Status of the Hawksbill turtle (*Eretmochelys imbricata*) on the Dutch Caribbean Islands of St. Maarten, St. Eustatius and Saba.

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June 2004

Introduction

Of all sea turtle species occurring in the Caribbean, the hawksbill turtle (*Eretmochelys imbricata*) (Linnaeus, 1766) is one of the most threatened species. The species is listed on the IUCN *Red List* as Critically Endangered (Baillie and Groombridge, 1996-*IUCN Red List of Threatened Species*), based on global population declines of 80% or more during the last three generations (105 years) and projected declines over the next three generations. For its worldwide survivorship the hawksbill turtle is mainly depending on nesting and foraging sites on the Indian Ocean Archipelagos, the Indonesian Archipelago, Australia and within the wider Caribbean region (Meylan & Donnelly, 1999). Worldwide the hawksbill populations, and all other populations of sea turtle species, still face severe declines due to harvesting and poaching of individuals and eggs, loss of nesting and foraging sites, incidental capture in fishing gear, ingestion of and entanglement in marine debris, oil pollution and boat collision (NMFS and USFWS, 1993; Lutcavage et al., 1997). Especially the illegal, commercial trade of hawksbill carapaces still causes severe declines among populations worldwide for this species (Carr, 1972; Mack et al., 1979; Nietschmann, 1981; Mortimer, 1984; Milliken & Tokunaga, 1987; Groombridge & Luxmoore, 1989; Meylan, 1989; Eckert 1995; Limpus, 1997; Palma, 1997).

In some parts of the wider Caribbean the population status of the hawksbill is unknown. Meylan (1999) reports that on the Netherlands Antilles (Bonaire, Curacao, Saba, St. Eustatius, St. Maarten) no estimates are available for the status of the hawksbill turtle populations. Nesting is reported to be rare (Meylan, 1983; Van Buurt, 1984; Sybesma, 1992). Sybesma (1992) stated that hawksbills appear to be much depleted from their former numbers in the Netherlands Antilles.

Still little is known about the migratory, foraging, and reproductive behavior of the hawksbill turtle within the wider Caribbean. For two decades, with limited evidence to the contrary, the hawksbill has been labeled as a non-migratory, or even sedentary (Witzell, 1983). Scientific data about foraging populations (all individuals from all life classes foraging on adjacent reefs year round without showing reproductive behavior) at the Netherlands Antilles are unavailable. Bowen et al. (1996) showed that the foraging population of Mona Island, Puerto Rico, largely consisted of turtles of several distant rookeries. The Republic of Cuba (1997) summarized results of similar studies carried out in both Mona Island, Puerto Rico and Cuba. These results showed similar outcomes.

However, different nesting populations seem to be genetically isolated in terms of maternal lineages, and thus represent distinct stocks (Bass, 1996, in Bass, 1999). This suggests that very little exchange of reproductive adults occurs among geographically separated nesting populations. These studies, combined with tag-return studies (see for a summary Meylan, 1999b), indicate that hawksbill turtles within the wider Caribbean seem to have a clear reproductive migratory behavior with little opportunity for gene flow; they exhibit small neighborhood sizes despite much migration between hatchling and adult stage. Furthermore these studies implicate that harvesting of (sub-) adults in foraging areas might influence survival of distant nesting populations.

Because of limited gene flow, these small nesting populations might be in danger of inbreeding. Multiple paternity, several males contributing to the offspring in a single clutch, might be an inhibiting factor for inbreeding. Hard evidence for multiple paternity among marine turtles has first been detected in the Olive Ridley turtle (*Lepidochelys olivacea*) (see Hoekert et al. above). Multiple paternity in hawksbill reproduction has not been studied yet.

In 1999 the CITES-meeting turned down the proposal of the Republic of Cuba (1997) to down list the Atlantic hawksbill population from Appendix I. Cuba's demand for the legitimacy of harvesting and selling (stocked) carapaces was received as a severe threat for the survival ship of the Atlantic, and thus the wider Caribbean, population by many sea turtle researchers and conservationists. Cuban territorial waters probably contain the most important feeding grounds within the wider Caribbean for the hawksbills turtle.

Background.

It is possible that both the nesting and foraging hawksbill populations of St. Maarten, Saba end St. Eustatius visit Cuban waters. In this case the presumably low population sizes (see Meylan, 1983; Van Buurt, 1984; Sybesma, 1992) might still be under severe thread. The Ph.D.-study proposes that both nesting and foraging hawksbill populations of the Dutch Caribbean Islands of St. Maarten, St. Eustatius and Saba will be ecologically and genetically studied in terms of population monitoring, nesting behavior, nest ecology, and population genetics to determine reproductive and migratory behavior and genetic population structure. Ecological (direct) and genetic (indirect) approaches are complementary and essential to get to a complete insight into population structure and dynamics.

The ultimate goal of the Ph.D.-study is to come to a better understanding of the ecology S.L. of the hawksbill turtle within the Lesser Antilles and the wider Caribbean in order to optimize conservation management on the three Dutch Islands, within the Lesser Antilles and within the wider Caribbean by integrating the results with other recent studies. The complete proposal can be found in Appendix III.

Objectives.

As mentioned before, on St. Maarten, Saba end St. Eustatius no long-term studies have been executed on the hawksbill turtle and sea turtles in general. All actual knowledge is based on three surveys (Meylan, 1983; Van Buurt, 1984; Sybesma, 1992).

In order to optimize fundraising efforts, a pilot-study will help valuing objectives for the Ph.D.-proposal. The objectives of this pilot study are:

1. To explore and determine the study area (nesting and foraging area) on St. Maarten, Saba and St. Eustatius.
2. explorative monitoring of the nesting and foraging hawksbill turtles on St. Maarten, Saba and St. Eustatius.
3. to establish contact with local conservation and research institutes on St. Maarten, Saba and St. Eustatius to build up a supportive network.
4. to gather all (historical) information possible.

General description.

St. Maarten.

St. Maarten, situated between Anguilla and St. Bartholomew, is situated northeast in the island arc of the Lesser Antilles, extending from the Virgin Islands to Venezuela (Westermann, 1957) (fig.1). The island (18°05'N, 63°03'W) consists of a French (52 km^2) and a Dutch part (34 km^2) (De Palm, 1985). The actual number of inhabitants is unclear due to illegal migration, but the population is estimated around 70.000 people.

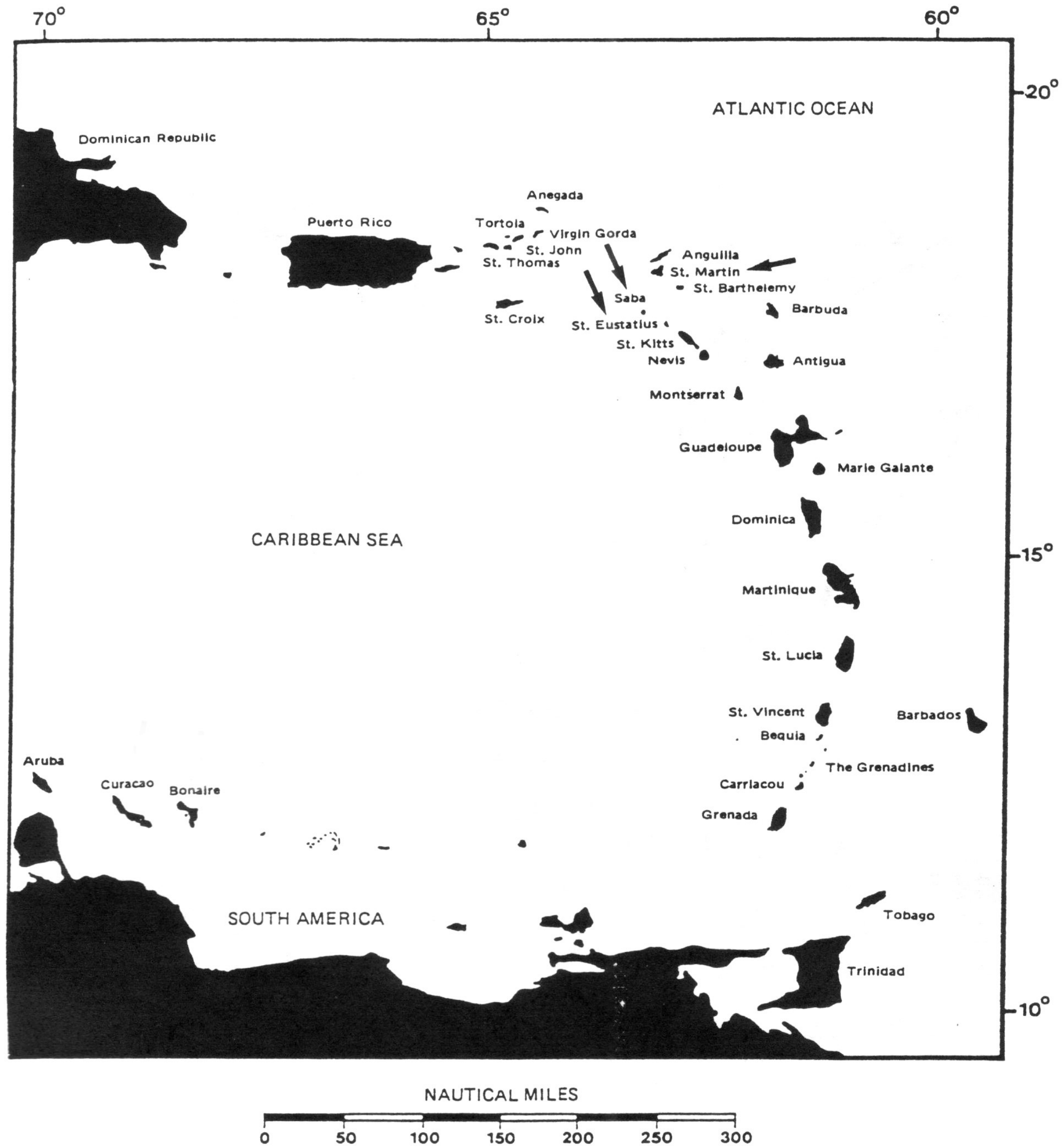

Figure 1: Map of the island arc of the Lesser Antilles, extending from the Virgin Islands to Venezuela. St. Maarten, St. Eustatius and Saba are pointed out with arrows. Map source: ECNAMP, 1980.

The climate of St. Maarten is tropical (the average temperature in the coldest month is above 18º C) and according to the system of Köppen falls between a savanna and a monsoon climate (Stoffers, 1956). The average yearly temperature is 26.8 ºC (1961-1990; CBS, 1996). The temperature variation over the year is small. January and February are on an average the coldest months with 25.2º C, and August and September are on an average the hottest months with 28.2º C. (1961-1990;Centraal Bureau of Statistics, 1996). The dominant wind direction is east (De Palm, 1985). All three Windward Islands are located in the Atlantic hurricane zone. On average one tropical storm or hurricane passes at a distance of less than 200 km each year. Once every 4 or 5 years hurricane conditions occur.

Sybesma (1992) reports that the island has developed in recent years into a thriving tourist destination and that the beaches on the southern coast are among the most commercially developed in the Eastern Caribbean. Around 1990 the number of visiting, stay-over tourists was about 400.000 per year (Central Bureau of Statistics, 1989). Nowadays, due to improved cruise and flight facilities this number easily equals 1.300.000 visitors per year (Central Bureau of Statistics, 2001). Most beaches of the island are commercially developed (see picture 1, 7, 9 and 13), bordered by private or commercial resorts or such are under construction or planned.

