



St Eustatius Sea Turtle Conservation Programme Annual Report 2005



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List of Acronyms and Abbreviations

ARGOS	ADVANCED RESEARCH AND GLOBAL OBSERVATION SATELLITE
AVID.....	AMERICAN VETERINARY IDENTIFICATION DEVICES
CCL	CURVED CARAPACE LENGTH
CCL N-T	CURVED CARAPACE LENGTH (NOTCH TO TIP)
CCW	CURVED CARAPACE WIDTH
CM	<i>CHELONIA MYDAS</i>
DC	<i>DERMOCHELYS CORIACEA</i>
DCNA	DUTCH CARIBBEAN NATURE ALLIANCE FOUNDATION
EI	<i>ERETMOCHELYS IMBRICATA</i>
GPS	GLOBAL POSITIONING SYSTEM
IUCN	INTERNATIONAL UNION FOR THE CONSERVATION OF NATURE AND NATURAL RESOURCES (WORLD CONSERVATION UNION)
KNAP.....	KLEINE NATUUR PROJECTEN FONDS, NEDERLANDSE ANTILLEN (SMALL NATURE PROJECT FUNDS, NETHERLANDS ANTILLES)
MINA	AFDELING MILIEU EN NATUUR (SECTION OF ENVIRONMENT AND NATURE OF THE MINISTRY OF PUBLIC HEALTH AND SOCIAL DEVELOPMENT)
NACRI	NETHERLANDS ANTILLES CORAL REEF INITIATIVE
NOAA	NATIONAL OCEANOGRAPHIC AND ATMOSPHERIC ASSOCIATION
PERS. COMM.	PERSONAL COMMUNICATION
PIT	PASSIVE INTEGRATED TRANSPONDER
STENAPA	ST EUSTATIUS NATIONAL PARKS FOUNDATION
USVI	UNITED STATES VIRGIN ISLANDS
WIDECAST	WIDER CARIBBEAN SEA TURTLE CONSERVATION NETWORK
WTT	WORLD TURTLE TRUST, HAWAII

Summary

- The St Eustatius Sea Turtle Conservation Programme was initiated in 2001 due to concerns that the island's sea turtle populations were being threatened due to habitat degradation and destruction. The programme is managed by St Eustatius National Parks Foundation (STENAPA), which is the main environmental non-governmental organization on the island.
- The Sea Turtle Conservation Programme is affiliated to the Wider Caribbean Sea Turtle Conservation Network (WIDECAST) and adopts its monitoring and tagging protocols.
- Since monitoring began three species of sea turtles have been confirmed nesting on the island; leatherback (*Dermochelys coriacea*), green turtle (*Chelonia mydas*) and hawksbill (*Eretmochelys imbricata*). There was an unconfirmed nesting by a fourth species, the loggerhead (*Caretta caretta*), in 2004.
- Five nesting beaches have been identified; Zeelandia Beach, Turtle Beach, Lynch Bay, Oranje Bay and Kay Bay. Zeelandia Beach is the primary nesting beach, and the only place where all three species nest regularly; the other beaches are used occasionally by green and hawksbills turtles.
- Daily track surveys are carried out on Zeelandia Beach and Turtle Beach throughout the nesting season; the other nesting beaches are monitored sporadically. Every track is identified to species; categorised as a false crawl or a nest; all nest locations are recorded for inclusion in the nest survival and hatching success study.
- In 2005:
 - Track surveys were conducted from 5 April to 21 November; a total of 190 surveys were completed.
 - Leatherback nesting activity occurred from 29 March – 22 June; 11 nests and eight false crawls were observed; all emergences were on Zeelandia Beach.
 - Green turtles were recorded from 4 July – 1 October; 15 nests and 52 false crawls were encountered; nesting was on Zeelandia Beach, Turtle Beach and Kay Bay.
 - Two hawksbill nests were observed on 27 May and 19 September; the first was on Kay Bay, the second on Zeelandia Beach.
- Night patrols are only conducted on Zeelandia Beach due to limited personnel and minimal nesting on other beaches; patrols run from 9.00pm – 4.00am. Each turtle encountered is identified to species; tagged with external flipper tags and an internal PIT tag (leatherbacks only); standard carapace length and width measurements are taken; nest locations are recorded for inclusion in the nest survival and hatching success study.
- In 2005:
 - Night patrols were conducted from 18 April – 20 October; 165 patrols were completed, totalling over 1,000 hours of monitoring.
 - Three leatherbacks and five green turtles were encountered during patrols; all were tagged by the Programme Co-ordinator.

- One of the green turtles was carrying a tag that had originally been applied in August 2002; this was the first record of a remigrant turtle for the project.
- Average carapace measurements for females nesting in 2005:
 - Leatherback: Curved carapace length (CCL) = 148.2cm; Curved carapace width (CCW) = 111.6cm
 - Green: CCL = 108.8cm; CCW = 100.0cm
 - No hawksbill turtles were encountered during night patrols.
- All marked nests were included in a study of nest survival and hatching success. During track surveys they are monitored for signs of disturbance or predation; close to the expected hatching date observers record signs of hatchling emergence. Two days after tracks have been recorded the nest is excavated to determine hatching and emerging success.
- In 2005:
 - 28 nests were marked; 11 leatherback, 15 green and two hawksbill
 - Two nests were lost during the incubation period; one leatherback nest was washed away during high tides and one green turtle nest was buried underneath a cliff fall.
 - Incubation period for leatherbacks was 60 days, for greens 58.6 days and for hawksbills 63 days.
- Excavations were performed on 20 nests; eight leatherback, 10 green and 2 hawksbill.
 - Average egg chamber depth varied greatly between the three species; leatherback = 73.5cm, green = 57.5cm and hawksbill = 44.5cm
 - Mean clutch size for each species; leatherback = 77.8 yolked + 48 yolkless eggs; green = 101.2 eggs and hawksbill = 147 eggs.
 - Hatching success was greater for green nests than either hawksbill or leatherback; 76.8% compared to 41.1% and 3.5%, respectively.
 - Emerging success was lower for leatherback nests than either hawksbill or greens; 2.1% compared to 41.1% and 70.1%, respectively.
 - Very little predation was observed and few deformed embryos were recorded; one albino green turtle hatchling was encountered, and one green turtle egg contained twin embryos.
 - One green turtle nest was relocated 25 days after it was laid, due to the risk of erosion; the eggs appeared relatively unaffected by the relocation, for when excavated the hatching success was 76.4%.
 - In future years the practise of relocating nests laid in erosion zones to safer sections of the beach will continue.
- A satellite tracking project was initiated in 2005 by the Dutch Caribbean Nature Alliance. This research was an inter-island collaboration of STENAPA and the Nature Foundation St Maarten. Dr Robert van Dam was the lead biologist, providing expertise and training in satellite telemetry methodology.
 - Two transmitters were successfully deployed on nesting females; one on a green turtle from St Eustatius in September, the second on a hawksbill from St Maarten in October.

