

Pond Surveys of St. Martin: 2004 Report

Adam Brown ¹, Natalia Collier
Environmental Protection In the Caribbean 200 Dr. Martin Luther King Jr. Blvd. Riviera Beach, Florida 33404
¹abrown@epicislands.org

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Abstract

We completed a fourth year of waterbird surveys of 18 wetland areas on the Caribbean island of St. Martin. These areas of St. Martin are suffering from a number of environmental impacts, including mangrove depletion, sewage run-off, garbage dumping, and development. The areas surveyed were chosen based on their locations, which were spread evenly throughout the island. We found common threats to all wetland areas, as well as specific threats to each. We observed 49 species of waterbird using the wetland areas during our surveys. Additionally, the wetlands and their immediate shores are the breeding grounds for eleven species of waterbird. Water quality was tested using the following parameters: temperature, conductivity, salinity, dissolved oxygen, and pH.

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 both transient, over-wintering, and resident waterbird species. This habitat was recently 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 from 22 January 2004 through 22 June 2004. Each wetland was surveyed once every month. 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.

We sought to determine basic water quality parameters through the testing of pH, conductivity, salinity, temperature and dissolved oxygen. A conductivity, salinity, and temperature meter was used to measure these parameters in the field. A refractometer was used to measure salinity levels. A dissolved oxygen meter was used to measure dissolved oxygen, where salinity levels did not obstruct a reading. Measurements were taken at approximately two feet from the margin of the pond at each sample point.

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.

Water Test Results-

DATE	TIME	pH	CONDUCT	TEMP	SALINITY	OXYGEN mg/l
			mS	Deg C	ppt	%
1-22	1210	ND	ND	31.3	82	ND
2-28	1655	ND	ND	30.8	97	ND
3-26	1215	ND	ND	30.6	>100	ND
4-26	1400	ND	ND	31.1	>100	ND
5-30	1050	8.46	ND	30.3	>100	ND
6-22	840	8.5	ND	29.3	>100	ND

Table 1. Weekly levels for pH, Conductivity (Ms=microsiemens), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND=Not Done.

Avifauna- Twenty-four species of bird were observed using Lowlands Main Pond, up from the four-year average of 20.7 species. Water level was high this year than during the previous three years, changing the general make-up of the species present. The higher water levels attracted more ducks and waders than during previous years. The muddy shorelines along the north end and along the northwest end

attracted many Lesser Yellowlegs (*Tringa flavipes*) and Greater Yellowlegs. Lowlands Main Pond averaged 85.8 birds per count, up from the four-year average of 59.2 birds per count. The average count for species observed in the pond was 8.8, the same as the four-year average.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Magnificent Frigatebird	1	0.17	1	122	0.19
Great Egret	1	0.17	1	530	0.19
Snowy Egret	2	0.33	1	326, 426	0.39
Green Heron	3	0.50	2	426	0.58
Yellow-crowned Night Heron	1	0.17	1	530	0.19
White-cheeked Pintail	18	3.00	8	122	3.50
Blue-winged Teal	2	0.33	2	326	0.39
Lesser Scaup	20	3.33	12	122	3.88
Bufflehead	2	0.33	1	122, 228	0.39
Black-bellied Plover	1	0.17	1	326	0.19
Wilson's Plover	2	0.33	2	228	0.39
Semi-palmated Plover	2	0.33	1	326, 426	0.39
Black-necked Stilt	85	14.17	27	622	16.50
Greater Yellowlegs	91	15.17	65	228	17.67
Lesser Yellowlegs	110	18.33	48	326	21.36
Spotted Sandpiper	6	1.00	3	122	1.17
Ruddy Turnstone	33	5.50	18	426	6.41
Sanderling	52	8.67	27	426	10.10
Semi-palmated Sandpiper	53	8.83	38	426	10.29
Least Sandpiper	4	0.67	4	326	0.78
Stilt Sandpiper	22	3.67	12	326	4.27
Laughing Gull	2	0.33	1	530, 622	0.39
Royal Tern	1	0.17	1	530	0.19
Least Tern	1	0.17	1	622	0.19

Table 2. Birds observed in Lowlands Main Pond during 2004.

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.

Water Test Results-

DATE	TIME	pH	CONDUC	TEMP	SALINITY	OXYGEN mg/l
			mS	Deg C	ppt	%
1-22	1315	ND	ND	34.6	60	ND
2-28	1630	ND	ND	34.3	92	ND
3-26	1300	ND	ND	32.0	>100	ND
4-26	1120	8.5	ND	30.5	85	ND
5-30	1120	8.5	ND	30.5	85	ND
6-22	850	8.64	ND	28.4	100	ND

Table 3. Weekly levels for pH, Conductivity (mS=microsiemens), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND= Not Done

Avifauna- Fifteen species of bird were seen using Lowlands Annex Pond, down from the four-year average of 16.8. The water, as in Lowlands Main Pond, was deeper than during the previous year. However, the shorelines along the south side of the pond remained shallow, providing good foraging habitat for Sanderlings (*Calidris alba*) and Semipalmated Sandpipers. The sandy islet located in the northwestern portion of the pond was excellent roosting habitat for plover species, including Black-bellied Plovers, Semipalmated Plover, and Wilson’s Plover. Wilson’s Plovers, Black-necked Stilts, and Least Terns were found to be breeding in this area. Lowlands Annex Pond averaged 81.6 birds per count, up from the four-year average of 57.5. The average count for species observed in the pond was 7.8, slightly up from the four-year average of 7.7.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Green Heron	3	0.50	2	622	0.61
White-checked Pintail	8	1.33	4	622	1.63
Black-bellied Plover	18	3.00	10	326	3.67
Wilson's Plover	40	6.67	17	426	8.16
Semi-palmated Plover	21	3.50	15	426	4.29
Black-necked Stilt	19	3.17	10	426	3.88
Greater Yellowlegs	16	2.67	15	122	3.27
Lesser Yellowlegs	29	4.83	16	122	5.92
Spotted Sandpiper	3	0.50	2	228	0.61
Ruddy Turnstone	7	1.17	3	326	1.43
Sanderling	98	16.33	95	326	20.00
Semi-palmated Sandpiper	90	15.00	39	426	18.37
Least Sandpiper	16	2.67	15	122	3.27
Stilt Sandpiper	32	5.33	17	326	6.53
Least Tern	90	15.00	90	530	18.37

Table 4. Birds observed in Lowlands Annex Pond during 2004.