Furthermore Sybesma (1992) reports that the island has several sheltered sandy beaches and that offshore the substrate is sandy with turtle sea grass (*Thalassia testudinum*), with well-developed coral reef patches in certain places. Recent reef monitoring (Caballero, pers. comm.) showed on three well developed reefs (Molly Beday Reef, Hens and Chickens, Mike's Maze) the overall percent hard coral cover at 29.8%, percent algal cover at 27.1%, and percent bottom cover by soft coral at 22.9%. Percent bottom cover by *Palythoa spec.* (8.4%), abiotics (5.6%), and other biotics (anemones, sponges etc.) (6.2%) were lower.

For a good overview of St. Maarten see figure 2.

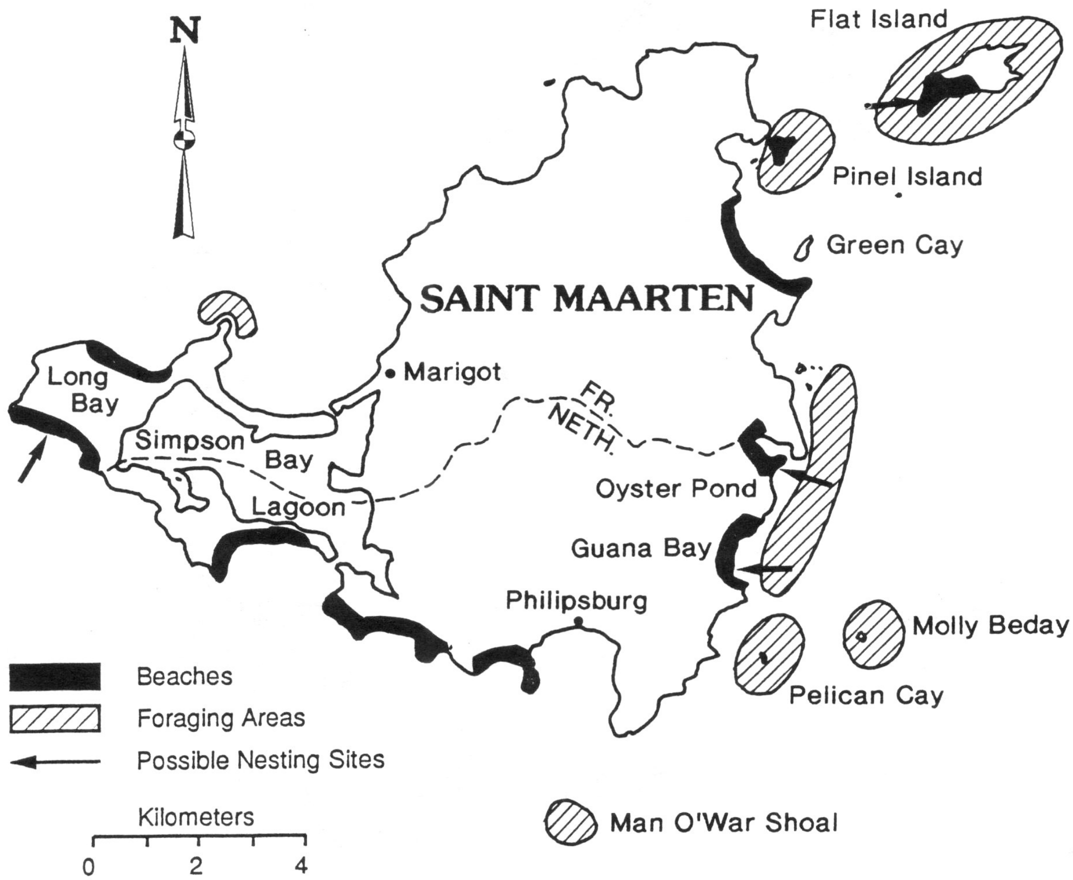

Figure 2: Map of St. Maarten with reported sea turtle nesting and foraging areas. Source: Sybesma, 1992 (modified from Meylan, 1983).

St. Eustatius.

The 21 km² island (Land Register, 1997) of St. Eustatius (17°49'N, 62°98'W) is situated 63 km straight south of St. Maarten and has and has a population of 2373 inhabitants in 2003 (Central Bureau of Statistics, 2003) (see fig.1).

The climate of St. Eustatius is tropical (the average temperature in the coldest month lies above 18º C) and according to the system of Köppen falls between a savanna- and monsoon-climate (Stoffers, 1956). The average rainfall is 1072.7 mm per year (1881-1980, Oranjestad) (De Palm, 1985), but the deviation of yearly rainfall is large. The monthly rainfall is very irregular too. No clear wet or dry season can be distinguished. Lazell (1972) calls St. Eustatius and Saba "Snag-islands". This type of island has one high peak (more than 600 m high) that arrests (snags) a few clouds and is able to hold on to them mainly because of evaporation from the island itself. The lowlands of these islands are very dry. The average yearly temperature is 25.7º C (1959-1980; De Palm, 1985). The dominant wind direction is east. St. Eustatius is situated in the Atlantic hurricane zone. On average one tropical storm or hurricane passes at a distance of less than 200 km each year. Once every 4 or 5 years hurricane conditions occur (De Palm, 1985).

The island has a few sandy beaches. The only well-developed beach is Zeelandia (see picture 16 and 17). According to Sybesma (1992) the southwest coast has well-developed coral reef ridges, interspersed with sandy channels, with some shallow patches near Jenkins Bay and Kay Bay. On the Atlantic side some coral development can be found on steep slopes near shore; in deeper water, coral patches and ridges occur in a mixed coral, sponges and algae community.

For a good overview of St. Eustatius see figure 3.

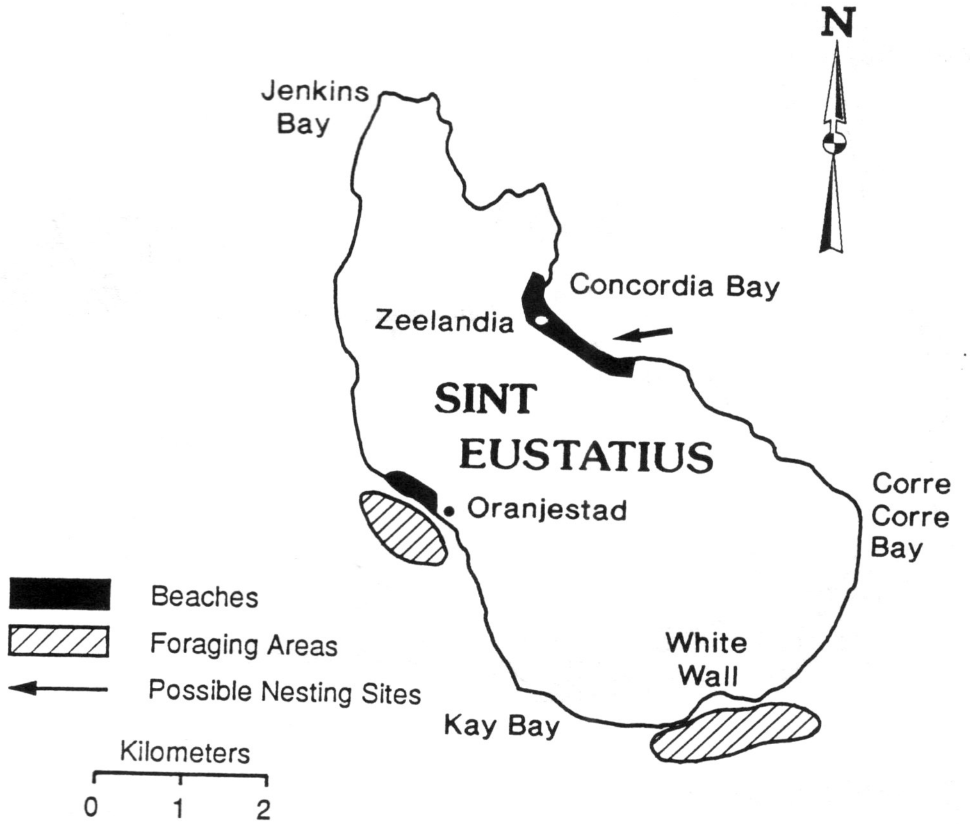

Figure 3: Map of St. Eustatius with reported sea turtle nesting and foraging areas. Source: Sybesma, 1992 (modified from Meylan, 1983).

Saba.

The 13-km² island of Saba (17°□□’N, 63°14’W) (De Palm, 1985) has 1383 inhabitants in 2003 (Central Bureau of Statistics, 2003) and forms an island triangle with St. Maarten (48,1 km) and St. Eustatius (33,6 km) (Land Register, 1997).

The climate of Saba is tropical (the average temperature in the coldest month lies above 18º C) and according to the system of Köppen falls between a savanna- and monsoon-climate (Stoffers, 1956). The average rainfall is 1101.3 mm per year (1891-1980, rain station in The Bottom), but the variation in yearly rainfall is large (De Palm, 1985). The monthly rainfall is very irregular too. No clear wet or dry season can be distinguished. Every 'wet' month may be dry and every 'dry' month may be wet. Like St. Eustatius, Saba is called a “Snag-islands” (Lazell, 1972). The average yearly temperature on Saba is probably the same as on St. Eustatius: 25.7º C (De Palm, 1985). The dominant wind direction is east. Saba is situated in the Atlantic hurricane zone. On average one tropical storm or hurricane passes at a distance of less than 200 km each year. Once every 4 or 5 years hurricane conditions occur (De Palm, 1985).

Saba is a steep, dormant volcano and has very steep shores (see picture 18). The island is surrounded by fringing reefs and has a few seasonal beaches (see picture 19) from about April to October (Sybesma, 1992). Both the islands of Saba and St. Eustatius are in the proximity of the Saba bank. This shallow underwater bank has some well-developed coral reefs and algae fields. According to the Saba fishermen, both habitats (reef and algae) serve as feeding grounds for green turtles and hawksbills (Sybesma, 1992).

For a good overview of Saba see figure 4.

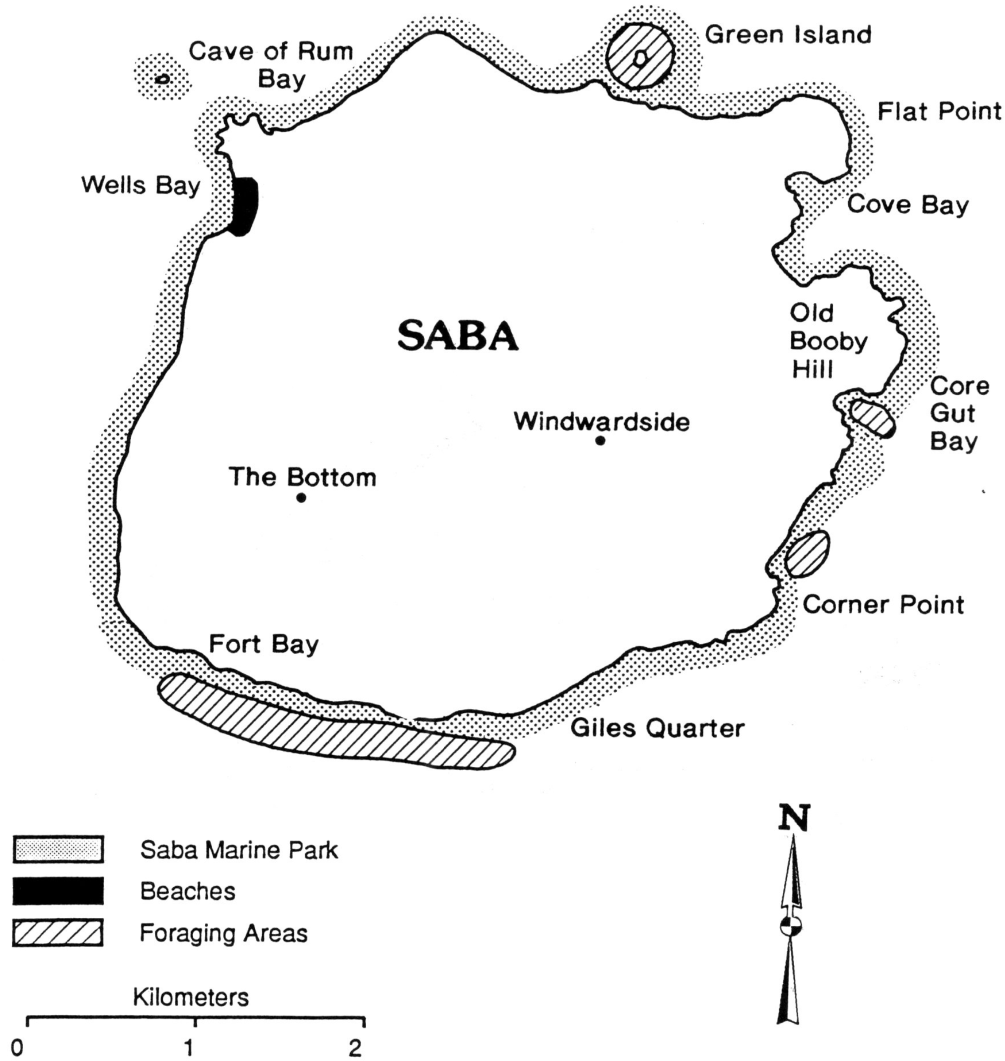

Figure 4: Map of Saba with reported sea turtle nesting and foraging areas. Source: Sybesma, 1992 (modified from Meylan, 1983).