- The green turtle returned to nest once more after the transmitter was attached; she then remained in the near-shore waters of the island, less than 5km from the release site on the Atlantic coast. This may be the first record of an adult green turtle female being resident in her breeding area. Transmissions ended on 15 November, 2005.
 - The hawksbill turtle migrated over 350km; she travelled to the British Virgin Islands, before her transmissions stopped on 14 December, 2005.
 - An extensive education programme was part of the project. Island schools were visited by the Programme Co-ordinator and students aged 5 – 13 were taught about satellite telemetry and its use in turtle conservation. Several newspaper articles were published, and radio interviews given; in addition an exhibit was organised at the local library.
 - Two competitions were organised for students; for the “Name the Turtle” Competition students had to draw a picture of a turtle, write a story about a turtle or make a model turtle out of recyclable materials. 106 entries were received; three winners were chosen and they won various prizes, including the chance to pick the name of one of the transmitter turtles. A similar competition was held on St Maarten. The green turtle was given the name “Miss Shellie” and the hawksbill was called “Archy”.
 - The “Where’s the Turtle?” Competition had students guessing where the turtles would go on their migrations, and how far they would swim. 256 students took part and four winners were announced in March 2006; each receiving a Marine Park t-shirt and certificate.
- Beach erosion continued on Zeelandia Beach in 2005:
 - Many of the numbered marker stakes were lost from 2004, due to high tides.
 - Over 20% were more than 2m from their 2004 location, suggesting extensive cliff erosion.
 - Sand mining compounds the erosion problem at the northern end of Zeelandia Beach. Despite being an illegal activity it occurred throughout 2005, in the gully and on the beach
 - Five major cliff falls were recorded; each month from June – October.
 - Monitoring of erosion will be a priority for 2006.
- Several different community activities were conducted in 2005:
 - A puppet show was organised for local schools and the after school programme to teach about several threats to turtles, and how they could be avoided.
 - Presentations on turtles were given at the Auxiliary Home and the Methodist church.
 - STENAPA participated in the School Vacation Programme; Antonio Flemming assisted with night patrols in his second year of the project.
- Six beach clean-ups were conducted on Zeelandia Beach. A total of 12 trucks full of rubbish bags were removed in addition to a fridge, large rope, fishing net and car batteries. Unfortunately support from the local community in these events was disappointing.
- The Sea Turtle Conservation Programme was featured in regular articles in the local press and on the radio. The STENAPA quarterly newsletter included two features about the research activities conducted in 2005 and the website contains several pages dedicated to the programme, with a focus on the Sea Turtle Satellite Tracking Project 2005.

- Staff participated in several regional and international meetings in 2005:
 - The 2004 Programme Co-ordinator attended the 25th International Sea Turtle Symposium in Savannah, Georgia, USA, 16 – 22 January 2005 and the WIDECAST Annual General Meeting. A teacher from the high school and a student also travelled to the symposium.
 - The 2005 Programme Co-ordinator was invited to a workshop in Cuba; the focus of this meeting was to discuss the role of community involvement in sea turtle conservation projects. She gave a presentation about the programme on St Eustatius.
 - In October the Programme Co-ordinator gave a lecture as part of the “Sea & Learn on Saba” event; the work of the Sea Turtle Conservation Programme was presented to international biologists, tourists and local residents.
- Several recommendations were made for the 2006 season:
 - Continued participation of volunteers, from Working Abroad and the STENAPA Intern Programme.
 - Monitoring of nesting beaches to continue; daily track surveys on all beaches and night patrols of the primary nesting beach.
 - Further development of the research programme; expand the focus of the programme by implementing an in-water survey of juvenile turtles and continue the satellite tracking project, with the possible inclusion of leatherback turtles.

Introduction

The St Eustatius National Parks Foundation (STENAPA) established the Sea Turtle Conservation Programme following concerns that the island's sea turtle populations were being threatened by anthropogenic disturbance and destruction of nesting beach habitats through sand mining, joy riding and pollution.

A community outreach campaign was organised in 2001, to begin raising public awareness about sea turtle conservation issues. Subsequent to this initiative, a beach monitoring programme was started in 2002, in affiliation with the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). The first year of the programme saw very limited and sporadic monitoring of the primary nesting beach due to a lack of personnel; however, in 2003 regular night patrols were made possible following the introduction of the Working Abroad Programme, which brings groups of international volunteers to assist with STENAPA projects in the National and Marine Parks. By 2004 the programme had expanded to include daily patrols on several of the island's nesting beaches, with a dedicated vehicle and a full-time project co-ordinator during the nesting season.

Data from the Sea Turtle Conservation Programme have shown that three species of sea turtle regularly nest on St Eustatius; the leatherback (*Dermochelys coriacea*), the green (*Chelonia mydas*) and the hawksbill (*Eretmochelys imbricata*), all of which are classified as either endangered or critically endangered by the IUCN. There has also been an unconfirmed report of nesting by a fourth species, the loggerhead (*Caretta caretta*), which is classed as threatened by the IUCN.

The ultimate objective of the St Eustatius Sea Turtle Conservation Programme is to promote the long-term survival of the sea turtle populations on and around the island. This goal is achieved by safeguarding critical sea turtle habitats; conducting research to provide policy and decision makers with current, relevant data on the status of sea turtles in the region, and limiting environmental impacts on nesting beaches and in near-shore waters. One of the most important factors to ensure the success of the project is the direct involvement of the local community in the programme to promote a better understanding of the importance of long-term conservation, not just for sea turtles but for other locally threatened species.

The aims of this Annual Report include the following:

- Summarise the activities of the Sea Turtle Conservation Programme conducted in 2005
- Review the accomplishments and deficiencies of the programme in 2005, and suggest recommendations for 2006
- Provide a summary of the data from 2005 research initiatives
- Present information locally, regionally and internationally about the research and monitoring programme on the island
- Produce a progress report for the Island Government, programme funding organisations, the local community and international volunteers.

Participating organisations

St Eustatius National Parks Foundation (STENAPA)

The Sea Turtle Conservation Programme is co-ordinated by the St Eustatius National Parks Foundation (STENAPA), which is the main non-governmental environmental organization on the island of St Eustatius (known locally as Statia). In 1996 STENAPA was given a legal mandate by the Island Government to administer a new Marine Park and, in 1998, for a new National Park; STENAPA also manages the Miriam C. Schmidt Botanical Garden. The Marine Park surrounds St Eustatius from the high water mark to the 30 metre depth contour; there are two marine reserves within the Marine Park, which are designated no-take zones and are in place to protect marine habitats and to reduce fishing pressures. The Marine Park maintains dive and yacht moorings and conducts many educational programmes, such as the Snorkel Club and the Junior Ranger Club, in addition to research activities such as the Sea Turtle Conservation Programme.

STENAPA is a not-for-profit foundation, relying on government subsidies, grants and minimal income from divers and yachts to conduct its activities. STENAPA has only eight staff and is reliant on volunteers to run projects such as the Sea Turtle Conservation Programme. The organisation is supported by two international volunteer programmes; the STENAPA Internship Programme and the Working Abroad Programme, which are discussed in more detail below.

STENAPA Internship Programme

Since the inception of the Internship Programme in September 2001 over 30 interns from various countries including Great Britain, the USA, Canada, Holland, Germany and New Zealand have helped accomplish projects at the Botanical Garden, in the Quill National Park, in the Marine Park; they have also assisted with educational programmes in the local schools. Interns are responsible for overseeing the daily activities of volunteers from the Working Abroad Programme, in addition to managing and completing individual assignments.

Interns are provided with a small monthly stipend, basic accommodation and the use of a truck during their six-month stay; however, they are personally responsible for all travel costs, and living expenses while on the island. The internships allow students and professionals to gain valuable practical experience in their chosen field. Without these dedicated volunteers, STENAPA would not be able to conduct many of its projects, since the Foundation could not afford such manpower or expertise.