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.

Water Test Results-

DATE	TIME	pH	CONDUCT	TEMP	SALINITY	OXYGEN
			mS	Deg C	ppt	%
1-22	1410	ND	ND	30.5	45	4.60
2-28	1515	ND	ND	35.0	61	ND
3-26	1315	ND	ND	31.0	82	ND
4-30	1135	7.53	ND	35.5	70	ND
6-22	920	7.47	ND	29.4	50	1.35

Table 5. Weekly levels for pH, Conductivity (mS=microsiemens), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND= Not Done

Avifauna- Seven species of bird were observed using Rouge Pond, down from the three-year average of 7.6. The overall shallow nature of the pond was similar to the previous two years and made it favorable to waders. The western edge of the pond had the highest abundance of waders including Lesser Yellowlegs. The deeper margin of the pond along the eastern shoreline provided good foraging habitat for Black-necked Stilts (*Himantopus mexicanus*), the most abundant waterbird found at this pond. Rouge Pond averaged 24.8 birds per count down from the three-year average of 31.8. The average count for species observed in the pond was 3.3 slightly up from the three-year average of 3.2.

Species	Total Birds Observed	Mean	High Count	High Count Date	Percent of Pond Mean
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Black-necked Stilt	85	14.17	27	326	57.05
Greater Yellowlegs	11	1.83	7	326	7.38
Lesser Yellowlegs	19	3.17	12	122	12.75
Spotted Sandpiper	4	0.67	2	122, 426	2.68
Ruddy Turnstone	12	2.00	6	228	8.05
Stilt Sandpiper	16	2.67	9	228	10.74
Laughing Gull	2	0.33	2	622	1.34

Table 6. Birds observed in Rouge Pond during 2004.

4. Cupecoy Pond

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.

Avifauna- Seven species of bird were observed using Cupecoy Pond, down from the four-year average of 7.5. The mangrove habitat along the northern margin provided the best habitat for roosting birds. High numbers of Lesser Yellowlegs and Greater Yellowlegs were recorded in the mangrove areas. Cupecoy Pond averaged 5.5 birds per count, down from the four-year average of 14.2. The average count for species observed in the pond was 2.5, slightly up from the four-year average of 2.4.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Snowy Egret	3	0.50	1	122, 426, 622	9.09
Green Heron	2	0.33	1	326, 426	6.06
Black-necked Stilt	6	1.00	3	426	18.18
Greater Yellowlegs	7	1.17	7	326	21.21
Lesser Yellowlegs	12	2.00	6	228	36.36

Spotted Sandpiper	2	0.33	1	122, 426	6.06
Tri-colored Heron	1	0.17	1	228	3.03

Table 7. Birds observed at Cupecoy Pond during 2004.

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- Ten species of bird were observed at the Millenium inter-tidal area, down from the four-year average of 13.5. The small pools and uplifted rock creates good habitat for both foraging and roosting birds. Most abundant species in the inter-tidal area, as in the three previous years, were Semipalmated Plover and Wilson's Plover. Both species were very active in this area. Millenium averaged 36.6 birds per count, down from the four-year average of 66.7. The average for species observed in the area was 3.0, down from the four-year average of 5.4.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Black-bellied Plover	14	2.33	8	228	6.36
Wilson's Plover	18	3.00	18	122	8.18
Semi-palmated Plover	141	23.50	49	326	64.09
Ruddy Turnstone	14	2.33	12	326	6.36
Sanderling	3	0.50	3	228	1.36
Semi-palmated Sandpipiper	16	2.67	16	228	7.27
Laughing Gull	9	1.50	8	426	4.09
Royal Tern	3	0.50	1	122, 426, 622	1.36
Belted Kingfisher	1	0.17	1	326	0.45
Least Tern	1	0.17	1	622	0.45

Table 8. Birds observed at Millenium Inter-tidal Area during 2004.

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 laying 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- Seven species of bird were observed using Julianna Pond, the same number as in 2003. This shallow pond was attractive to Black-necked Stilts and Lesser Yellowlegs. Julianna Pond averaged 12.3 birds per count down from 20.1 in 2003. The average count for species observed in the pond was 2.6 down from 3.2 in 2003.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Green Heron	3	0.50	2	426	4.05
Yellow-crowned Night Heron	1	0.17	1	122	1.35
Black-bellied Plover	1	0.17	1	326	1.35
Semi-palmated Plover	3	0.50	2	228	4.05
Black-necked Stilt	55	9.17	18	122	74.32
Lesser Yellowlegs	8	1.33	4	122	10.81
Semi-palmated Sandpiper	3	0.50	3	228	4.05

Table 9. Birds observed in Julianna Pond during 2004.

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 leads 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.

Water Test Results-

DATE	TIME	pH	CONDUCT mS	TEMP	SALINITY	OXYGEN mg/l
			mS	Deg C	ppt	%
1-24	0950	ND	2.83	28.2	2	5.61
2-26	1000	ND	3.30	31.6	0	9.03
3-20	1115	9.5	3.51	28.5	2	8.02
3-25	0915	ND	3.90	27.7	3	5.98
4-27	1000	ND	3.74	29.7	1	4.93
5-31	0900	8.29	2.92	29	2	1.98
6-23	830	7.94	3.08	28.9	3	1.26

Table 10. Weekly levels for pH, Conductivity (mS=microsiemens), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND= Not Done

Avifauna- Nineteen species of bird were observed using Fresh Pond down from the three year average of 21.6. The extensive mangrove habitat, availability of safe roosting habitat on the small islet, and lower salinity provide good habitat for vegetation, creating an appealing environment for birds.