Historical conservation efforts.

Next passage is a summarized description and free translation of sea turtle biology and conservation in the West Indies around 1900. Dr. J. Boeke, then lector at the University of Leiden, the Netherlands, published a report (Boeke, 1907) about his study on the status of the fishery and industry of sea products, on behalf of the Minister of Colonies of the Dutch government.

The local communities of the Dutch West Indies knew several species of sea turtles. Most common species were the green 'or eatable' turtle and the hawksbill turtle. These species represented high trade values; the green turtle for its meat and the hawksbill turtle for its shield. On top of this the eggs of both species were a very wanted delicacy. Furthermore, loggerhead and 'several other species' were reported.

Curacao fishermen described 7 species: next to green turtle and hawksbill turtle they distinguished 'de Cawama', 'de roemkop', 'de dikkop', 'de vliekop' and 'de driekiel'. Because he has not seen specimen of these five 'species', Boeke has not been able to verify 'if these were indeed different species and, if yes, which species'. Though he suggests that with the 'Dikkop', literally 'thick head', the loggerhead turtle might have been mentioned. Nowadays in the local language the 'Cawama' stands for the loggerhead turtle and the 'Driekiel' stands for the leatherback turtle.

Boeke speaks of declining numbers of turtles. He does not mention whether it concerns the nesting population, sightings or catch. In his view, when no measures were being taken to minimize the ongoing slaughter or other means of preserving the species were being taken, the slaughter soon would end up in extinction of the sea turtles in the West Indies. The turtles were said to withdraw to less visited or uninhabited smaller islands. But even there they were being hunted and numbers were declining.

Center of the sea turtle trade in the West Indies was Jamaica; in 1899 export of live green turtles (mainly to England) and hawksbill carapaces valued about £10.000,-. Most turtles were being caught near the Mosquito Coast in Central America and near the neighboring small islands (cays). Smaller amounts come from Cuba and the Pedro- and Morant cays. Captive turtles were hold in crawls and fed with *Zostera marina* ('dulce') until being transported.

Official reports on turtle export from the Dutch islands mentioned 1 sold green turtle from St. Maarten (fl3,-) and table 1 shows figures of trade in hawksbill turtle meat from St. Eustatius from the beginning of the 19th century:

Table 1	1899	1900	1901	1903
Kilograms	6	10	1	25
Price in fl.	48,-	100,-	22.50	375,-

Eggs were mostly found on the Windward Islands and sold by private contact, so no details on amounts could be given. Prices of eggs were between fl 0.03 and fl 0.05.

Complaints about the continuing decline of the amount of turtles in the West Indies increased, so Boeke proposed measures to prevent regional extinction:

- No catch of specimen during the breeding season. An identified difficulty was that only collaboration between states would have effect. Furthermore a total prohibition would cause a considerate decrease of income for the already poor local community. Therefore this measure was thought to be unlikely to succeed.

- Convincing fishermen not to harvest nests and catch small turtles and sell juveniles as pets. As long as there was a good market for these products also this option was thought to be doomed to fail.

- Turtle farming. Basic knowledge about sea turtle biology comprehended facts like 'turtles are very fertile and lay 200-600 eggs in 2-4 parts in different nests. It takes 6 to 7 weeks until hatching. Most die in the first few weeks after hatching.' Protection during this period was considered to be helpful. Captive breeding of juveniles was considered to be easy. Boeke reports several places where turtles were kept in tubs and 20 turtles in a stone reservoir on Bonaire. Captive breeding of hatchlings seemed to be more of a problem, though on Great Inagua, Bahamas, eggs had been incubated and hatchlings had been raised successfully for several years. With the results of these efforts, Boeke did a similar attempt on Curacao, with marginal success; the local population was reluctant to sell eggs. Boeke has been searching for more suitable places, and found 'little Mullit Pond', an inlet of the Simson Bay Lagoon the sole potential place on the Windward Islands, but saw the danger of destructive hurricanes as a difficulty. Whether turtles have been bred on St. Maarten, stays uncertain.

Boeke also reports early migration records of turtles 'caught near the Mosquito coast, brought to Jamaica, escaped because of a hurricane and caught again near the Mosquito coast, apparently returned to their natal grounds ±6oo miles away.'

St. Maarten.

Historical Background.

Inhabitants of St. Maarten have always been depending on fishing for a sufficient protein diet. Obviously sea turtles and their eggs must have been part of this diet. Concerning fishing first known recordings come from a Dutch governmental report written by Boeke (1907). He reports that the local fish fleet used 20 sea turtle nets, mostly fly nets, deep 6 to 8 fathom (11-14.6 meter), with meshes of 30 to 40 cm. (after the Curacao type), and two long nets for catching smaller sea turtles, deep 30 to 40 fathoms (55-73 meter), with meshes of 15 to 25 cm.

Furthermore Boeke (1907) reports that dragnets and drift nets were used exclusively in Simson bay and Simson Lagoon, and the sea turtle nets also around the rocky islands east of St. Maarten, the Pelican Rocks and the Molly Beday Rocks (see fig.2), until Anguilla. However, annual catch did not exceed 50 to 60 individuals.

Locals speak of regular sightings during daily spearfish and free-dive activities in the sixties and seventies(pers. Comm.). Meylan (1983) reported that “a few hawksbills” nested at Guana Bay and Oyster Pond on the windward coast of St. Maarten, at Long Bay on the southwestern tip of the island, and on Flat Island; copulating had been observed in the Oyster Pond area (see fig.2).

Actual status.

Meylan (1983) reported the following nesting sites: Baie Longue, Guana Bay, Dawn Beach and Tintamarre; numbers of nesting are not given though described as ‘rare’. In a more recent report, Tranchart (2001) adds the following beaches to the nesting sites above: Baie Rouge, Mullet Bay Beach, Gibb’s Bay, Baie Embouchure, Baie Orientale and Pinel. The Nature Foundation of St. Maarten names two more beaches as nesting sites, Cupecoy beach and Maho beach, though numbers of nesting on these beaches are reported ‘unknown’ (see table 3). Table 2 shows all hawksbills activities observed during Trancart’s monitoring period from 13-6-2001 until 6-9-2001.

Table 2: number of hawksbill activities per beach during 13/6/2001-6/9/2001:

Mullet Bay Beach	3
Baie Embouchure	3
Gibb’s Bay	2
Baie Orientale	1
Guana Bay	1
Pinel	1

The Nature Foundation of St. Maarten reports 30 identified nests during the 1998-2002 nesting seasons (pers. comm., see table 3), with no specification on which species:

Table 3:

Species:	Nests:
Dawn Beach	4
Guana Bay Beach	3
Gibb’s Bay	6
Simpson Bay Beach	6
Mullet Bay Beach	11
Cupecoy Beach	Not known
Maho Beach	Not known

In 2003, during the monitoring period , nesting only occurred on Baie Longue, Mullet Bay Beach, Gibb’s Bay, Simpson Bay Beach, (see table 4).

Table 4: Monitoring period 2003: 15/7/2003-7/8/2003:

Date:	Species:	Beach:
July 15th	Hawksbill	Simpson Bay Beach *
July 29th	Hawksbill	Gibb’s Bay
August 6th	Hawksbill	Mullit Bay Beach
August 7th	Leatherback	Baie Longue

* source: local newspaper

With the assumption that the timing and distribution of the nesting emergences are similar amongst nesting sites in the eastern Caribbean (Kerr et al., 1999) and using estimates of the average proportion of the annual nesting cohort over 11 years (sighting probability, P) "encountered" by surveys lasting 18 days (fig.5), the method, Kerr et al. provides to estimate population size by using a limited monitoring period, can be applied:

$N=M*1/P$

N = Expected numbers of nesters for n nights of a saturation all-season survey.
M = Number of individual nesters sighted in a partial-season survey.
P = Sighting Probability

The 18-day (20/07/2003-06/08/2003) monitoring period has been done on 5 target beaches defined by the St. Maarten Nature Foundation (Dawn Beach, Guana Bay, Gibb's Bay, Simpson Bay beach and Mullet Bay Beach). With P = 0,37 (fig.7) and M = 2:

$N = 2 * 1/0,37 = 5,4$

This means that on average 5,4 hawksbill female individuals are expected to nest on these 5 target beaches annually. Affirmation of this estimation is almost impossible, since the turtles do not nest on these five, regularly monitored, target beaches alone; St. Maarten, including the French side has many beaches and most are not monitored.

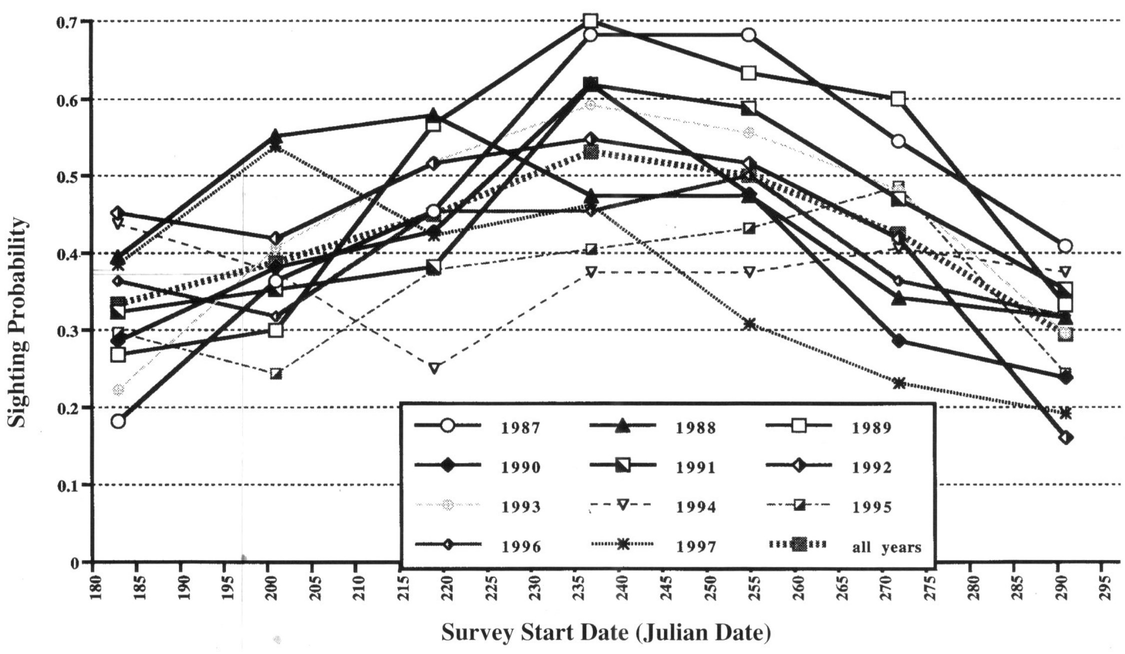

Figure 5: Estimates of the proportion of the annual nesting cohort (sighting probability, P) "encountered" by surveys lasting 18 days. Jumby Bay hawksbills, 1987-97. Source: Kerr *et al.*, 1999.