Working Abroad Programme – Statia Conservation Project

Working Abroad is an international networking service based in the United Kingdom that, since it was founded in 1997, has established volunteer projects in over 150 countries worldwide. STENAPA started its collaboration with the Working Abroad Programme in January 2003, and to date a total of 90 volunteers have been recruited via their organisation. On St Eustatius groups of up to eight volunteers stay for two months and assist in the development of the Botanical Garden, conduct maintenance of the National Park trails and, during turtle season, participate in night-time beach patrols. For their stay each volunteer pays approximately US\$1700 towards

food, water, lodging, truck hire, fuel and a project expenses fee (this does not include international travelling costs or personal living expenses during their stay).

Wider Caribbean Sea Turtle Conservation Network (WIDECAST)

The St Eustatius Sea Turtle Conservation Programme is affiliated to the Wider Caribbean Sea Turtle Conservation Network (WIDECAST). Founded in 1981, WIDECAST represents the largest network of sea turtle research and conservation projects in the world; with members in over 30 Caribbean states and territories. Affiliation provides access to a collaborative framework of organisations within the region, with a strong emphasis on information exchange, training and active community participation. WIDECAST promotes interaction between different stakeholder groups to ensure effective management and conservation of turtle populations in the Caribbean.

In June 2003, STENAPA Manager Nicole Esteban was appointed WIDECAST Country Co-ordinator for St Eustatius, following completion of a training course in St Croix (US Virgin Islands). Subsequent to this the St Eustatius Sea Turtle Conservation Programme implemented WIDECAST-approved protocols for monitoring and data collection. The Sea Turtle Programme Co-ordinator attended the WIDECAST Annual General Meetings in 2004 and 2005; with funding and logistical assistance provided in part through WIDECAST.

Dutch Caribbean Nature Alliance (DCNA)

The DCNA was founded in 2005, and represents a formal coalition of the six nature conservation management organizations of the Netherlands Antilles and Aruba, with representation from international agencies, central government and financial experts. Their main goals are to safeguard the biodiversity and promote sustainable management of the natural resources of the islands, through the establishment of long-term, sustainable funding sources. The Manager of STENAPA is currently the chairperson of the DCNA.

Funding agencies and donors

To effectively run the Sea Turtle Conservation Programme, the STENAPA Manager and Project Co-ordinator allocate approximately 10 to 30 % of their time to raise funds to cover the annual programme costs. Fundraising occurs both locally and internationally by soliciting specific organisations, and by donation requests through newsletters and turtle awareness campaigns.

Organisations that have contributed to the Sea Turtle Conservation Programme in 2005 are:

- Prince Bernhard Culture Fund, Netherlands Antilles
- Dutch Caribbean Nature Alliance (DCNA)
- Travel Committee of the International Sea Turtle Society
- Wider Caribbean Sea Turtle Conservation Network (WIDECAST), USA
- World Turtle Trust (WTT), USA
- Working Abroad Programme, France

We also acknowledge those individuals who have contributed to the success of the programme by donating their time or providing financial assistance.

Study Sites

St Eustatius

The island of St Eustatius is part of the Netherlands Antilles that includes Bonaire, Curaçao, St Maarten, Saba and St Eustatius. It lies in the North-eastern Caribbean, and is located in the Windward Islands, lying within the longitude and latitude median of 17°30 North and 62°58 West; the sister islands of Saba and St Maarten stretch out 30km north-west and 63km north, respectively (See Figure 1).

St Eustatius is 21km² in size and is dominated by two volcanoes; an extinct volcano comprising the “Northern Hills” (150 million years old) and a dormant volcano called the “Quill” in the south, formed 22000 to 32000 years ago. As a result of its volcanic origin, the beaches of St Eustatius all have dark sand.



Figure 1. Map showing location of St Eustatius in the Eastern Caribbean

Sea Turtle Nesting Beaches

Since the initiation of the Sea Turtle Conservation Programme in 2002 nesting activity has been recorded at five beaches on St Eustatius; Zeelandia Beach, Turtle Beach and Lynch Bay on the Atlantic side of the island, and Oranje Bay and Kay Bay on the Caribbean side (See Figure 2). There follows a brief description of each of these beaches.



Figure 2. Map showing location of nesting beaches on St Eustatius

Zeelandia Beach



At over 1km this is the longest beach on St Eustatius; it is directly linked to Turtle Beach at its southern end. It is quite a narrow beach backed by cliffs, except in the northern 200m where there is a relatively sparse border of Sea Grape trees (*Coccoloba uvifera*). In this region there are also the remains of an abandoned hotel behind the beach and the principal public access area. Ground vegetation is not extensive, limited to small patches of Beach Morning Glory (*Ipomoea pes-caprae*) and an unidentified succulent-type plant, which are both grazed by cows that occasionally shelter under the sea grape trees. The beach is very dynamic with considerable sand movement throughout the year; despite this it is still the most stable, permanent beach on the island. Erosion is extensive close to the access area, especially following heavy rains; the problem is exacerbated by sand removal in that region. Close to the southern end of the beach is a large storm water gut which acts as the landfill for the island's household waste. It is the primary turtle nesting beach hosting three species of turtle (green, leatherback and hawksbill), and the only place on the island where leatherbacks have been recorded nesting. It is the only beach monitored at night by the Sea Turtle Conservation Programme.

Turtle Beach

This is the second longest beach on the Atlantic side, measuring approximately 400m. It links to Zeelandia Beach at its northern point, and connects to Lynch Bay around a point to the south. It is a steeply sloping bay, which is subject to considerable sand movement especially during the hurricane season (June – November). It is backed by cliffs and there is virtually no vegetation except for occasional Sea Grape trees on the cliffs. There is a storm water gut in the middle of the beach which was formerly used as the land-fill



for the island; although not currently used this gut still contains a large amount of refuse and is open to the beach. Nesting activity to date has been limited to green turtles. Unfortunately access to this beach at night is often prohibited due to the tides, and therefore it is only patrolled during the day except when conditions permit.

Lynch Bay



This very small, rocky beach is located around the point to the south of Turtle Beach; it is approximately 200m long. There is considerable ground vegetation cover, primarily Beach Morning Glory and it is backed by a sloping cliff which provides the only access when tides prohibit movement from Turtle Beach. Unlike many of the other beaches on the island Lynch Bay is stable due to the adjacent reef barrier that provides a natural shelter and also for sand retention. Green and hawksbill nesting activity has been recorded at this beach, and it was the site of an unconfirmed loggerhead nest (I. Berkel, Pers. Comm.). Due to access issues Lynch Bay can only be monitored safely during the day.

Oranje Bay

This is a very dynamic sandy beach on the Caribbean side of the island; it experiences considerable sand movement throughout the year. It stretches for almost 2km and runs into the harbour at its southern end. The beach is bordered by grass and the occasional Coconut Palm (*Cocos nucifera*) in addition to several hotels and shops; there are also ruins of warehouses on the sand and in the near-shore waters along its entire length. Very little nesting of green and hawksbill turtles has been observed, due to which fact it is not monitored regularly.



Kay Bay



This is a short, rocky bay on the Caribbean side of the island; approximately 200m long. It is backed by a high cliff, which has a few Sea Grape trees; there is no other vegetation cover. Green and hawksbill turtles have been recorded nesting on this beach. The only access to Kay Bay is via private residential properties; the owners of one property report any signs of turtle nesting activity to STENAPA as this beach is not monitored on a regular basis.