The deep nature of the pond led to large numbers of diving and dabbling birds as opposed to wading birds that are found in most of the other island ponds. Extensive floating aquatic vegetation is available as forage, as well. Most of the islands duck species were present on the Fresh Pond, including White-cheeked Pintail (*Anas bahamensis*) and Ruddy Duck (*Oxyura jamaicensis*). The largest colony of Snowy Egrets (*Leucophoyx thula*) and Cattle Egrets (*Bubulcus ibis*) on the island are found at this pond. Fresh Pond averaged 238.5 birds per count down from the three-year mean of 245.9 birds per count. The average count for species observed in the pond was 11.3 down from the three-year average of 13.1.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Pied-billed Grebe	6	1.00	2	427, 623	0.42
Brown Pelican	4	0.67	2	226, 427	0.28
Magnificent Frigatebird	4	0.67	2	226	0.28
Great Blue Heron	2	0.33	1	325, 427	0.14
Great Egret	67	11.17	16	226	4.68
Snowy Egret	328	54.67	121	531	22.92
Cattle Egret	335	55.83	221	226	23.41
Green Heron	3	0.50	1	325, 427, 623	0.21
Green-winged Teal	2	0.33	2	226	0.14
American Widgeon	2	0.33	1	226, 325	0.14

White-cheeked Pintail	205	34.17	73	427	14.33
Ruddy Duck	200	33.33	46	531	13.98
Common Moorhen	47	7.83	15	325	3.28
American Coot	10	1.67	4	325	0.70
Caribbean Coot	27	4.50	15	124	1.89
Black-necked Stilt	1	0.17	1	124	0.07
Spotted Sandpiper	1	0.17	1	124	0.07
Laughing Gull	186	31.00	97	427	13.00
Great Black-backed Gull	1	0.17	1	226	0.07

Table 11. Birds observed in Fresh Pond during 2004.

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- Fourteen species of bird were observed on Fresh Pond South in 2004, slightly less than the 17 observed in 2003. The island in the middle was roosting habitat for many species of bird including White-Cheeked Pintail. The deep water throughout the pond along with the large amount of aquatic vegetation attracted large numbers of Common Moorhens and Caribbean Coots. The mangrove stands along the eastern side of the pond was a large roost spot for Cattle Egrets, Snowy Egrets, and Great Egrets (*Casmerodius albus*). Fresh Pond South averaged 34 birds per count, substantially down from the 139.3 birds per count in 2003. The average count for species observed in the pond was 7.7, down from 8.6 in 2003.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Pied-billed Grebe	3	0.43	1	124, 325, 427	1.26
Brown Pelican	7	1.00	5	124	2.94
Magnificent Frigatebird	2	0.29	1	124, 325	0.84
Great Egret	4	0.57	2	320	1.68
Snowy Egret	47	6.71	15	623	19.75
Cattle Egret	8	1.14	3	623	3.36
Yellow-crowned Night Heron	1	0.14	1	531	0.42
White-cheeked Pintail	60	8.57	21	623	25.21
Ruddy Duck	32	4.57	7	427	13.45
Common Moorhen	45	6.43	10	427	18.91
American Coot	12	1.71	4	325	5.04

Caribbean Coot	8	1.14	2	226, 325, 427	3.36
Black-bellied Plover	3	0.43	3	320	1.26
Laughing Gull	6	0.86	6	623	2.52

Table 12. Birds observed in Fresh Pond South during 2004.

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.

Water Test Results-

DATE	TIME	pH	CONDUCT	TEMP	SALINITY	OXYGEN mg/l
			mS	Deg C	ppt	%
1-24	0845	ND	4.57	26.4	8	3.61
2-26	1020	ND	5.57	28.0	4	8.53
3-20	0920	ND	6.60	28.0	5	8.12
3-25	0830	ND	7.40	24.5	5	2.72

4-27	0830	ND	8.18	26.9	7	3.55
5-31	0820	8.95	6.3	26.3	5	3.86
623	725	8.09	7.08	25.4	6	2.62

Table 13. Weekly levels for pH, Conductivity (mS=microsiemens), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND= Not Done

Avifauna- Twenty-four species of bird were observed using Belair Pond, up from the four-year average of 20. The mangroves that were planted by the Sint Maarten Nature Foundation in 2001 have continued to create good habitat for both roosting and foraging birds. The floating vegetation along the margins of the pond were often filled with foraging Common Moorhens. A large group of Ruddy Ducks were seen during each observation. Belair Pond averaged 65.6 birds per count, down from the four-year average of 135.3 birds.. The average count for species observed in Belair Pond was 12.4, up from the four-year average of 10.8.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Pied-billed Grebe	9	1.29	3	325	1.96
Brown Pelican	41	5.86	17	124	8.93
Magnificent Frigatebird	7	1.00	3	427	1.53
Great Blue Heron	4	0.57	1	124, 226, 320, 325	0.87
Great Egret	1	0.14	1	623	0.22
Snowy Egret	11	1.57	5	427	2.40
Cattle Egret	4	0.57	3	623	0.87
Green Heron	1	0.14	1	325	0.22
Green-winged Teal	1	0.14	1	226	0.22
White-checked Pintail	43	6.14	12	427	9.37
Blue-winged Teal	40	5.71	14	320	8.71
Ruddy Duck	131	18.71	35	124	28.54
Ring-necked Duck	1	0.14	1	124	0.22
Lesser Scaup	2	0.29	1	226, 325	0.44
Sora	1	0.14	1	325	0.22
Common Moorhen	87	12.43	17	226	18.95
American Coot	31	4.43	10	320	6.75
Caribbean Coot	20	2.86	6	325, 623	4.36
Black-necked Stilt	7	1.00	2	623	1.53
Lesser Yellowlegs	6	0.86	2	320, 325	1.31
Spotted Sandpiper	2	0.29	1	124, 320	0.44
Sandwich Tern	1	0.14	1	623	0.22
Tri-colored Heron	4	0.57	1	124, 226, 320, 325	0.87
Least Tern	4	0.57	4	623	0.87

Table 14. Birds observed in Belair Pond during 2004.

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. It’s immense size and connection to other ponds, make Great Salt Pond one of the most ecologically important ponds on the St. Martin.