Current foraging areas for hawksbill turtles and occasional green turtles are said to be situated on the east side and south of the island, mainly on the reefs of Pointe du Bluff, The Gregory near Mullet Bay, Isabelia and the Bridge near Simpson Bay, Proselyte reef, Pinel island and Tintamarre and around the rocks of Molly Beday, Hens and Chicks, Cows and Calves and Pelican Cay (see fig.2). Occasional sightings are reported from the sea grass beds at the south west side of St. Maarten (pers. comm.). During daily free dive sessions around the island on most of these foraging areas except for the rocks, only one hawksbill has been spotted (juvenile) in a month period, though far out of the shore (Proselyte reef).

Locals report frequent sightings until about 20 years ago, on certain spots (Tintamarre, Guana Bay) several specimen per (free) dive session. Many were spear gunned for sports (pers. comm.). There is no evidence that this is still the case, though during Carnival turtle meat is still being sold.

Beach descriptions.

The Nature Foundation of St. Maarten has identified seven target beaches on the Dutch side of the island (figure 2), where most of the monitoring is being focused on. The following beaches were designated as target beach:

Dawn Beach.

Situated on the east side, just south of the border with the French part of the island, Dawn beach consists of two parts.
Part one stretches out for about 150 m in front of a big resort (see picture 1). The beach is narrow, bordered by a fence, filled with beach chairs and other equipment and has no natural vegetation.
The second (sse picture 2 and 3) part lies in front of an abandoned resort and is about 350 meter long, on average 10 to 20 meters broad, with some shrubs and other low vegetation behind the beach. The incoming trade winds can cause significant surf, though a surrounding reef protects the beach.

Red Pond Beach.

This beach on the south east side of the island is about 30 meter long and very narrow. It is enclosed by cliffs and there for has a stony character. This gives the beach an unsuitable look for nesting, though nesting have been recorded.

Gibb's Bay.

The beach of Gibb's Bay, just north of Guana Bay (see picture 4) stretches for about ± 80 meters and is on average 10 meters wide with shrubs and dense bushes behind it (see picture 5). Adjacent reefs prevent a rough surf because of incoming trade winds, so accessibility for nesting is good. The beach is only sporadically visited by people and illuminated by surrounding, but distant, estate is of no influence.

Guana Bay.

This beach is situated on the southeast part of the island. The dominant wind direction during the nesting season is land inward, which cases rough waves. Adjacent reefs in combination with the wind cause strong surge currents, which might influence accessibility of the beach. The beach is about 600 m in length and up to 30 m broad at certain points (see picture 6). Dense bushes separate the beach from the land behind, designated for private resorts. These bushes were left to create a natural barrier against illumination from these resorts. At the north point of the beach a hotel/bar/restaurant has its residence, though illumination of the beach seems limited.

Simpson Bay Beach.

Simpson Bay Beach is the longest of the 7 target beaches with a length of about 3 km. The beach is situated south of the land surrounding the Simpson Bay Lagoon, and adjacent to the international airport. Almost half of the beach, mainly the eastern part, is being developed with private and commercial resorts (see picture 7). There for the eastern side is very narrow and highly illuminated. The middle- and western part is about 20 to 40 m wide with almost no light influence at night (see picture8).

Maho Beach.

Maho beach is a small and narrow beach strip of about 100 m. It's divided in two parts by rock formations, enclosed by two very big tourist resorts on both sides and the beginning of the air strip in the middle and with a night bar on the beach (see picture 9 & 10). Beach erosion made this beach even more unsuitable for nest attempts, though nesting has been recorded until recently.

Mullet Bay Beach.

Mullet Bay Beach is a about 450 m long and up to 50 wide, including vegetated area's in the south east corner. The orientation of the beach is southwest to northeast, so the dominant wind is seaward. A golf course is situated behind the beach, so illumination is limited. Despite its popularity amongst tourists for daily visits, Mullet Bay Beach is best-known nesting site on the Dutch part of St. Maarten.

St. Maarten has several more beaches. Some beaches, like Cupecoy Beach (see picture 11) and Cay Bay Beach, are remote and uninhabited, though nesting does not seem to occur on these beaches. The same is the case for Grand Bay Beach, Little Bay Beach and Kim Sha Beach (see picture 12) amongst others. Beaches like these are highly developed for the tourist industry and are thus unlikely to host nesting turtles.

The French part of St. Maarten has many beaches too and several of those are known as nesting beach. The Following beaches have been subject to monitoring activities in the past.

Baie Longue.

Baie Longue, situated on the west side of the island, is a quiet beach with of about 1 km long and on average 20 to 30 m. wide. The dominant wind direction during the nesting season is mostly along the coastline, which makes the surf quiet and easy to access. Fences and/or vegetation of private estate, which makes illumination levels are relatively low, border most of the beach (see picture13).

Baie aux Prûnes.

Baie aux Prûnes, next to Baie Longue, has almost the same characteristics, though it's length is approximately 450 m (see picture14 & 15). Wind direction is away from the beach, which makes the surf very calm and thus easy accessible.

Baie Orientale.

Though Baie Orientale, on the north east coast, is known as the most important nesting beach of the entire island, it is also the most touristy developed and visited beach, with restaurants and hotels on the beach and enclosed solely by hotels and commercial resorts, which all cause a great deal of illumination. During the daytime activities like parasailing, jet skiing, water-skiing and kite surfing are dominant features. At night boats, beach chairs and other equipment are left on the beach. Even if nesting still occurs, it won't be for long.

Pinel.

Pinel is very little island just north of Baie Orientale. It has a small and narrow beach, where nesting have been reported on the northern and western shore. The coastal zone of the entire island is part of Marine reserve, though the beach on the west side is frequently visited. Its position near to areas with dense tourist accommodation and water sport activities makes its potential as a nesting habitat uncertain.

Baie Embrouchure.

This beach of about 1.5 km long is situated just south of Baie Orientale, but has totally different features. Except for one hotel, this beach is almost entirely surrounded by vegetation and is part of a nature reserve. The beach is facing the incoming trade winds, though a reef and a little island prevent a rough surf. Water sport activities are present but limited.

Tintamarre (Baie Blanche).

Tintamarre, or Flat Island, situated north east of St. Maarten in the French Marine Reserve, has two beaches. The beach on the southwest end of the island has a rough, incoming surf, despite a protective reef and thus consists mainly of coral gravel, which is not favorable for successful nesting. The beach on the west side, called Baie Blanche, is known as a nesting beach. Its size differs due to periodic erosion and accretion, despite its leeward position protecting it against a rough surf. Most of the coastal zone is declared natural reserve, though boats visit Baie Blanche daily.

If nesting does occur on Baie aux Prunes, Baie Nettle, Galisbay Beach, Baie de Grand Case, Anse Marcel, Baie de Petites Cayes, Grandes Cayes and Baie Lucas is not known. Still no monitoring has taken place on these beaches and reports of nesting are not known, except for Friar's Bay Beach and Happy bay Beach (pers. comm.).

Reef description.

Sybesma (1992, modified from Meylan, 1983) has identified several reported foraging areas for sea turtles. Turtles were reported in the vicinity of the eastern shore reefs and around offshore reefs: Cupecoy to Plum Bay, Molly Beday, Pelican Rock, Cow and Calves, Grouper Rock, East of Tintamarre (see fig.2).

Recent recordings of turtle sightings cover Pinel and Hens and Chicks on the eastern side of the island and Proselyte reef, Isabelia, The Bridge and the Gregory on the southern side (pers. comm.).

Recent reef monitoring (Caballero, pers comm.) showed on three well developed reefs (Molly Beday Reef, Hens and Chickens, Mike's Maze) the overall percent hard coral cover at 29.8%, percent algal cover at 27.1%, and percent bottom cover by soft coral at 22.9%. Percent bottom cover by *Palythoa spec.* (8.4%), abiotics (5.6%), and other biotics (anemones, sponges etc.) (6.2%) were lower (see fig.6).

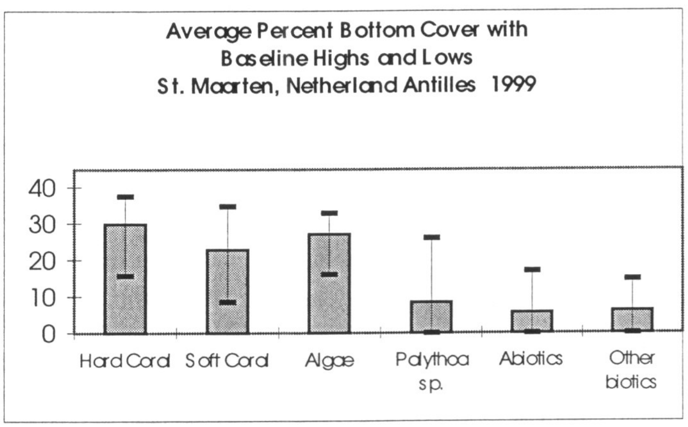

Figure 6: Source Caballero, Pers. Comm..

Nowadays most reefs in the vicinity of the beaches are severely damaged because of tourist activities, water sports and hurricanes, though many reef fish species appear to be abundant. However, turtles, as said, are rarely seen in the vicinity of the beaches.

St. Eustatius.

Historical background.

Also the inhabitants of St. Eustatius have a long tradition of fishing. Boeke (1907) reports that the St. Eustatius fisherman owned 25 sea turtle nets, 20 fathoms long (36.6 m.) and 3 fathoms deep (5.5 m), with meshes of 30 cm width (knot to knot). They were being put out along the coast, mostly in bays on the north side of the island (Concordia Bay, Turtle Bay). Except with nets also long lines and towlines were used to catch sea turtles amongst others.

More recently, Van Buurt (1984) speaks of fisherman reporting foraging hawksbills in the waters of St. Eustatius, specifically in Tumble Down Dick and Jenkins Bays.

Residents frequently site Zeelandia, in Concordia Bay, as a turtle nesting area (Van Buurt, 1984). According to Meylan (1983) small beaches at Nap, Corre Corre Bay (east point), Kay Bay and Crook Bay (south west side) may be used (see fig.3).

Sybesma (1992) speaks of green and hawksbills turtles that apparently nest on rare occasions, most likely on the Atlantic shore, and that no nesting has been reported from Oranjestad, the second-largest beach on St. Eustatius.

During a 1992 marine area survey of St. Eustatius by Tom Van’t Hof and Jeffrey Sybesma, small to medium-sized hawksbill turtles were regularly encountered. In some cases the turtles were quite tame and could be touched by hand by SCUBA divers, especially off the southwestern coast of the island, which is characterized by well-developed coral reefs (White Wall) (Sybesma, 1992) (see fig.3).

Actual status.

Sybesma (1992) reports that there is no longer any nesting along the Caribbean side of St. Eustatius, where the beach was washed away, probably due to changes in currents. A dive station situated at this side reports 1 nest per 2 to 3 years in their 'backyard'.

