Gids* 28: 193-216.