Water Quality-

DATE	TIME	pH	CONDUCT	TEMP	SALINITY	OXYGEN mg/l
			mS	Deg C	ppt	%
1-24	1040	ND	ND	27.6	28	7.21
2-26	1300	ND	ND	29.6	31	6.40
3-20	1100	ND	46.4	26.8	36	7.53
3-25	1030	ND	ND	28.4	38	5.87
4-27	1100	ND	ND	29.2	36	2.75
5-31	0925	8.25	ND	29.1	36	2.36
6-23	835	7.44	ND	27.2	27	.93

Table 15. Weekly levels for pH, Conductivity (mS=microsiemens), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND= Not Done

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- Twenty-one species of bird were observed using Great Salt Pond Plot, up from the four-year average of 18.5. Similar to previous years, the shallow water in the southeast corner provided excellent foraging habitat for Snowy Egret and Black-necked Stilts. The rock walls, which run lengthwise through the plot, provided good roosting habitat for many species of gull including an estimated 5,780 Laughing Gulls (*Larus atricilla*) birds in April. Great Salt Pond Plot averaged 87.6 (average does not include the April count of 5,800 Laughing Gulls) birds per count, down from the four-year average of 146.4. The average count for species observed in Great Salt Pond Plot was 10.1, down from the four-year average of 11.0.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Brown Pelican	17	2.43	8	325	0.26
Great Blue Heron	2	0.29	1	320, 325	0.03
Great Egret	8	1.14	3	124, 325	0.12
Snowy Egret	41	5.86	15	325	0.63
Yellow-crowned Night Heron	3	0.43	2	325	0.05
White-cheeked Pintail	19	2.71	10	226	0.29
Ruddy Duck	5	0.71	5	226	0.08
Common Moorhen	12	1.71	4	325	0.18
Black-bellied Plover	30	4.29	15	226	0.46
Killdeer	5	0.71	2	531, 623	0.08
Black-necked Stilt	311	44.43	77	325	4.76
Greater Yellowlegs	17	2.43	7	325	0.26
Lesser Yellowlegs	28	4.00	13	226	0.43
Spotted Sandpiper	3	0.43	3	124	0.05
Ruddy Turnstone	33	4.71	14	325	0.50
Semi-palmated Sandpiper	6	0.86	6	124	0.09
Least Sandpiper	5	0.71	5	124	0.08
Laughing Gull	5932	847.43	5780	427	90.76
Lesser Black-backed Gull	25	3.57	16	325	0.38
Royal Tern	28	4.00	28	427	0.43
Least Tern	6	0.86	4	325	0.09

Table 16. Birds observed in Great Salt Pond Plot during 2004.

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- Thirteen species of bird were observed at the Philipsburg Plot, down from the four-year average of 14.7 species. Sea-water was added to the Great Salt Pond within the Philipsburg Plot keeping a high water level in this area. The high water covered most of the rock walls that run through the center of the pond, reducing the available roosting habitat by an estimated 75%. The entire shoreline drops quickly into deeper water, eliminating most species from using these areas for foraging. Despite the deep water along the margins, Black-necked Stilts and Brown Pelicans (*Pelecanus occidentalis*) were observed foraging in these areas. Philipsburg Plot averaged 66.6 birds per count, up from the four-year average of 51.4. The average count for species observed in Philipsburg Plot was 5.2, down from the four-year average of 6.5.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Brown Pelican	41	6.83	18	531	10.25
Great Blue Heron	2	0.33	2	124	0.5

Snowy Egret	3	0.50	1	325, 427, 531	0.75
Cattle Egret	1	0.17	1	124	0.25
White-cheeked Pintail	3	0.50	3	226	0.75
Common Moorhen	2	0.33	1	124, 226	0.5
Black-bellied Plover	6	1.00	3	325	1.5
Killdeer	2	0.33	2	531	0.5
Black-necked Stilt	157	26.17	50	325	39.25
Greater Yellowlegs	1	0.17	1	226	0.25
Lesser Yellowlegs	19	3.17	13	226	4.75
Ruddy Turnstone	26	4.33	16	226	6.5
Laughing Gull	137	22.83	135	531	34.25

Table 17. Birds observed in Great Salt Pond Philipsburg Plot during 2004.

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.

Water Test Results-

DATE	TIME	pH	CONDUCT	TEMP	SALINITY	OXYGEN mg/l
			mS	Deg C	ppt	%
1-24	1220	ND	ND	32.3	40	7.66

2-26	1400	ND	ND	32.9	49	10.19
3-25	1130	ND	ND	32.1	65	ND
4-27	1320	ND	ND	32.4	69	ND
5-31	1010	8.83	ND	31.9	40	5.3
6-23	915	8.66	ND	29.5	55	ND

Table 18. Weekly levels for pH, Conductivity (mS=microsiemens), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND= Not Done

Avifauna- Twenty-eight species of bird were observed using Gallion Pond, up from the four-year average of 22.7. As in previous years, Gallion Pond continues to attract many species of birds as well as high numbers of species. The shallow sections of the pond often supported hundreds of foraging birds including Sanderling and Semipalmated Sandpiper. Gallion Pond averaged 207.5 birds per visit, up from the four-year average of 240.8. The average count for species seen in Gallion Pond was 13.3, up from the four-year average of 12.3.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Brown Pelican	3	0.50	2	325	0.24
Great Blue Heron	7	1.17	3	325	0.56
Great Egret	5	0.83	2	427	0.40
Snowy Egret	11	1.83	5	325	0.88
Little Blue Heron	4	0.67	3	427	0.32
Yellow-crowned Night Heron	1	0.17	1	623	0.08
White-cheeked Pintail	5	0.83	3	124	0.40
Black-bellied Plover	73	12.17	34	325	5.86
Snowy Plover	7	1.17	3	325	0.56
Wilson's Plover	32	5.33	13	623	2.57
Semi-palmated Plover	120	20.00	63	124	9.64
Killdeer	7	1.17	4	427	0.56
Black-necked Stilt	3	0.50	3	623	0.24
Greater Yellowlegs	2	0.33	1	325, 623	0.16
Lesser Yellowlegs	4	0.67	2	124	0.32
Spotted Sandpiper	1	0.17	1	325	0.08
Ruddy Turnstone	42	7.00	18	124	3.37
Sanderling	314	52.33	151	124	25.22
Semi-palmated Sandpiper	369	61.50	320	124	29.64
Least Sandpiper	99	16.50	95	124	7.95
Short-billed Dowitcher	2	0.33	2	124	0.16
Laughing Gull	19	3.17	10	531	1.53
Royal Tern	21	3.50	11	325	1.69
Sandwich Tern	8	1.33	7	427	0.64
Belted Kingfisher	2	0.33	1	124, 325	0.16
Least Tern	23	3.83	16	531	6.51
Willet	1	0.16	1	427	0.08
Whimbrel	1	0.17	1	623	0.16

Table 19. Birds observed in Gallion Pond during 2004.