At the windward side of the island there is one beach, stretching from Concordia Bay to Zeelandia Bay (see fig.3). The St. Eustatius National Parks Foundation (STENAPA) has been carrying out a monitoring program on this sole beach of St. Eustatius, since the nesting season of 2002 (see table 5).

Table 5: Sea turtle activities on Zeelandia Bay in 2002 and 2003.

	2002	**2003**
Hawksbill; activity/nests	1/0	4/0
Green Turtle; activity/nests	3/1	3/0
Leatherback; activity/nests	0/0	9/0
Unknown; activity/nests	4/2	0/0

Apparently this beach is suitable for nesting, though successful nesting or even hatching only occurs sporadically. This may be due to the effect of the beach dynamics. Relocation of laid nests to a more safer and suitable place might be of help in the efforts to re-establish a successful rookery on St. Eustatius.

Dive stations and STENAPA staff report frequent encounters with foraging and resting hawksbill turtles on reefs at the entire west side of the island. Sightings occur 'on average every second dive'. More frequent sightings occur during night dives, when '5 encounters per dive are no exception'.

Turtle hunting and incidental capture is said to be absent, since the marine park is well protected, though locals report sporadic illegal spear fishing now and then (pers. comm.). St. Maarten locals suggested that the origin of the carnival turtle meat lies in these waters.

Beach description.

At the moment St. Eustatius has only one beach where nesting does occur. This beach, called Zeelandia Beach, is situated on the eastern (windward) side of the island. It dramatically differs seasonally and annually, because of strong erosive and accretive forces. At the southern stretch vegetation is bordering the beach (see picture16), while most of its length cliffs enclose the beach (see picture 17).

Apparently there is no significant beach at the Caribbean side of the island (see above).

Reef description.

The reefs of St. Eustatius are situated on the western (leeward) side of the island, stretching from north to south (see fig.7). Most reefs are unspoiled and in very good shape; hard and soft corals, sponges, reef fish and other biotic and a-biotic elements are very diverse and highly abundant. Most reefs are protected as part of the St. Eustatius Marine Park Reserve.

Tourist activities and water sports are sparse and appear to leave the reefs unaffected. Diving activities are only possible with STENAPA-permits and under supervision of guides and occur on a relatively small scale.

Figure 7: Contours of the the Statia Marine Park and the Marine Park Reserves. Source STENAPA.

Saba.

Historical background.

The inhabitants of Saba were regionally known as well skilled sailors. These skills must have come from their fishing tradition. Boeke (1907) does report turtles being caught around Aves-Island by the Saban fishing fleet, but does not give numbers and details. It is obvious that sea turtles too must have been on the Saban trade list and menu.

Meylan (1983) reports observed mating in the surrounding waters. This implies possible nesting. Sybesma (1992) reported that, despite the fact that Saba has no permanent beaches, rare nesting is reported by residents at Cave of Rum Bay, Wells Bay, and Fort Bay (see fig.4). Also Van Buurt specified Cave of Rum Bay, a dark volcanic sand beach with rocks and pebbles, as a nesting beach for hawksbill turtles.

The Saba Marine Park has provided 2 data sets of sea turtle sightings in 1986 and 1987, gathered by Saba Deep, Sea Saba (both commercial SCUBA dive operators) and the Saba Marine Park. During the first period, from October 1986 till July 1987, a total number of 115 sightings (103 hawksbills, 11 greens and 1 loggerhead) have been recorded, excluding sightings of turtles in the feeding area (Giles Quarters-Fort Bay (fig.4); daily counts between 6-18 turtles, mostly greens). During the second period (08/87-12/87) 46 sightings have been recorded (37 hawksbills (6 males!), 5 greens (1 male!), 1 loggerhead and 3 unidentified) around Saba.

The size distribution of both data sets (table 6) shows that most individuals can be classified as juveniles and sub-adults (< 51 cm for green and hawksbill). This means that, despite the absence of nesting grounds, apparently Saba was visited year round by relatively high numbers of sea turtles, mostly hawksbills, most probably for its rich foraging grounds.

Table 6: size distribution of foraging sea turtles around Saba in 1986 and 1987.

	> 25 cm	25 - 50 cm	51 – 75 cm	> 76 cm
10/86-07/87	10	62	33	10
08/87-12/87	4	23	10	9

The data is said to be inaccurate, because of irregular gathering of data and irregular dive trips by operators, who are depending on the tourist season.

Actual status.

Saba does not have beaches (see picture 18). Sybesma (1992) speaks of two seasonal beaches, namely Wells Bay (see picture 19) and Cave or Rum Bay. The lesser could well have any significance as a nesting area because it is totally inaccessible from shore and hardly ever visited from the ocean (Tom van ’t Hof, pers. comm., 1996, in Sybesma 1992). Locals confirm sporadic nesting at these sites. Some locals speak of hawksbill females ‘climbing up the rocks for about 10 meters to nest there’ and even of successful hatching of such a nest.

The underwater situation is more promising. The coral reefs of Saba and the Saba bank are amongst the less disturbed reefs of the world, so they can be considered as excellent foraging grounds. Sightings are still frequently reported. During 6 under water sessions during 3 days on 5 different spots (free or SCUBA dive; ± 30 minutes each) 5 sightings of a hawksbill turtle have been counted (see picture 20). This implies the presence of a relatively high density of foraging hawksbill turtles in the Saban waters.

Despite considerate regulations and legal protection outsiders still speak of sporadic incidental catch by locals (pers. comm.), though encountered turtles did not show fright (see picture21).

Implications.

St. Maarten.

With the objectives of the Preliminary Ph-D proposal in mind (see appendix III), it can be concluded that St. Maarten offers few opportunities to study any of these objectives.

The nesting hawksbill population is too small, if present at all as a population. Nesting is still very rare and scattered over many beaches of the island. Nocturnal monitoring on all known and/or potential nesting beaches, the only change for gathering data on nesting behavior, tagging and collecting tissue samples for genetic analysis, is useless because of the low number of successful nesting individuals and the unpredictability of their beach selection.

The situation under water, concerning the foraging hawksbill population, does not look promising as well. Sightings are reported not to be common. Most potential foraging areas, with little or no tourist influences, are situated in deeper waters offshore. Gathering of tissue samples seems to be a difficult and time-consuming job.

Both facts seem to exclude any decent possibilities for a paternity study on the hawksbill turtle.

However, daily monitoring on the target beaches and some potential nesting beaches on the French side of the island is still valuable. The presence of sea turtles in the St. Maarten waters still show relatively healthy ecological circumstances in the surrounding waters and can certainly be of economic value by attracting tourists. Educating the local people and tourists about the biology and ecology of the sea turtles can also be used to improve conservation of the natural environment of St. Maarten.

St. Eustatius.

Like on St. Maarten, the hawksbill nesting population seems virtually absent. Nesting is very rare, though several individuals of three species (hawksbill, green turtle, leatherback) seem to find their way to Zeelandia beach annually. With specific conservation efforts (e.g. relocation and/or protection of nests), next to the existing daily monitoring, a slow increase of the nesting populations of the nesting species might be established over decades. Also head-starting might be a useful tool.

The foraging hawksbill population of St. Eustatius seems to be relatively big and stable over the years, due to the exceptional good and protected state of the surrounding coral reefs. The fact that individuals seem approachable (see picture 21), means that the foraging hawksbills are relatively undisturbed. This may have a positive effect on the foraging population size.

The reported numbers of sightings makes this foraging population suitable for gathering tissue samples, basic physical data of individuals and tagging these individuals. This makes it possible to study the following objectives, retrieved form the Preliminary Ph-D proposal:

- To determine the composition (geographical origin) of the foraging hawksbill populations of the three Dutch islands.
- To determine migration patterns within the Lesser Antilles and within the wider Caribbean and to correlate actual migration patterns with (historically integrated) migration/gene flow as inferred from the population genetic analysis.

Saba.

Considering the absence of potential and stable nesting beaches, one can say that a nesting population does not exist on Saba. The sporadically reported nesting can be considered unsuccessful, so will not change this fact.

The high quality of the coral reefs of the Saban coastal waters and the vast Saba Bank provide excellent feeding grounds for numerous hawksbills. The hawksbill foraging population can thus be considered as fairly big and stable. Several surveys underline these facts. Sightings are still reported frequent and individuals seem easy approachable.

The foraging hawksbill population of Saba seems to be ideal for gathering tissue samples, basic physical data of individuals and tagging these individuals. This makes it possible to study the same objectives as in the case of St. Eustatius (see above).

Protection of foraging populations might be essential for the survival of several distant rookeries (see introduction). Identifying migration routes with genetic analysis and a tagging program and determining the genetic health and structure of the foraging population might contribute better (international) conservation tools.

Preliminary results of this study were presented with a poster (see picture 22 & 23) at the 24^{th} International Symposium on Sea Turtle Biology and Conservation (for a summary see Appendix IV). This meeting took place in February in San José, Costa Rica. At this symposium results of genetic analysis of several nesting and foraging populations in Mexico (Alberto Abreu-Grobois *et al.*, 2004) and on Marie Galante (Chevalier, pers.comm) and a study on migratory and breeding behavior of male hawksbill turtles (Van Dam *et al.*, 2004) were presented. Several sea turtle experts emphasized the importance of any study on these subjects to improve general knowledge on the biology, ecology and behavior of the hawksbill turtle in the Caribbean and in this way to improve (international) conservation efforts.

Acknowledgements.

The author wish to thank Andy Caballero and Paul Ellinger of the St. Maarten Nature Foundation, Nicole Esteban of the St. Eustatius National & Marine Parks and David Kooistra of the Saba Marine Park for providing data and general information and supporting field visits, Harm van der Geest and Paul van Nugteren for helping with Picture and Video editing, and further Prof. Dr. Steph Menken of the Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, Martijn Steffens, and last but not least Rosalie Brinks for their support in general. Without these persons this study would have been impossible to execute.

The author wishes to thank the Schure-Beijerinck-Popping Foundation for the financial support.

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Appendix I.

Contacts with Counterparts.

17-7-2003 Meeting with The Nature Foundation of St. Maarten; Andy Caballero. Subjects: collaboration, target beaches, target reefs, global planning.

22-7-2003 Meeting with The Nature Foundation of St. Maarten; Andy Caballero, Paul Ellinger. Subjects: exchange of data and literature.

26-7-2003 Meeting with Association de la Reserve Naturelle de St. Martin; Nicolas Maslach. Subjects: Activities on French part, permission for visiting French beaches, exchange of data and literature.

27-7-2003 Excursion to Tintamarre with Paul Ellinger, The Nature Foundation of St. Maarten.

31-7-2003 Excursion to Isabelia, the Bridge and Proselyte reef with Paul Ellinger, The Nature Foundation of St. Maarten. Exploration of reef and sea grass bed sites.

01-8-2003 Interview with The Daily Herald, local newspaper.

10-8-2003 Night patrol with Volunteers of St. Eustatius National Parks Foundation (STENAPA) on Zeelandia beach.

10-8-2003 Diving excursion to Barracuda reef and the Blocks with Divestatia, commercial scuba diving operator. Exploration of reef sites.

11-8-2003 Meeting with St. Eustatius National Parks Foundation (STENAPA); Nicole Esteban. Subjects: Research review, research proposal, exchange of data and literature, collaboration.

12-8-2003 Meeting with Saba National Marine Park; David Kooistra. Subjects: Research review, research proposal, exchange of data and literature, collaboration.

13-8-2003 Excursion to Green Island and Torrence point with Saba National Marine Park. Exploration of reef sites.

14-8-2003 Diving excursion to tent reef and Ladder Labyrinth with Saba National Marine Park. Exploration of reef sites.