Methodology

Pre-Season Preparations

The Sea Turtle Conservation Programme 2005 commenced with the following pre-season activities:

Selection of New Programme Co-ordinator

Following the departure of the existing Programme Co-ordinator in January 2005, the position was advertised locally through January and February in the local newspaper and on the radio. To attract international applicants the job was also advertised at the 25th International Sea Turtle Symposium and on the Internet via the Seaturtle.Org and WIDECAST websites, and the NACRI (Netherlands Antilles Coral Reef Initiative) list server.

Beach Preparation

To prepare the primary nesting beach for patrols, numbered stakes were positioned at 20m intervals along Zeelandia Beach; these stakes are used to mark the location of all nests or false crawls recorded during day or night patrols. Each stake was placed as close as possible to the vegetation or cliff behind the beach. Some stakes were remaining from the 2004 season, these were repainted; any that were missing were replaced.

Updating of Data Collection Sheets and “Guidelines for Visitors” Information

Prior to the start of beach patrols, the new Programme Co-ordinator updated the data collection sheets for the tagging and nest marking data, as well as creating a new data form for the nest excavation data. In addition, the “Guidelines for Visitors” handout that is given to community members or tourists wishing to join a night patrol was rewritten to improve the information given to potential volunteers about protocols on the beach.

Training of Volunteers

The materials used for training volunteers about the Sea Turtle Conservation Programme were reviewed before the first group from Working Abroad arrived in April 2005. Two short presentations were created; the first was a basic introduction to sea turtles, their biology and nesting behaviour; the second focused on beach monitoring protocols and the correct use of the data collection sheets. Every volunteer received training before assisting with beach monitoring.

Monitoring and Research Activities

During the 2005 nesting season several different monitoring and research activities were conducted as part of the Sea Turtle Conservation Programme:

Track Surveys

Daily track surveys were conducted on the primary nesting beach (Zeelandia Beach) and Turtle Beach; surveys of other beaches were performed periodically when deemed necessary. These surveys provide data on the temporal and spatial utilisation of previously identified turtle nesting beaches throughout the nesting season. For each track observed the following information is recorded (See example of data collection sheet in Appendix 1):

- Observer – Name of observer recording data.
- Date
- Weather – Brief description of environmental conditions.
- Moon phase – Based on the previous night’s moon; this information is recorded to determine whether there is a relationship between moon phase and emergence.
- Species – If possible to determine from the track.

- Track width – Measured as the straight-line distance between the outer flipper edge marks; taken to the nearest millimetre. For each track the width is measured at three random locations and the average used in analyses.
- GPS location – Measured either at the centre of the nest or at the apex of a false crawl track.
- Locale name – Name of the beach.
- Triangulation measurements to two landmarks – Straight-line distance to the two nearest numbered stakes; taken to the nearest centimetre. Measured either from the centre of the nest or at the apex of a false crawl track.
- Distance to vegetation – Straight-line distance to the vegetation behind the beach or to the cliff if no vegetation; taken to the nearest centimetre. Measured either from the centre of the nest or at the apex of a false crawl track.
- Distance to high tide line – Straight-line distance to the most recent high-tide line; taken to the nearest centimetre. Measured either from the centre of the nest or at the apex of a false crawl track.
- Number of unsuccessful nest cavities – If the turtle made more than one attempt at nesting during the same emergence.
- Result of nesting attempt – Recorded as either lay, probable lay, false crawl (when some nesting activity observed) or track only (no nesting activity at all).

All marked nests were monitored daily and their status recorded; any disturbed or destroyed nests were noted. After the data have been recorded a line is drawn in the sand through both tracks to indicate that it has been registered, ensuring that data are not collected twice for the same track. Surveys were conducted as early as possible in the morning to prevent tracks from being disturbed or washed away. For continuity, and to increase the accuracy of data collection, surveys were conducted by the Programme Co-ordinator or trained personnel in her absence.

Beach Patrols

Nightly beach patrols were conducted on Zeelandia Beach and, when tidal conditions permitted, Turtle Beach; data from previous years show very low nesting densities at other beaches, making it an inefficient use of resources to carry out night patrols at these other locations. Each patrol consisted of a minimum of two people; including either the Programme Co-ordinator or a Marine Park intern where possible, although occasionally two Working Abroad volunteers conducted a patrol together. A stretch of beach approximately 1km in length was monitored on Zeelandia Beach (up to 1.6km when Turtle Beach was included) from the cliffs at the northern end to just south of Smith's Gut; hourly patrols of this section were conducted between 9.00pm - 4.00am.

The primary objective of the beach patrols was to encounter as many nesting turtles as possible; to tag them with flipper and/or internal tags as appropriate, collect carapace measurements, mark the location of the nest for inclusion in a nesting success survey and relocate any nests laid in designated erosion zones. For each turtle observed the following data were recorded (See example of data collection sheet in Appendix 1):

- Observer – Name of observer recording data.
- Date – Patrols span two dates but to avoid confusion the first date is used throughout the entire patrol.
- Time – At the moment the turtle is first encountered

- Weather – Brief description of environmental conditions.
- Moon phase – This information is recorded to determine whether there is a relationship between moon phase and nesting emergence.
- Species – If the turtle is not observed the species is determined from the track, where possible.
- Gender
- Tag information – See detailed description below of data recorded.
- Activity – At the moment the turtle is first encountered. Classed as emerging, searching, body pitting, digging egg chamber, laying, covering, disguising, gone (used if turtle has returned to the sea).
- Carapace Length – See detailed description below of measurements taken for each species.
- Carapace Width - See detailed description below of measurements taken for each species.
- Parasites/Ectobiota – The presence of any parasites on the turtle are recorded, with a brief description of the parasite; its location is indicated on a diagram on the data collection sheet.
- Injuries – Any injury to the turtle is described and the location indicated on a diagram on the data collection sheet.
- Notes – Any additional pertinent information about the turtle or their behaviour is recorded here.
- Track width – This is only recorded if the turtle is not observed during the patrol. Measured as the straight-line distance between the outer flipper edge marks; taken to the nearest millimetre. For each track the width is measured at three random locations and the average used in analyses.
- GPS location – Measured either at the centre of the nest or at the apex of a false crawl track. When possible this is taken while the turtle is laying, when the egg chamber is open and the exact location of the eggs is known.
- Locale name – Name of the beach.
- Triangulation measurements to two landmarks – Straight-line distance to the two nearest numbered stakes; taken to the nearest centimetre. Measured either from the centre of the nest or at the apex of a false crawl track. When possible these measurements are made while the turtle is laying so that the exact location of the eggs is known.
- Distance to vegetation – Straight-line distance to the vegetation behind the beach or to the cliff if no vegetation; taken to the nearest centimetre. Measured either from the centre of the nest or at the apex of a false crawl track. When possible this measurement is made while the turtle is laying so that the exact location of the eggs is known.
- Distance to high tide line – Straight-line distance to the most recent high-tide line; taken to the nearest centimetre. Measured either from the centre of the nest or at the apex of a false crawl track. When possible this measurement is made while the turtle is laying so that the exact location of the eggs is known.
- Number of unsuccessful nest cavities – If the turtle made more than one attempt at nesting during the same emergence.
- Result of nesting attempt – Recorded as either lay (when the turtle was seen laying), probable lay (if the nest site suggests that the turtle laid but no eggs were seen), false crawl (when some disturbed sand observed) or track only (no nesting activity at all, no disturbed sand).