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- Twenty-two species of bird were observed at this pond down from the 2003 total of 24 species. The mudflats along the ponds margins attracted large numbers of Black-necked Stilts and Stilt Sandpipers. Orient Pond averaged 92.5 birds per count, down from the 369.7 birds per count in 2003. The average count for species observed at Orient Pond was 8.2, down from 11.1 in 2003.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Brown Pelican	11	1.83	5	531	1.98
Magnificent Frigatebird	1	0.17	1	531	0.18
Great Blue Heron	2	0.33	2	226	0.36
Great Egret	1	0.17	1	226	0.18
Snowy Egret	51	8.50	21	124	9.19
Little Blue Heron	2	0.33	1	124, 226	0.36
Green Heron	5	0.83	2	124	0.90
American Widgeon	1	0.17	1	124	0.18
White-cheeked Pintail	22	3.67	11	623	3.96
Sora	4	0.67	2	226, 325	0.72
Wilson's Plover	5	0.83	3	427	0.90
Semi-palmated Plover	4	0.67	2	325, 623	0.72
Killdeer	1	0.17	1	325	0.18
Black-necked Stilt	226	37.67	208	124	40.72
Greater Yellowlegs	19	3.17	10	124	3.42
Lesser Yellowlegs	10	1.67	7	124	1.80
Spotted Sandpiper	2	0.33	1	226, 427	0.36
Semi-palmated Sandpiper	4	0.67	4	325	0.72
Least Sandpiper	3	0.50	3	325	0.54
Stilt Sandpiper	170	28.33	170	124	30.63
Short-billed Dowitcher	9	1.50	7	124	1.62
Tri-colored Heron	2	0.33	1	124, 226	0.36

Table 20. Birds observed in Orient Pond during 2004.

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- Twenty-nine species of bird were observed using Cul-de-sac Pond, up from the 2003 total of 15 species. Large numbers of Black-necked Stilts were often seen foraging along the margin of the pond. Groups of White-cheeked Pintails were regularly seen foraging along the eastern margin of the pond. The Cul-de-sac Pond averaged 333.8 birds per count notably higher than the 2003 average of 17.4 birds per count. The average count for species observed in Cul-de-Sac Pond was 11.8, up from the 2003 average of 4.3.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Pied-billed Grebe	1	0.17	1	226	0.05
Brown Pelican	154	25.67	120	427	7.69
Great Blue Heron	2	0.33	1	226, 325	0.10
Great Egret	7	1.17	3	325	0.35
Snowy Egret	28	4.67	15	325	1.40
Green Heron	2	0.33	1	325, 427	0.10
Yellow-crowned Night Heron	2	0.33	2	623	0.10
Green-winged Teal	2	0.33	2	226	0.10
White-cheeked Pintail	241	40.17	144	226	12.03
Blue-winged Teal	2	0.33	2	325	0.10
Ruddy Duck	2	0.33	2	325	0.10
Lesser Scaup	2	0.33	1	124, 226	0.10
Common Moorhen	10	1.67	5	226	0.50
Wilson's Plover	5	0.83	3	325	0.25
Semi-palmated Plover	142	23.67	135	427	7.09
Black-necked Stilt	766	127.67	395	226	38.24
Greater Yellowlegs	8	1.33	4	124, 325	0.40
Lesser Yellowlegs	46	7.67	16	124, 226	2.30
Spotted Sandpiper	3	0.50	2	124	0.15
Ruddy Turnstone	7	1.17	4	427	0.35
Semi-palmated Sandpiper	92	15.33	66	427	4.59
Least Sandpiper	16	2.67	16	325	0.80
Stilt Sandpiper	24	4.00	20	427	1.20
Short-billed Dowitcher	97	16.17	97	427	4.84
Laughing Gull	327	54.50	270	427	16.33
Royal Tern	2	0.33	1	325, 531	0.10
Sandwich Tern	8	1.33	6	427	0.40
Least Tern	3	0.50	2	427	0.15
Willet	2	0.33	2	531	0.10

Table 21. Birds observed in Cul-de-sac Pond during 2004.

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.

Water Test Results-

DATE	TIME	pH	CONDUCT	TEMP	SALINITY	OXYGEN mg/l
			mS	Deg C	ppt	%
1-24	1425	ND	18.46	31.7	12	9.11
2-26	1600	ND	ND	29.3	19	3.46
3-25	1315	ND	ND	33.0	32	6.11
4-27	1530	ND	ND	32.4	42	2.94
5-31	1135	8.44	ND	33.8	36	3.39
6-23	1030	8.22	ND	31.8	60	ND

Table 22. Weekly levels for pH, Conductivity (mS=parts per thousand), Temperature (C=celsius), and Salinity (ppt=parts per thousand). ND= Not Done

Avifauna- Eighteen species were observed using Grand Case Airport Pond, up from the three-year average of 17.6 species. The mixed habitat of this pond attracts a variety of waterbirds. We observed large numbers of White-checked Pintails foraging along the northern margin of the pond as well as high numbers of Black-necked Stilts foraging along the entire margin of the pond. The Grand Case Airport Pond averaged 158.5 birds per count up from the three-year mean of 79.2 birds per count. The average count for species observed in Grand Case Airport Pond was 8.2, slightly down from the three-year mean of 8.4.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Brown Pelican	101	16.83	85	531	10.62
Great Blue Heron	1	0.17	1	124	0.11
Great Egret	10	1.67	5	427	1.05
Snowy Egret	33	5.50	11	325, 427	3.47
Little Blue Heron	2	0.33	2	427	0.21
Cattle Egret	4	0.67	4	226	0.42
Green Heron	1	0.17	1	531	0.11
Yellow-crowned Night Heron	2	0.33	1	427, 531	0.21
White-cheeked Pintail	384	64.00	322	427	40.38
Common Moorhen	7	1.17	6	325	0.74
Wilson's Plover	3	0.50	2	531	0.32
Killdeer	2	0.33	1	124, 226	0.21
Black-necked Stilt	134	22.33	75	427	14.09
Greater Yellowlegs	7	1.17	3	531	0.74
Lesser Yellowlegs	27	4.50	14	325	2.84
Laughing Gull	224	37.33	195	427	23.55
Least Tern	3	0.50	2	623	0.32
Willet	6	1.00	3	531, 623	0.63

Table 23. Birds observed in Grand Case Airport Pond during 2004.