16-8-2003 Diving excursion to tent reef and Man O'War Shoal with Saba Deep Scuba Diving Center, commercial scuba diving operator. Exploration of reef sites.

Appendix II.

Budget.

Budget item	Budgeted (in €)	Used (in €)
Air transport*	**1050.00**	**1194.90**
Return ticket Amsterdam-St. Maarten		1050.00
Round ticket St. Eustatius-Saba-St. Maarten		116.70
Departure fees		28.20
Local transport*	**800.00**	**713.82**
Car rental		579.06
Fuel		134.76
Accommodation*	**1000.00**	**850.78**
Accommodation rental		579.06
Hotel St.Eustatius & Saba		271.72
Research materials*	**550.00**	**530.46**
Phone costs		129.07
Copying, photo materials, field equipment		147.16
Boat fuel		50.00
Park fee		19.60
Diving equipment rental		182.63
Subsistence allowance	**1158.00**	**1246.75**
Medical Insurance (2 months)		170.38
Subsistence allowance NA (35 days)*		516.37
Subsistence allowance NL (28 days*€20,-)		560.00
Total expenses	**4558.00**	**4536.71**

*All receipts available

Appendix III.

Preliminary Ph-D proposal.
This proposal was rejected by WOTRO in June 2003.

Please consult WOTRO subsidy guide (chapter 2) and instructions for preliminary applications before applying	
Please complete using Arial 10 pt font (applications using other formats will not be taken into account)	
1. Applicant: Address: Tel.: Fax: E-mail: Male or Female:	**Prof. Dr. Steph B.J. Menken Institute for Biodiversity and Ecosystem Dynamics University of Amsterdam Kruislaan 318, 1098 SM Amsterdam 020-5256297 020-5257878 menken@science.uva.nl Male**
2. Proposed researcher: Date of birth: Nationality: Academic degree: Date(s) of graduation/doctorate: Male or Female	**Drs. Johannes L. Swinkels 08-03-1971 Dutch MSc Biology (University of Amsterdam) 22-02-1996 Male**
3. Title (incl. country in which the research will be carried out)	**Conservation ecology and genetics of the Hawksbill turtle (*Eretmochelys imbricata*) of the Dutch Caribbean Islands of St. Maarten, St. Eustatius and Saba.**
4. Relevant research group(s): (co)promoter/researcher etc.	Prof. Dr. Steph B.J. Menken; Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, the Netherlands. Dr. Nancy N. Fitzsimmons; Applied Ecology Research Group, University of Canberra, Australia. Drs. Johannes L. Swinkels; Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, the Netherlands.
5. Max. 5 recent relevant publications by members of the research group as defined under 4. (please provide full details on authors, title, journal).	J.L. Swinkels, P. van Nugteren, J. Chevalier, M. Girondot, L.H.G. van Tienen and L. Kelle, 1999. Sea Turtle Protection in the Guayana Shield Region: Optimization of Collaboration and Conservation. Proceedings of the 19th Annual Symposium on Sea Turtle Conservation and Biology. NOAA Technical Memorandum NMFS-SEFSC-443; pp 53-54. W.E.J. Hoekert, H. Neufeglise, A.D. Schouten, and S.B.J. Menken, 2002. Multiple paternity and female-biased mutation at a micro satellite locus in the olive ridley sea turtle (*Lepidochelys olivacea*). Heredity (2002) 89, pp 107-113. A. Hille, I.A.W. Janssen, S.B.J. Menken, M. Schlegel, and R.S. Thorpe, 2002. Heterologous Amplification of Micro satellite Markers From Colubroid Snakes in European Natricines (Serpentines: Natricinea). The Journal of Heredity 2002; 93(1) pp 63-66. N.N. Fitzsimmons, C. Moritz, S.S. Moore, 1995. Conservation and

	Dynamics of Micro satellite Loci over 300 Million Years of Marine Turtle Evolution. Mol. Biol. Evol. 12: 432-440. N.N. Fitzsimmons, 1998. Single paternity of clutches and sperm storage in the promiscuous green turtle (*Chelonia mydas*). Mol. Ecol. 7: 575-584.
6. (optional) Participation in a Graduate School (Onderzoekschool)	
7. Brief description of the project (including at least the following aspects: scientific significance / innovative aspects, hypothesis / research question, general approach / methodology) Maximum 1200 words Word count: 1180 words	**Project outline.** Both nesting and foraging hawksbill populations of the Dutch Caribbean Islands of St. Maarten, St. Eustatius and Saba will be ecologically and genetically studied in terms of population monitoring, nesting behavior, nest ecology, and population genetics to determine reproductive and migratory behavior and genetic population structure. Ecological (direct) and genetical (indirect) approaches are complementary and essential to get to a complete insight into population structure and dynamics. The ultimate goal is a better understanding of the ecology s.l. of the hawksbill turtle within the Lesser Antilles and the wider Caribbean in order to optimize conservation management on the three Dutch Islands, within the Lesser Antilles and within the wider Caribbean by integrating the results with other recent studies. **Background** The hawksbill turtle (*Eretmochelys imbricata*) is listed on the IUCN *Red List* as Critically Endangered, based on global population declines of 80% or more during the last three generations (about 105 years) and projected declines over the next three generations. For its survival as a species the hawksbill turtle is depending on nesting and foraging sites on the Indian Ocean Archipelagos, the Indonesian Archipelago, Australia, and within the wider Caribbean region. Worldwide the hawksbill populations face severe declines due to harvesting and poaching of individuals and eggs, loss of nesting and foraging sites, incidental capture in fishing gear, ingestion of and entanglement in marine debris, oil pollution, and boat collision. Especially illegal, commercial trade of hawksbill scutes still causes severe declines worldwide. In some parts of the wider Caribbean the status of the nesting populations of the hawksbill is unknown. Meylan (1999a) reports that on the Netherlands Antilles (Bonaire, Curacao, Saba, St. Eustatius, St. Maarten) no estimates are available for the status of the hawksbill nesting populations. Nesting is reported to be rare (Sybesma, 1992, in Meylan, 1999a). Sybesma stated that hawksbills appear to be much depleted from their former numbers in the Netherlands Antilles. Still little is known about the migratory, foraging, and reproductive behavior of the hawksbill turtle within the wider Caribbean. For two decades, with limited evidence to the contrary, the hawksbill has been labeled as non-migratory, or even sedentary. Scientific data about **foraging** populations (all individuals from all life classes foraging on adjacent reefs year-round without showing reproductive behavior) at the

Netherlands Antilles are unavailable. Bowen et al. (1996, in Bass, 1999) showed that the foraging population of Mona Island, Puerto Rico, largely consisted of turtles of several distant rookeries. A comparable study by The Republic of Cuba in both Puerto Rico and Cuba showed similar outcomes.

However, different **nesting** populations seem to be genetically isolated in terms of maternal lineages, and thus represent distinct stocks (Bass, 1996, in Bass, 1999). This suggests that very little exchange of reproductive adults occurs among geographically separated nesting populations. These studies, combined with tag-return studies (see for a summary Meylan, 1999b), indicate that hawksbill turtles within the wider Caribbean seem to have a clear reproductive migratory behavior with little opportunity for gene flow; they exhibit small neighborhood sizes despite much migration between hatchling and adult stage. Furthermore these studies implicate that harvesting of (sub-)adults in foraging areas might influence survival of distant nesting populations.

Because of limited gene flow, these small nesting populations might be in danger of inbreeding. Multiple paternity, several males contributing to the offspring in a single clutch, might be an inhibiting factor for inbreeding. Hard evidence for multiple paternity among marine turtles has first been detected in the Olive Ridley turtle (*Lepidochelys olivacea*) (see Hoekert et al. above). Multiple paternity in hawksbill reproduction has not been studied yet.

Research Objectives.

- To determine the actual status of the hawksbill nesting populations of the three Dutch Islands.
- To study the nesting behavior and nest ecology of the hawksbill populations of the three Dutch Islands and to compare these with other Caribbean nesting populations.
- To determine genetical relationships within and between nesting populations of the three Dutch islands, the lesser Antilles and the wider Caribbean.
- To determine the composition (geographical origin) of the foraging hawksbill populations of the three Dutch islands.
-To determine migration patterns within the Lesser Antilles and within the wider Caribbean and to correlate actual migration patterns with (historically integrated) migration/gene flow as inferred from the population genetical analysis.
- To study multiple paternity in Hawksbill reproduction.

Methods

Study area

The study area will be the nesting beaches of the three Dutch Caribbean islands of St. Maarten, St. Eustatius and Saba and the adjacent reefs (foraging grounds) surrounding these islands.

Population status and nesting behavior

Nesting beaches of the three Dutch Caribbean islands of St. Maarten, St.

	Eustatius and Saba will be monitored for 3 years, every night during the nesting season (May until November). Monitoring consists of counting nesting females, nests and trails. With these data the size of the nesting populations can be determined. Additional data on nesting behavior and nest ecology will be taken, such as fecundity, hatching success, description of nesting habitat etc. These data will be used for comparison of nesting behavior and ecology between different nesting populations and as a start for local long-term monitoring programs. <u>Regional genetical relationships, reproductive migration and other genetical aspects</u> Tissue samples will be taken from nesting females during nocturnal monitoring sessions. The samples of the nesting populations will be used to identify the mitochondrial DNA haplotype composition of these populations. Sampled females will be double-tagged with Inconel tags. Tissue samples will also be taken from hatchlings from nests laid by sampled and identified mothers. These and samples from occasionally captured males will be used to determine multiple paternity occurrence from variation at micro satellite loci. Former studies show that female hawksbills nest once every two or three years. Collecting data and tissue samples during three nesting seasons from May till November will ensure that almost the entire population will be monitored and studied. Furthermore tissue samples will be taken from foraging individuals (male and female; juveniles and (sub-)adults) during dive sessions. These individuals will be double-tagged with Inconel tags. The samples of the foraging population will be used to determine the mtDNA haplotype diversity and thus to determine the nesting ground of sampled individuals of the foraging population. Sampling will take place outside the nesting season to prevent sampling individuals from the nesting populations of the three islands. These nesting females migrate after the nesting season, so belong to different foraging populations. The results of this study will be compared with the results of similar recent studies carried out within the wider Caribbean. The Schure-Beijerinck-Popping Foundation has provided the proposed researcher/PhD.-applicant with a grant to execute a one-month pilot-study during the nesting season of 2003. **Literature** Bass, A.L. 1999. Genetic analysis to elucidate the natural history & behavior of hawksbill turtles (*Eretmochelys imbricata*) in the wider Caribbean: a review & re-analysis. Chelonian Conservation & Biology 3(2):195-199. Meylan, A.B. 1999a. Status of the hawksbill turtle (*Eretmochelys imbricata*) in the Caribbean region. Chelonian Conservation & Biology 3(2):177-184. Meylan, A.B. 1999b. International movements of immature & adult hawksbill turtles (*Eretmochelys imbricata*) in the Caribbean region.

	Chelonian Conservation & Biology 3(2):189-194.	
8. **Funds are requested for: (please consult WOTRO subsidy guide chapter 2 for budgetary guidelines)**	**…………. Postdoc (2 years)** **1 PhD-researcher (4 years)**	**€ .....13000…. Durables** **€ .... 20000…. Consumables** **€ ....12000…. Travel costs**
9. **Preference for assessment by the WOTRO committee for:**	**□Humanities/Social Sciences or,**	**□xNatural-Medical Sciences**
10. **Signature applicant:**		
Please return this form **<u>before</u>** **15 April 2003, 16.00 p.m**. to: WOTRO P.O. Box 93120 2509 AC THE HAGUE Telephone: (+31) (0)70 34 40 763 Fax: (+31) (0)70 38 19 874		

Appendix IV.