- Relocation data – If the nest is deemed to have been laid in an unsuitable location which is prone to erosion or flooding the eggs are relocated to a more secure section of the beach. The following data are recorded for this new nest site.
 - New GPS location – Taken at the centre of the new egg chamber.
 - Triangulation measurements to two landmarks – Straight-line distance to the two numbered stakes closest to the new nest location; taken from the centre of the new egg chamber.
 - Distance to vegetation – Taken from the centre of the new egg chamber.
 - Distance to high tide line – Taken from the centre of the new egg chamber.
 - The number of eggs – The total number of eggs; also recorded separately are the number of yolked and yolkless eggs.
 - Time eggs laid – The time the turtle began to lay eggs.
 - Time eggs reburied – The time the eggs were placed in the new egg chamber.

All data were collected either while the turtle was laying or immediately afterwards, when she was covering the nest site; no turtle was touched before she had started laying.

Once the turtle had returned to the sea a line was drawn in the sand through both tracks to indicate to the person conducting the track survey the following morning that data had been collected, preventing data repetition for the same track or nest.

Tagging Methods

Flipper Tags

Metal flipper tags (National Band and Tag Company, MONEL Style #49: WC251 – WC350 and INCONEL Style #681: WE1 – WE100) were donated by the Marine Turtle Tagging Centre, Barbados, which is affiliated with WIDECAST. All tag applicators are inspected and cleaned on a routine basis and replaced when they ceased to function properly.

Standard tagging methods are used, based on the protocols of the Turtle Monitoring Programme in St Croix, USVI. For leatherbacks, external flipper tags are applied to the centre of the fleshy skin located between the back flipper and the tail (See Figure 3). For hard shell species, tags are applied adjacent to the first large scale on the proximal part of the front flipper (See Figure 4), where the swimming stroke will cause minimal tag movement (Balazs, G. H, 1999). Tags are applied while the turtle is covering her nest, immediately after she has finished laying eggs; this is done so that the turtle is not disturbed prior to laying. Two metal tags are attached to each turtle, both leatherbacks and hard-shelled species; this is to ensure that even if one tag is lost the individual can still be recognised. External flipper tags were only applied by trained personnel, either the Programme Co-ordinator or Marine Park intern.

Passive Integrated Transponder (PIT) Tags

PIT tags were purchased by the Sea Turtle Conservation Programme with funding from KNAP Fund, MINA. For leatherbacks only, in addition to the two external flipper tags, one PIT tag is also applied to each individual. A PIT tag is a small microprocessor which transmits a unique identification number when read using a hand-held scanner. While the turtle is laying a single PIT tag is inserted under the skin in the front shoulder muscle of the turtle using an applicator (See Figure 3). All leatherbacks encountered were scanned for the presence of PIT tags using an

AVID scanner before a PIT tag was inserted, to avoid double-tagging individuals. Only the Programme Co-ordinator and STENAPA Manager were trained to apply PIT tags.

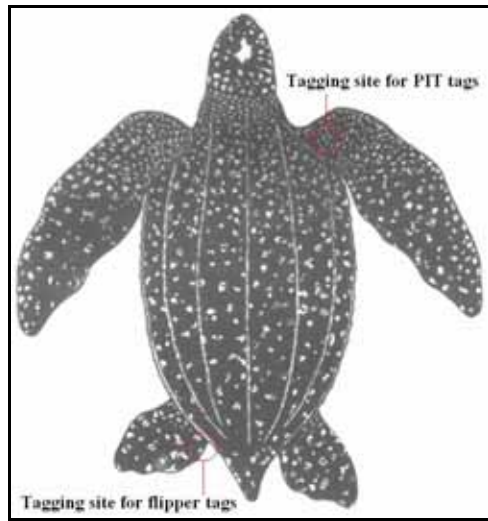


Figure 3. Tagging sites for leatherbacks

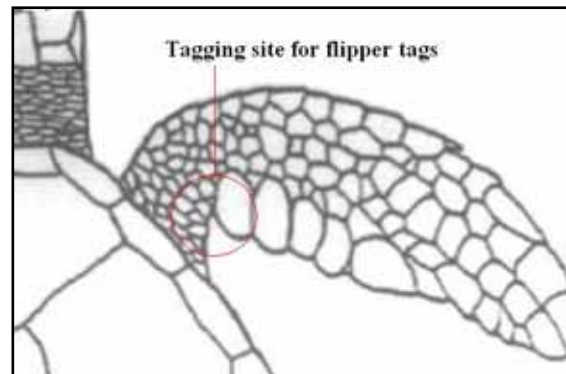
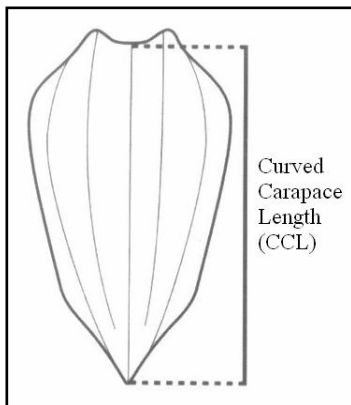


Figure 4. Tagging site for hard shell species

Carapace Measurements

Standard carapace length and width measurements (as of Bolten, 1999) were taken of each nesting turtle encountered, after she had finished laying. Measurements were made using a flexible metal or fibreglass tape measure; each measurement was taken once, to the nearest millimetre.

Leatherback



Curved carapace length (CCL) was measured from the nuchal notch (the anterior edge of the carapace where it meets the skin) in a straight line to the most posterior tip of the caudal projection (See Figure 5). When the caudal projection is not symmetrical the measurement is made to the longest point (any such irregularity would be noted on the data collection sheet as influencing the measurement). Measurements were taken just to the right of the central ridge, not along its crest, to avoid errors associated with carapace surface irregularities.

Figure 5. Carapace length - leatherback

Curved carapace width (CCW) is measured at the widest point, but there are no standard features delineating the end points (See Figure 6). The tape measure passes over the ridges and does not follow their contours.

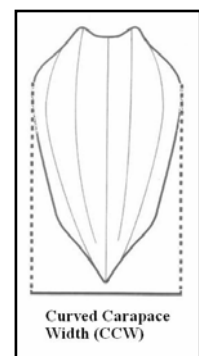


Figure 6. Carapace width – leatherback

Hard shell species

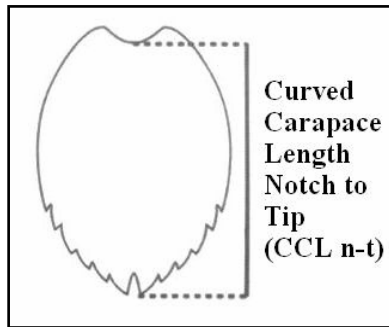


Figure 7. Carapace length –hard shell

Curved carapace width (CCW) is measured in a straight line between the widest points of the carapace (See Figure 8); there are no anatomical features marking the end points.

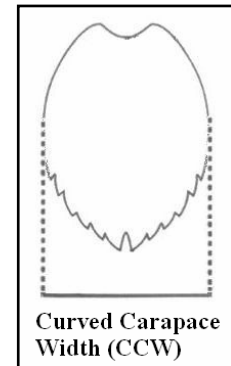


Figure 8. Carapace width – hard shell

Nest Survival and Hatching Success

All nests recorded were included in a study on nest survival and hatching success. Every day during morning track surveys the status of each marked nest was observed; a record was made if a nest was deemed disturbed, destroyed or washed away. Close to the predicted hatching dates (at around 50 days) the triangulation data were used to mark the site of the egg chamber; to prevent the surveyor having to re-measure the nest each day a small “V” of sticks was placed on the sand behind the nest site. This area was closely monitored for evidence of hatching; a depression, hatchling tracks or hatchlings. When any signs of hatching were observed the nest was excavated after 48 hours; if no signs of hatching were recorded the nest was excavated after at least 70 days from the date the eggs were laid. All excavations were conducted by the Programme Co-ordinator or trained personnel to ensure accuracy of data collection.