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 separate 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- Twenty-five species were observed at Grand Case Bay Pond, down from 19 in 2003. The islands in the center of the pond were good roosting habitat for White-cheeked Pintails. The deep waters over most of the pond appeared to be good foraging habitat for diving species and we observed Brown Pelicans in these areas. The shallow margins on the west end were attractive to waders and we often observed high numbers of Black-necked Stilts foraging in these areas. The Grand Case Bay Pond averaged 234.2 birds per count up from the 2003 average of 159.9 birds per count. The average count for species observed in Grand Case Bay Pond was 10.5, up from the 2003 average of 9.6 species.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Brown Booby	1	0.17	1	531	0.07
Brown Pelican	51	8.50	33	623	3.63
Great Blue Heron	1	0.17	1	124	0.07
Great Egret	20	3.33	9	531	1.42
Snowy Egret	76	12.67	36	531	5.41
Green Heron	2	0.33	2	427	0.14
Muscovey Duck	3	0.50	3	124	0.21
White-cheeked Pintail	149	24.83	44	427	10.60
Ring-necked Duck	1	0.17	1	124	0.07
Common Moorhen	31	5.17	14	531	2.21
American Coot	4	0.67	2	226	0.28

Black-bellied Plover	2	0.33	1	531, 623	0.14
Wilson's Plover	2	0.33	2	623	0.14
Semi-palmated Plover	5	0.83	4	623	0.36
Killdeer	2	0.33	2	531	0.14
Black-necked Stilt	92	15.33	39	427, 531	6.55
Greater Yellowlegs	7	1.17	5	325	0.50
Lesser Yellowlegs	6	1.00	4	325	0.43
Spotted Sandpiper	1	0.17	1	427	0.07
Ruddy Turnstone	11	1.83	6	623	0.78
Semi-palmated Sandpiper	8	1.33	7	427	0.57
Stilt Sandpiper	2	0.33	2	325	0.14
Laughing Gull	904	150.67	460	427	64.34
Least Tern	13	2.17	6	623	0.93
Willet	11	1.83	6	531	0.78

Table 24. Birds observed in Grand Case Bay Pond during 2004.

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- Fifteen species of bird were observed at this pond, up from 11 observed in 2003. The shallow waters along the east end were attractive to wading shorebirds where we saw large numbers of Black-necked Stilts. The mangroves edging the north side of the pond were good roosting habitat for Snowy Egrets. The Grand Case Airport Small Pond averaged 77.2 birds per count down from the 2003 average of 319 birds per count. The average count for species observed in Grand Case Airport Small Pond was 7.0, slightly down from 7.5 in 2003.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Great Egret	12	2.00	1	226, 427	2.59
Snowy Egret	103	17.17	55	427	22.25
Cattle Egret	1	0.17	1	124	0.22
Green Heron	1	0.17	1	226	0.22
Yellow-crowned Night Heron	2	0.33	1	325, 427	0.43
White-checked Pintail	6	1.00	4	124	1.30
Blue-winged Teal	6	1.00	6	226	1.30
Common Moorhen	23	3.83	10	325	4.97
American Coot	3	0.50	1	124, 226, 325	0.65
Killdeer	1	0.17	1	325	0.22

Black-necked Stilt	254	42.33	173	325	54.86
Lesser Yellowlegs	27	4.50	14	325	5.83
Spotted Sandpiper	1	0.17	1	226	0.22
Semi-palmated Sandpiper	6	1.00	6	325	1.30
Laughing Gull	17	2.83	13	531	3.67

Table 26. Birds observed in Grand Case Airport Small Pond during 2004.

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 appear 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- Twenty species were observed using Grand Case Town Pond, up from 14 species in 2003. We observed large numbers of Snowy Egrets and Black-necked Stilts along the ponds margins. The Grand Case Town Pond averaged 196.2 birds per count, substantially up from 15.7 birds per count in 2003. The average count for species observed in Grand Case Town Pond was 8.3, up from 4.4 in 2003.

Species	Total Birds Seen	Mean	High Count	High Count Date	Percent of Pond Mean
Brown Pelican	6	1.00	5	623	0.51
Great Egret	80	13.33	29	226	6.80
Snowy Egret	485	80.83	138	427	41.21
Cattle Egret	28	4.67	26	124	2.38
Green Heron	3	0.50	2	226	0.25
Red-breasted Merganser	1	0.17	1	226	0.08
Muscovey Duck	6	1.00	6	226	0.51
Green-winged Teal	2	0.33	2	226	0.17
White-cheeked Pintail	13	2.17	5	226, 427	1.10
Common Moorhen	26	4.33	9	531	2.21
American Coot	1	0.17	1	325	0.08
Caribbean Coot	1	0.17	1	325	0.08
Killdeer	5	0.83	3	226	0.42
Black-necked Stilt	471	78.50	267	623	40.02
Greater Yellowlegs	4	0.67	3	427	0.34
Lesser Yellowlegs	1	0.17	1	427	0.08
Spotted Sandpiper	2	0.33	1	226, 325	0.17
Ruddy Turnstone	1	0.17	1	623	0.08
Laughing Gull	34	5.67	14	531, 623	2.89
Least Tern	7	1.17	7	623	0.59

Table 27. Birds observed in Grand Case Town Pond during 2004.

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.

Island-wide, we surveyed a total of 16,412 individual birds of 49 species using St. Martin ponds. Monthly surveys averaged 2,735 birds.