Summary of the poster presented at the 24th International Symposium on Sea Turtle Biology and Conservation.

Status update on St. Maarten, St. Eustatius and Saba, Netherlands Antilles.

Swinkels, J.L.[1], Caballero, A.[2], Esteban, N.[3], Kooistra, D.[4].

[1] *Institute for Biodiversity and Ecosystem Dynamics, University of Amsterdam, kruislaan 318, 1098 SM, Amsterdam, Netherlands. (jlswinkels@yahoo.com).*

[2] *St. Maarten Nature Foundation. Great Bay Marina, Unit #3, P.O. Box 863, St. Maarten, Netherlands Antilles.*

[3] *St. Eustatius National & Marine Parks. Gallow Bay, St. Eustatius, Netherlands Antilles.*

[4] *Saba Marine Park. Fort Bay, Saba, Netherlands Antilles.*

In the summer of 2003 a survey was done on St. Maarten, St. Eustatius and Saba, Netherlands Antilles, to update information about the actual main nesting and foraging sites and to establish population estimations and trends. All beaches on all three islands were visited and described as well as several reef sites. Five 'target' beaches on the Dutch side of St. Maarten were monitored daily. All information possible was gathered.

On the St. Maarten beaches nesting does occur on the least tourist-influenced beaches, though in small numbers with no spatial and temporal patterns. The hawksbill turtle is the only frequent visitor; green turtles and leatherbacks have been observed nesting as well. On most beaches tourist facilities, resorts and estates are dominantly present or still being developed. Turtle sightings underwater, mainly hawksbill, are common, though in much less numbers than decades ago. During the annual Carnival festivities, turtle meat and soup is still available.

Zeelandia beach is the only beach on St. Eustatius. Hawksbills, green turtles and leatherbacks have been observed on the beach yearly in very small numbers, though recordings of successful nesting is very rare. Underwater sightings of hawksbill turtles are very common. The St. Eustatius reefs are in a very good condition and contain a high diversity of sponges and (soft) coral.

This is also the case for Saba, so encounters with foraging hawksbill turtles are very frequent. Because of its volcanic geomorphology, Saba lacks beaches. Sporadic nesting on temporary sand deposits have been reported.

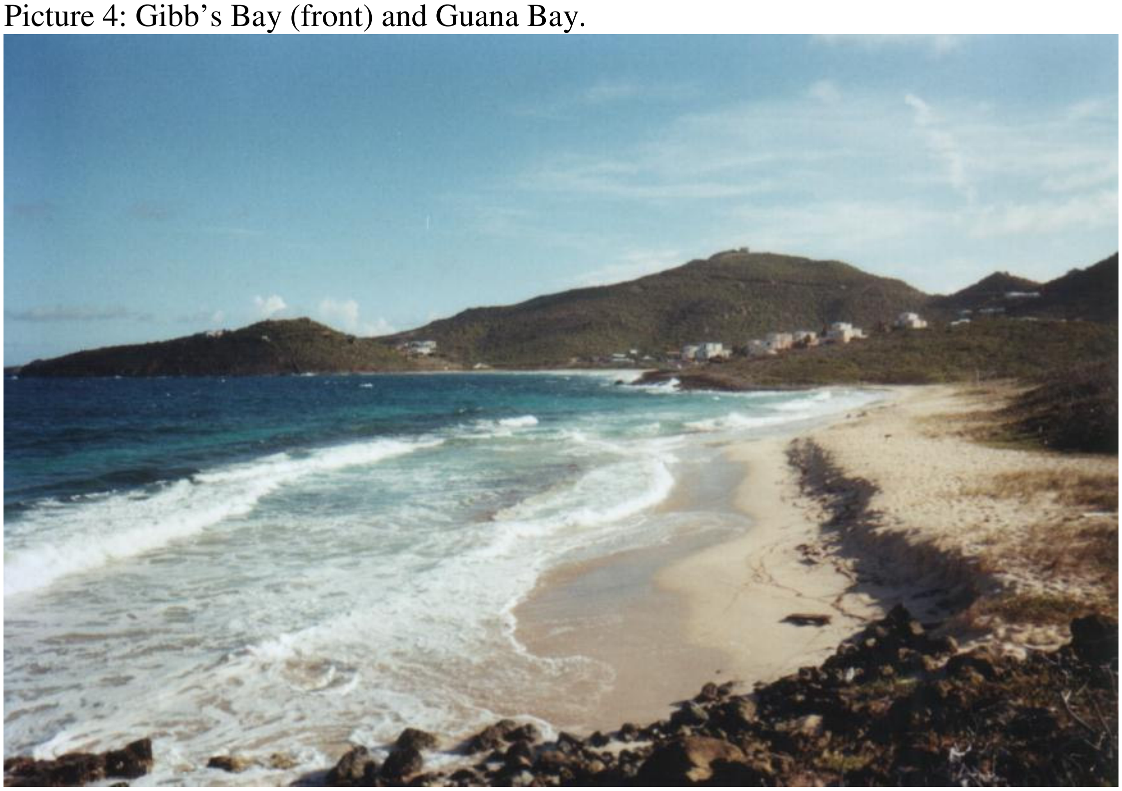
Appendix V.

Picture 1: Dawn Beach, part with resort.

Picture 2: Dawn Beach northern side.

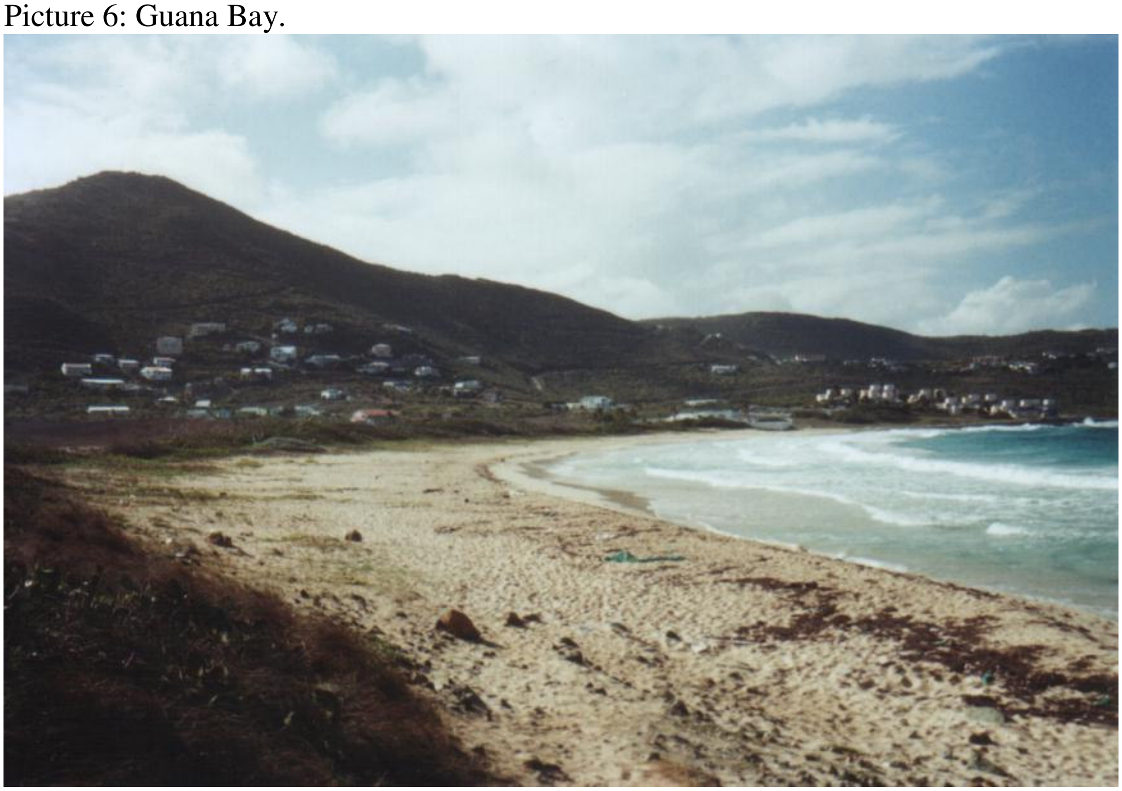
Picture 3: Dawn Beach southern side.

Picture 4: Gibb's Bay (front) and Guana Bay.



Picture 5: Gibb’s Bay.

Picture 6: Guana Bay.

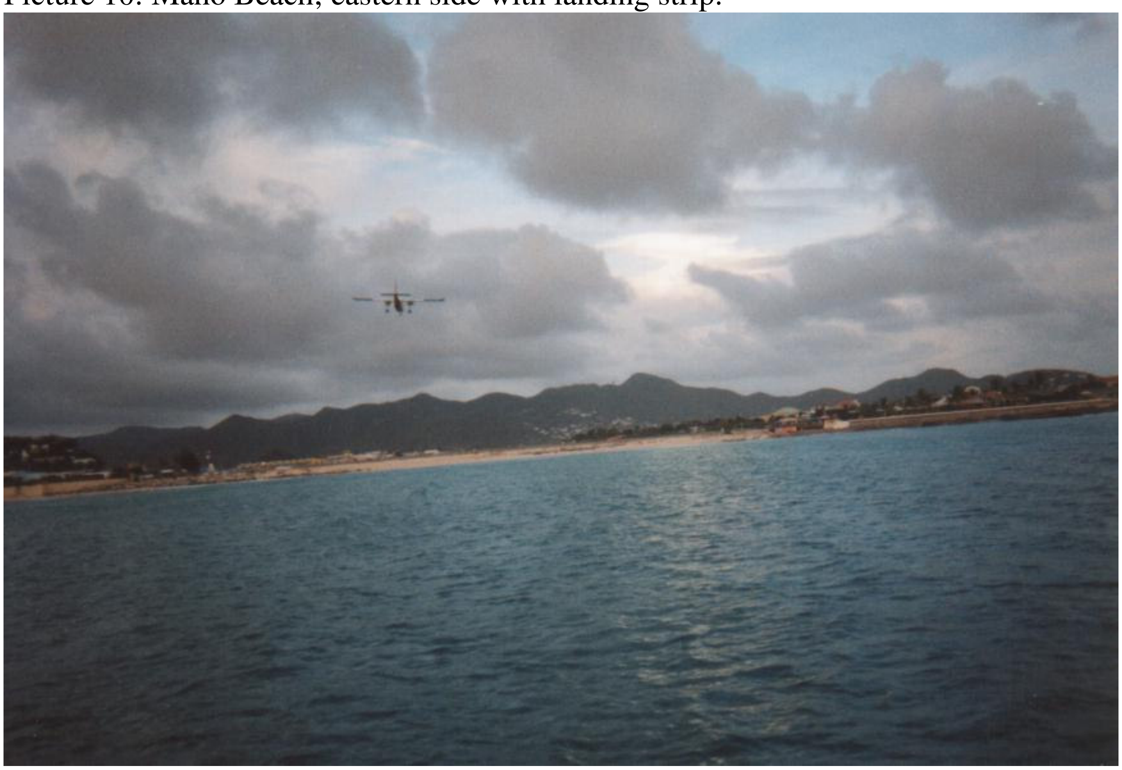


Picture 7: Simpson Bay Beach eastern side.

Picture 8: Simpson Bay Beach middle section.