If a depression or other sign of hatching was present the excavator carefully dug down at this point until the first egg was encountered; if hatching had not been observed the triangulation data were used to locate the expected site of the egg chamber where digging commenced. Using gloves, the nest contents were carefully removed from the egg chamber and inventoried. The following data were recorded for each excavated nest (See example of data collection sheet in Appendix 1):

- Nest code – Each nest was given a unique identification number.
- Observers – Names of people present during excavation.
- Date – The date the nest was laid; when hatching was observed and the date the excavation was conducted.
- Number of empty shells – Only shells corresponding to more than 50% of the egg were counted; representing the number of hatched eggs.

- Number of hatchlings – Any hatchlings found in the egg chamber were recorded; dead or alive.
- Number of unhatched eggs – Eggs were opened to search for the presence of embryos and categorised as:
 - No embryo – No obvious embryo present.
 - Embryo – Embryo present; includes all stages of development.
 - Full embryo – Embryo in final stages of development and ready to hatch.
- Number of pipped eggs – Eggs where hatchling had broken the egg shell but failed to hatch; characterised by triangular hole in the shell. Whether hatchling was alive or dead was also recorded.
- Number of predated eggs – If possible the type of predator was noted; often characterised by a circular hole in the shell.
- Number of deformed embryos – Any deformities were recorded such as missing flippers, additional scutes on carapace, albinism or the presence of multiple embryos in a single egg
- Number of yolkless eggs – Small, yolkless eggs were counted separately.
- Notes – Any additional pertinent information was recorded.
- Depth of nest – To the top of the egg chamber (first egg encountered) and the bottom of the egg chamber (after final egg removed); measure to nearest centimetre.

Any hatchlings found alive were released to the sea. When the inventory was complete the nest contents were returned to the egg chamber and reburied.

In-water Turtle Sightings

To obtain information on in-water sightings of turtles, data collection forms were given to the three dive centres on St Eustatius; Dive Statia, Golden Rock Dive Centre and Scubaqua (See example of data sheet in Appendix 2). The following data were recorded for each sighting:

- Name – Name of observer.
- Date
- Location – Name of dive site or GPS location.
- Time – Time of sighting.
- Species of turtle – Green, hawksbill, loggerhead, leatherback, could not determine.
- Length of shell – Less than 10cm, 10 – 50cm, 50 – 100cm, more than 100cm.
- Did the tail extend more than 15cm past the shell? – Yes, no, don't know.
- Status of the turtle – Alive, dead, injured. If injury, a description of the injury.
- Behaviour of the turtle – Resting, mating, swimming or eating.
- Depth of turtle – In feet or metres.
- Location of turtle – On the surface, in the water column or at the bottom.
- Environment – Sand, sea grass, coral reef, rock or other (cave, wreck, etc.).
- Any other comments

Divers were asked to complete the forms whenever they encountered a turtle while diving. The Programme Co-ordinator visited the dive centres periodically throughout the 2005 season to collect any completed forms.

Sea Turtle Satellite Tracking Project 2005

In June funding was confirmed from the DCNA to initiate a sea turtle tracking project in the Netherlands Antilles. This project was an inter-island initiative between the DCNA, STENAPA and the Nature Foundation Sint Maarten; led by sea turtle biologist Dr Robert van Dam. The objective was to learn the geographical range of adult female green and hawksbill turtles nesting on St Eustatius and St Maarten, by determining their migratory movements and the location of their feeding grounds. Another important aspect of the project was as a forum to engage local communities in sea turtle conservation issues, by showcasing turtle migratory behaviour from the islands.

Preliminary visits to the two islands were scheduled in July; these were intended to locate the primary nesting beaches and also discuss logistics for the research trip later in the season. In addition training in transmitter attachment procedures was to be given by Dr van Dam to research personnel. A tentative schedule was determined for the September visit and patrols arranged to collect data on nesting emergences to calculate predicted nesting dates for individuals during that time. It was planned to deploy five transmitters on green and hawksbill turtles; three on St Eustatius and two on St Maarten.

Basic Satellite Telemetry

Satellite telemetry involves attaching a small transmitter to the carapace of a turtle; each time the turtle surfaces to breathe a signal is sent to an ARGOS receiver on-board a polar orbiting NOAA satellite. This signal provides information about the location of the turtle; the signal is classified into one of five location classes depending on its accuracy. This will vary depending on several factors including environmental conditions and relative location of transmitter and satellite. Using satellite transmitters it is possible to follow individuals and gain detailed information about turtle migration and migratory behaviour patterns. By knowing where turtles are going and the routes they use between breeding and feeding areas, researchers can determine potential threats in all areas frequented by turtles and so focus conservation efforts where most needed.

Satellite transmitters are small and lightweight; the Telonics ST-18 used on St Eustatius measured 12cm by 5cm and weighed approximately 200g (See Figure 9). Essentially they are electronic components and a battery housed inside a hard plastic casing, with an external antenna at one end. They are designed to be hydrodynamic and so cause minimal disruption to a turtle's natural swimming and diving behaviours. For hard shell species transmitters lie on a layer of elastomer that cushions between the transmitter and the carapace; it is then secured using layers of fibreglass resin.



Figure 9. Satellite transmitter fitted to a turtle carapace

The fibreglass creates a protective casing for the transmitter against damage on reefs or other hard surfaces during its time in the ocean. Transmitters will normally last several months until the battery fails, the antenna is broken, or it is dislodged from the carapace.

Education and Media Activities

Two school visits were planned; the first prior to the research visit in September, to provide students with information about satellite telemetry and how it can assist turtle research and conservation, the second after transmitters had been attached to give feedback on what had been achieved and show the location of each turtle. Competitions were organised for local children to choose the name of the turtles in the study, and to guess where the turtles might go on their migrations.

To raise public awareness of the project, different media events were arranged; these included radio interviews, articles in the local newspaper and STENAPA newsletter, exhibits and features on the STENAPA website.

Beach Erosion

When the numbered stakes were placed along Zeelandia Beach before the start of patrols the distance from the stake to the cliff or vegetation was recorded to determine the extent of erosion along the monitored section of beach since 2004.

If a significant landslide or cliff fall was encountered during a patrol on any nesting beach the following data were recorded; the date, time (if known), amount of cliff affected and a description of the damage, including a photograph whenever possible.

Community Outreach Events

Raising community awareness of the Sea Turtle Conservation Programme is a fundamental part of the project. Various activities were arranged during 2005, which are described below:

School Activities

Presentations in the local schools were organised in conjunction with Dominique Vissenberg, the Turtle Education Outreach Co-ordinator for the Windward Islands, as part of the “Help Out or Sea Turtles Miss Out” campaign being conducted on St Maarten, St Eustatius and Saba. In addition, several schools were also visited as part of the education component of the Sea Turtle Satellite Tracking Project 2005 (See above).

School Vacation Programme

This programme was implemented by the Island Government in 2004; recent graduates, who are continuing their studies overseas, are given work placements with local businesses during their summer vacation. STENAPA has participated in this scheme since its inception and accepts at least one student each summer; they assist with many STENAPA programmes including the Sea Turtle Conservation Programme, helping on night patrols, nest excavations and beach clean-ups.