Avian diversity in each pond is a vital characteristic in assessing the pond's overall health. We look here at total species represented in each pond and compare it to the island's total bird species list, to get a better idea of each pond's diversity.

Cul-de-Sac Pond was found to have the most bird species present island-wide (59%, 29 species). Cul-de-Sac Pond was found to contain good habitat, possessing large areas for safe roosting and successful foraging. The recent development of the areas surrounding this pond are a concern for the future.

Gallion Pond had the second highest count of species present (57%, 28 species). The extensive mudflats and mangrove edging provided excellent habitat for multiple species of bird.

Grand Case Bay Pond (51%, 25 species) provided good habitat for many of the islands species providing habitat for both ducks, egrets, and heron as well as wading shorebird species. The healthy mangrove areas along the edges of both of these areas provided good nesting and roosting habitat for many species of bird.

Important roosting areas were found at Lowlands Main Pond (49%, 24 species), Belair Pond (49%, 24 species), Orient Pond (45%, 22 species), and Great Salt Pond (43%, 21 species). These areas provided either protection in mangrove stands or along man-made rock walls that are commonly found in many St. Martin ponds.

During our monthly water testing of eight ponds, all of the ponds experienced slightly fluctuating pH levels. Only two of the ponds had conductivity readings low enough to be detected by our instruments, Belair Pond and Fresh Pond. Conductivity levels in these two ponds increased over the early survey period and then fluctuated. Oxygen was only measurable in two ponds, Belair Pond and Fresh Pond, due to the high conductivity levels in the other five ponds. Oxygen levels fluctuated in both ponds over the study period. Salinity was found to slightly fluctuate in all ponds. Water temperature fluctuated in all of the ponds.

Overall, the bird trends in 2004 (total species per pond, mean birds per count, and mean species per count) decreased. Our extended effort in 2004 gave us further insight into avian natural history on St. Martin, particularly to migrant bird departure dates and breeding birds nesting dates. Increased nesting habitat in the re-planted mangroves of Belair Pond and Fresh Pond was clearly evident through the increased observations of nesting birds in these areas. Many of the non-migratory waterbirds of the island including Common Moorhen, Caribbean Coot, Pied-billed Grebe, and White-cheeked Pintail, are known to nest in mangrove habitat (Brown and Collier 2001, Brown and Collier 2002).

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 both the local governments and non-profits, St. Martin's ponds will again flourish in abundance and diversity.

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Appendix A

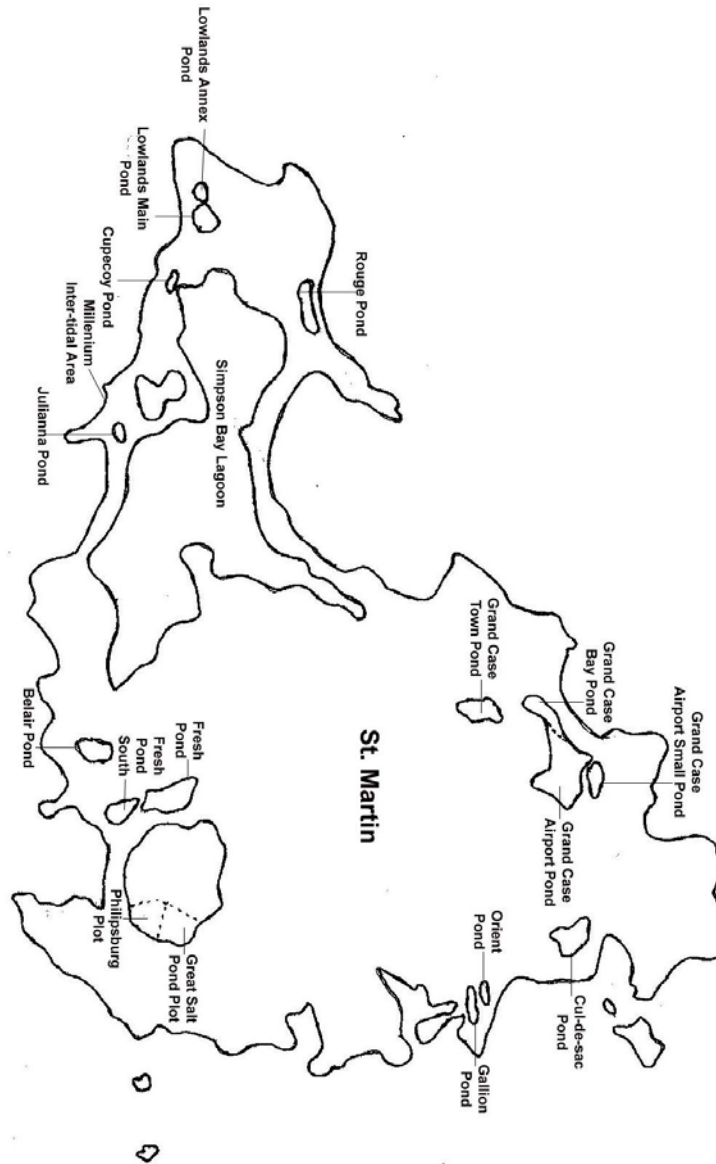


Figure 1. Island of St. Martin with identifiers for island ponds and inter-tidal areas that were surveyed during 2004.