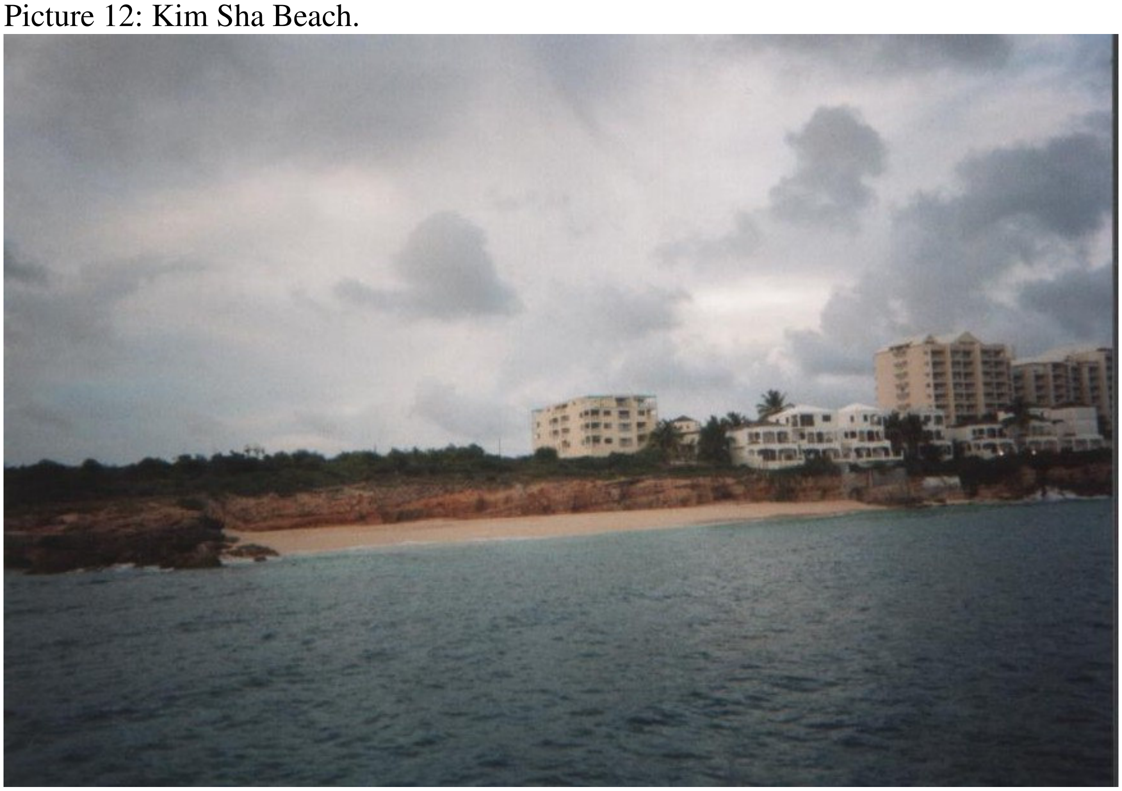
Picture 9: Maho Beach; western side with tourist resorts.

Picture 10: Maho Beach; eastern side with landing strip.



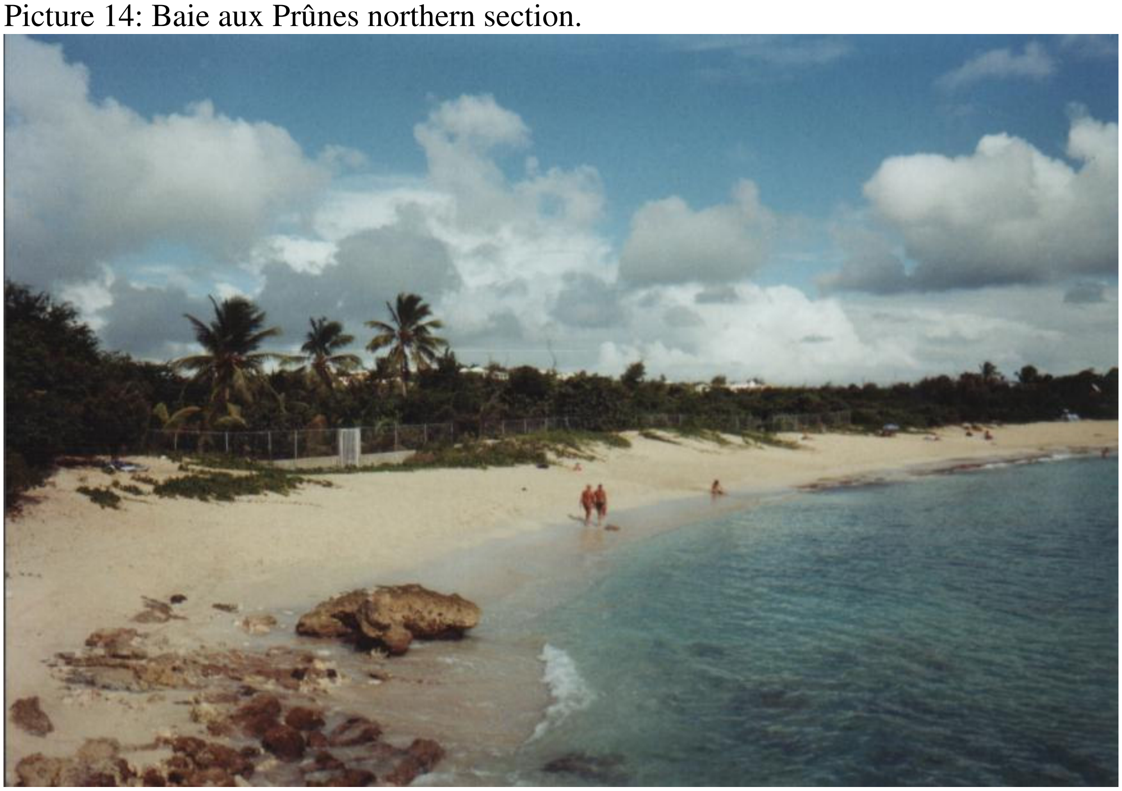
Picture 11: Cupecoy Beach.

Picture 12: Kim Sha Beach.



Picture 13: Baie Longue eastern section.

Picture 14: Baie aux Prûnes northern section.



Picture 15: Baie aux Prûnes.

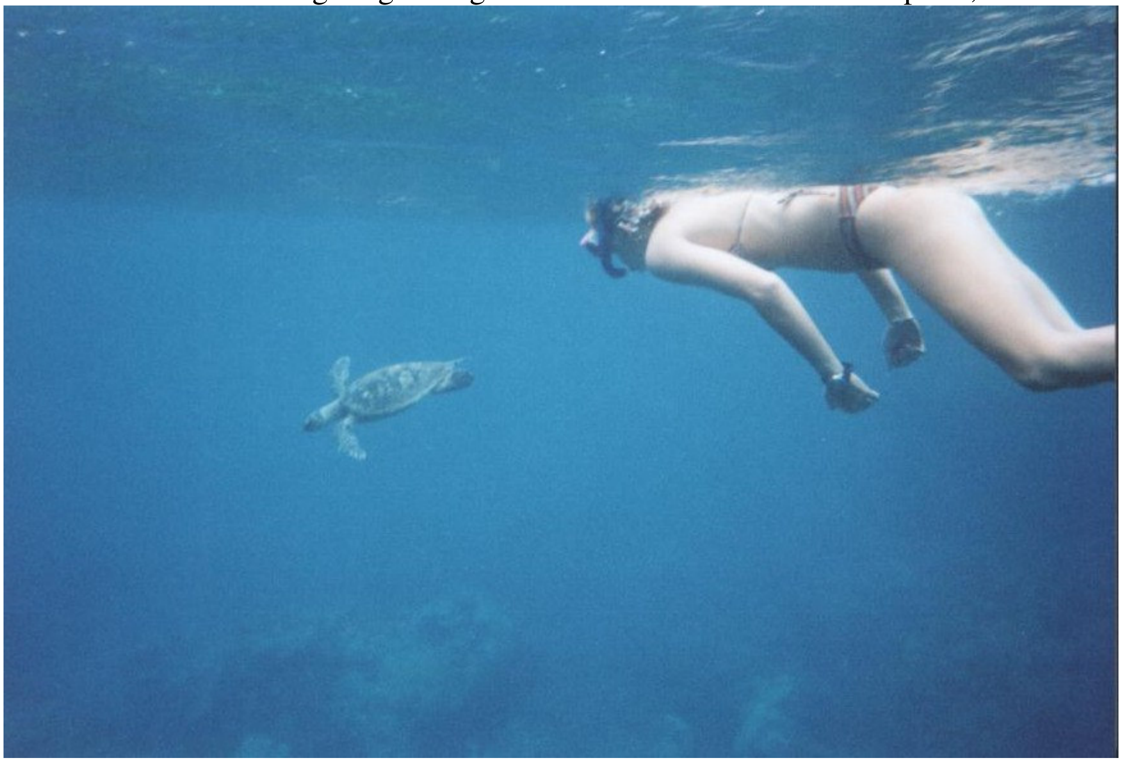
Picture 16: Zeelandia Beach northern side.

Picture 17: Zeelandia Beach southern side.

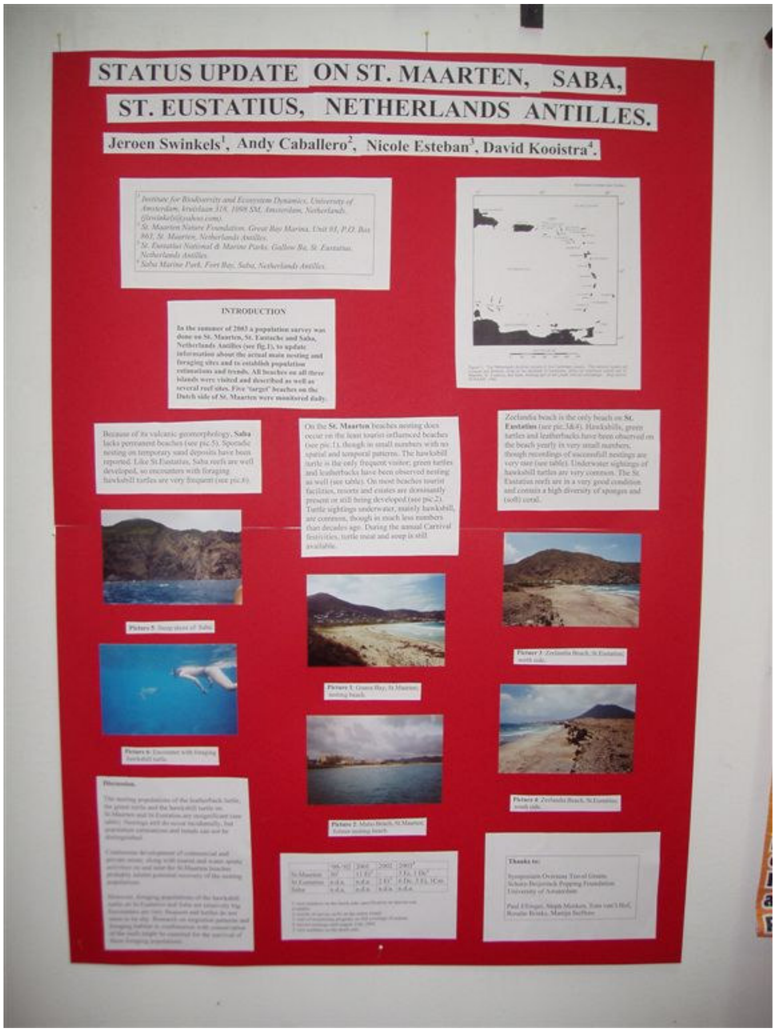
Picture 18: Saban coastal shore.

Picture 19: Seasonal beach near Well's Bay.

Picture 20: Hawksbill sighting during free-dive session near Torrence point, Saba.



Picture 21: Poster presentation at The 24th International Sea Turtle Symposium, San José, Costa Rica.



Picture 22: Poster presentation with author at The 24th International Sea Turtle Symposium, San José, Costa Rica.