Beach Clean-Ups

Monthly beach clean-ups were scheduled on Zeelandia Beach; this site was chosen as it is the primary turtle nesting beach on the island, and the beach where the majority of the turtle research

activities occur. These events were conducted with the aid of STENAPA staff, interns, Working Abroad volunteers and members of the public. Each clean-up was advertised in advance to encourage participation by the local community. A record was made on the number of participants at each clean-up and the amount and type of rubbish collected. All rubbish was disposed of at the Smith's Gut landfill site.

Media Exposure and Public Presentations

Whenever possible the events of the Sea Turtle Conservation Programme 2005 were publicised in the local newspaper, STENAPA newsletter, on local radio or via the STENAPA website. Public presentations were also given to different groups on the island.

Participation in Meetings, Workshops and Symposia

In an effort to broadcast the work of the St Eustatius Sea Turtle Conservation Programme to as wide an audience as possible, the Programme Co-ordinator tried to attend any relevant meetings, workshops or symposia relating to turtle biology, research or conservation issues. Such gatherings create ideal opportunities to establish regional and international contacts within the sea turtle community; these contacts may provide guidance or support to expand and develop the programme on St Eustatius in the future.

Results

Pre-Season Preparations

Selection of New Programme Co-ordinator

Applications for the position of Programme Co-ordinator were accepted until the end of February 2005, with 30 applications received. Seven candidates were short-listed, of these three were interviewed in March 2005. The successful applicant, Dr Emma Harrison, was informed on 18 March 2005 and appointed to start on 2 April, 2005; an application for a work permit was submitted to the island authorities prior to her arrival on St Eustatius.

Beach Preparation

A total of 65 stakes were prepared by the Programme Co-ordinator; each stake had a number engraved and then painted white. A band of reflective tape was applied to help locate them on the beach at night using a flashlight. Stake 1 was located at the northern limit of Zeelandia Beach and they ended at stake 65, half-way along Turtle Beach; they were positioned by the Programme Co-ordinator and a group of Working Abroad volunteers. Only part of Turtle Beach was marked in April as no leatherback nesting had been observed on that beach in previous years; in August temporary stakes were placed on the remainder of Turtle Beach, when green turtle nesting activity was recorded. Over the course of the nesting season some of the stakes were lost due to high tides and beach erosion; these were replaced using temporary markers.

Updating of Data Collection Sheets and "Guidelines for Visitors" Information

The new data collection sheets for tagging and nest marking data included a section on PIT tags; their presence, location and the number (See Appendix 1). Prior to 2005 there was no specific

data collection sheet for nest excavation data; the new form standardised the information collected.

The “Guidelines for Visitors” fact-sheet is very important as it provides useful information to anyone wanting to participate in a monitoring patrol. The new form (See Appendix 3) reflected changes in beach protocols implemented in 2005. All visitors were required to sign the form once they had read it acknowledging that they agreed to abide by the rules and regulations mentioned. It was used as the basis of a brief orientation session that visitors received with the Programme Co-ordinator prior to joining researchers on the beach.

Training of Volunteers

The Programme Co-ordinator conducted the first training session on 15 April 2005; present were Working Abroad volunteers and Marine Park staff and interns. Each successive group of Working Abroad volunteers received an identical orientation; in July, September and November. In addition to the two theoretical presentations on sea turtle biology and data collection they received practical training on nest marking methodology and carapace measurements.

Two Marine Park interns also received training in external flipper tagging protocols; it was hoped that they could tag turtles encountered on nights when the Programme Co-ordinator was not leading beach patrols. However, during the monitoring period all turtles requiring tags were actually observed on patrols led by the Programme Co-ordinator.

Monitoring and Research Activities

The following is a summary of the data collected during the 2005 monitoring and nesting activities of the Sea Turtle Conservation Programme.

Track Surveys

Daily morning track surveys were conducted between 5 April and 21 November, 2005; a total of 190 surveys were completed. On 41 days surveys were not performed either due to inclement weather conditions making surveying dangerous, training or lack of personnel. The Programme Co-ordinator conducted 90% of the track surveys; trained volunteers carried out the surveys in her absence.

Zeelandia Beach was always included in the survey; Turtle Beach was surveyed on all but eight days and Lynch Beach was only surveyed on 35 occasions during the season. For the last month surveys were limited to Zeelandia Beach as nesting activity had ceased; morning surveys were only conducted to monitor marked nests for hatching activity.

The first track was observed on 29 March, 2005; a leatherback nest was recorded on Zeelandia Beach. This nest was reported to STENAPA by a member of the public as the Programme Co-ordinator had not arrived on island and no surveys were being conducted at that time. The last nesting activity was recorded on 2 October, 2005; a green turtle nest was laid on Zeelandia Beach.

Three species of turtle were recorded nesting in 2005; leatherback, green and hawksbill. Leatherback nesting occurred between 29 March and 22 June, 2005; green turtle nesting activity

was recorded from 4 July – 1 October, 2005; only two hawksbill nesting attempts were observed, on 27 May and 19 September, 2005.

Very little nesting activity was observed in 2005 (See Table 1, Figure 10 and Figure 11); a total of 28 nests and 60 false crawls for all three species. Zeelandia Beach was the primary nesting beach, as observed in previous years; very few emergences were made on Turtle Beach or Kay Bay.

Table 1. Summary of turtle nesting data collected during track surveys in 2005

Species	Number of Nests	Location of Nests	Number of False Crawls	Location of False Crawls
Leatherback	11	All Zeelandia Beach	8	All Zeelandia Beach
Green	15	13 Zeelandia Beach 1 Turtle Beach 1 Kay Bay	52	46 Zeelandia Beach 6 Turtle Beach
Hawksbill	2	1 Zeelandia Beach 1 Kay Bay	0	N/A