Species	Belair	Cul-Sac	Cupe	Fresh	Fresh S	Gall	GC Sm	GC Air	GC Bay	GCTo	Gsalt	Juli	Lannex	Lmain	Mill	Ori	Pburg	Rouge
Pied-billed Grebe	1.29	0.17	0.00	1.00	0.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brown Booby	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Brown Pelican	5.86	25.67	0.00	0.67	1.00	0.50	0.00	16.83	8.50	1.00	2.43	0.00	0.00	0.00	0.00	1.83	6.83	0.00
Magnificent Frigatebird	1.00	0.00	0.00	0.67	0.29	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.17	0.00	0.00
Great Blue Heron	0.57	0.33	0.00	0.33	0.00	1.17	0.00	0.17	0.17	0.00	0.29	0.00	0.00	0.00	0.00	0.33	0.33	0.00
Great Egret	0.14	1.17	0.00	11.2	0.57	0.83	2.00	1.67	3.33	13.33	1.14	0.00	0.00	0.17	0.00	0.17	0.00	0.00
Snowy Egret	1.57	4.67	0.50	54.7	6.71	1.83	17.17	5.50	12.67	80.83	5.86	0.00	0.00	0.33	0.00	8.50	0.50	0.00
Tri-colored Heron	0.57	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00
Little Blue Heron	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00
Cattle Egret	0.57	0.00	0.00	55.8	1.14	0.00	0.17	0.67	0.00	4.67	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00
Green Heron	0.14	0.33	0.33	0.50	0.00	0.00	0.17	0.17	0.33	0.50	0.00	0.50	0.50	0.50	0.00	0.83	0.00	0.00
Yellow-crowned Night Heron	0.00	0.33	0.00	0.00	0.14	0.17	0.33	0.33	0.00	0.00	0.43	0.17	0.00	0.17	0.00	0.00	0.00	0.00
Muscovey Duck	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.50	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Green-winged Teal	0.14	0.33	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
American Widgeon	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00
White-cheeked Pintail	6.14	40.17	0.00	34.2	8.57	0.83	1.00	64.00	24.83	2.17	2.71	0.00	1.33	3.00	0.00	3.67	0.50	0.00
Blue-winged Teal	5.71	0.33	0.00	0.00	0.00	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00
Ruddy Duck	18.7	0.33	0.00	33.3	4.57	0.00	0.00	0.00	0.00	0.00	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ring-necked Duck	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Lesser Scaup	0.29	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.33	0.00	0.00	0.00	0.00
Bufflehead	0	0	0	0	0	0	0	0	0	0	0	0	0	0.50	0	0	0	0
Sora	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.67	0.00	0.00
Common Moorhen	12.4	1.67	0.00	7.83	6.43	0.00	3.83	1.17	5.17	4.33	1.71	0.00	0.00	0.00	0.00	0.00	0.33	0.00
American Coot	4.43	0.00	0.00	1.67	1.71	0.00	0.50	0.00	0.67	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Caribbean Coot	2.86	0.00	0.00	4.50	1.14	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Black-bellied Plover	0.00	0.00	0.00	0.00	0.43	12.2	0.00	0.00	0.33	0.00	4.29	0.17	3.00	0.17	2.33	0.00	1.00	0.00
Snowy Plover	0.00	0.00	0.00	0.00	0.00	1.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wilson's Plover	0.00	0.83	0.00	0.00	0.00	5.33	0.00	0.50	0.33	0.00	0.00	0.00	6.67	0.33	3.00	0.83	0.00	0.00
Semi-palmated Plover	0.00	23.67	0.00	0.00	0.00	20.0	0.00	0.00	0.83	0.00	0.00	0.50	3.50	0.33	23.50	0.67	0.00	0.00
Killdeer	0.00	0.00	0.00	0.00	0.00	1.17	0.17	0.33	0.33	0.83	0.71	0.00	0.00	0.00	0.00	0.17	0.33	0.00
Black-necked Stilt	1.00	127.67	1.00	0.17	0.00	0.50	42.33	22.33	15.33	78.50	44.43	9.17	3.17	14.17	0.00	37.7	26.17	14.17
Greater Yellowlegs	0.00	1.33	1.17	0.00	0.00	0.33	0.00	1.17	1.17	0.67	2.43	0.00	2.67	15.17	0.00	3.17	0.17	1.83
Willet	0.00	0.33	0.00	0.00	0.00	10.0	0.00	0.67	1.83	0.00	0.00	0.00	0.00	0	0.00	0.00	0.00	0.00
Whimbrel	0	0	0	0	0	0.17	0	0	0	0	0	0	0	0	0	0	0	0
Lesser Yellowlegs	0.86	7.67	2.00	0.00	0.00	0.67	4.50	4.50	1.00	0.17	4.00	1.33	4.83	18.33	0.00	1.67	3.17	3.17
Spotted Sandpiper	0.29	0.50	0.33	0.17	0.00	0.17	0.17	0.00	0.17	0.33	0.43	0.00	0.50	1.00	0.00	0.33	0.00	0.67
Ruddy Turnstone	0.00	1.17	0.00	0.00	0.00	7.00	0.00	0.00	1.83	0.17	4.71	0.00	1.17	5.50	2.33	0.00	4.33	2.00
Sanderling	0.00	0.00	0.00	0.00	0.00	52.3	0.00	0.00	0.00	0.00	0.00	0.00	16.33	8.67	0.50	0.00	0.00	0.00
Semi-palmated Sandpiper	0.00	15.33	0.00	0.00	0.00	61.5	1.00	0.00	1.33	0.00	0.86	0.50	15.00	8.83	2.67	0.67	0.00	0.00
Least Sandpiper	0.00	2.67	0.00	0.00	0.00	16.5	0.00	0.00	0.00	0.00	0.71	0.00	2.67	0.67	0.00	0.50	0.00	0.00
Stilt Sandpiper	0.00	4.00	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	5.33	3.67	0.00	28.3	0.00	2.67
Short-billed Dowitcher	0.00	16.17	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.50	0.00	0.00
Laughing Gull	0.00	54.50	0.00	31.0	0.86	3.17	2.83	37.33	150.7	5.67	847.4	0.00	0.00	0.33	1.50	0.00	22.83	0.33
Lesser Black-backed Gull	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.57	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Great Black-backed Gull	0	0	0	0.17	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Royal Tern	0.00	0.33	0.00	0.00	0.00	3.50	0.00	0.00	0.00	0.00	4.00	0.00	0.00	0.17	0.50	0.00	0.00	0.00
Sandwich Tern	0.14	1.33	0.00	0.00	0.00	1.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Least Tern	0.57	0.50	0.00	0.00	0.00	3.83	0.00	0.83	2.17	1.17	0.86	0.00	41.67	0.17	0.17	0.00	0.00	0.00
Belted Kingfisher	0.00	0.00	0.00	0.00	0.00	0.33	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.17	0.00	0.00	0.00

Table 28. Mean birds per species observed per pond during 2004 surveys.