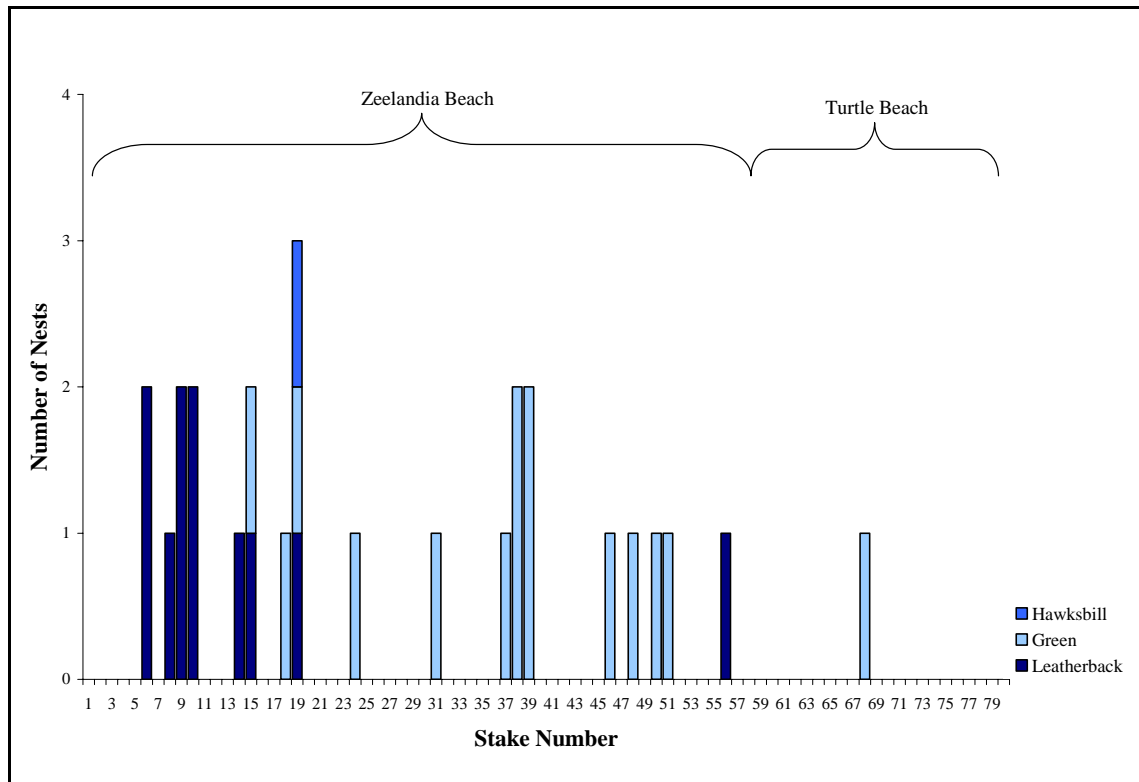


Figure 10. Distribution of nests on Zeelandia Beach and Turtle Beach in 2005

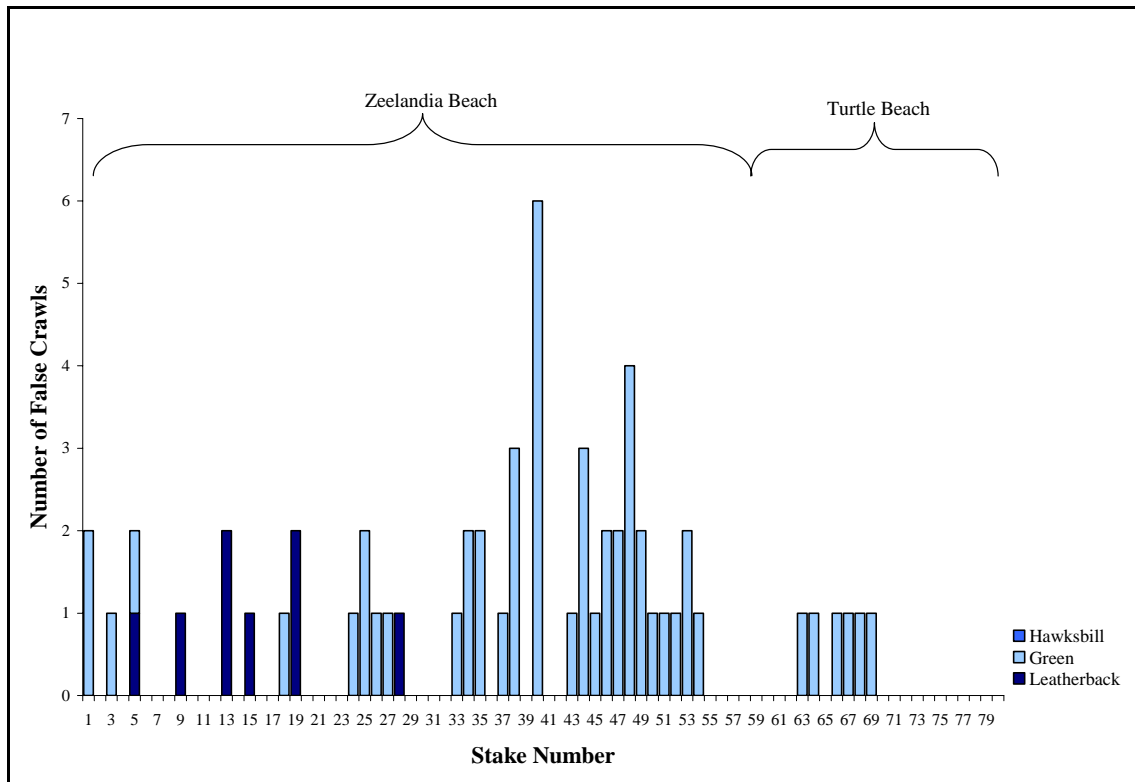


Figure 11. Distribution of false crawls on Zeelandia Beach and Turtle Beach in 2005

All leatherback nesting activity occurred on Zeelandia Beach, and was almost exclusively limited to a 300m stretch at the northern end (See Figures 10 and 11); only one nest and one false crawl were south of this area. Green turtles were the only species using all three beaches; but most emergences were on Zeelandia Beach. In contrast to leatherbacks, green turtle activity was concentrated in a different section of the beach, south of stake number 32 (See Figures 10 and 11). Hawksbills showed no particular preference, nesting on Zeelandia Beach and Kay Bay.

Beach Patrols

Unlike previous years, in 2005 monitoring of Zeelandia Beach was increased from five to seven nights per week, to include weekends. This decision was taken to maximise the possibility of encountering a nesting female thus increasing the amount of data collected. Patrols commenced at 9.00pm and ended around 3.00am; they were conducted along the entire length of Zeelandia Beach and occasionally on Turtle Beach, when tidal conditions permitted.

Night patrols were conducted between 18 April and 20 October, 2005; patrols ended on this date as no nesting activity had been observed for three weeks and it was assumed that the season had finished. In total, 165 patrols were conducted; more than 1,000 hours of monitoring. If insufficient personnel were available patrols were cancelled; on six nights patrols were cancelled or terminated early due to bad weather causing dangerous conditions on the beach. The Programme Co-ordinator led 59.4% of patrols, assisted by STENAPA interns and Working

Abroad volunteers; when not on patrol the Programme Co-ordinator was on radio stand-by to assist the team on the beach if necessary.

Turtles were encountered on 29 separate nights; approximately 18% of patrols, or an encounter rate of 1 turtle every 5.7 nights. The first leatherback was observed on 22 April, the last on 7 June; the first green turtle was encountered on 20 July and the last turtle of the 2005 season was a green turtle seen on 1 October.

Eight individual females were encountered; three leatherbacks and five green turtles, no hawksbills were observed during patrols. One leatherback was seen eight times, of which six were successful nesting attempts; the average inter-nesting interval was 8.9 days (with a range of 8 – 10 days). Of the green turtles, three were observed more than once; one laid two nests and made four false crawls; one laid two nests and made one false crawl; another nested successfully five times. Average inter-nesting interval for green turtles, calculated from one individual, was 10.8 days (with a range of 10 – 11 days).

Visitors were always welcome on night patrols, both tourists and members of the local community. However, very few people joined researchers in 2005; only 22 people in total, comprising new STENAPA staff with their family, medical students, a journalist, tourists and interested members of the public. In addition, on four nights, students from the Caribbean Marine Reserves Programme (part of the Broachreach Programme) joined patrols; this programme brings groups of high school students from the United States to study how marine reserves are managed and also participate in hand-on field research. Due to the limited number of local volunteers a flyer was produced in July advertising the Sea Turtle Conservation Programme and inviting interested parties to contact the Programme Co-ordinator for more information (See Appendix 4).

Tagging

All of the eight individual females encountered on beach patrols during the 2005 nesting season (See above) were tagged; three leatherbacks and five greens. None of the leatherback turtles had tags when first encountered; all were given two external flipper tags in their rear flippers and a single PIT tag in the right-hand shoulder muscle. Of the five greens, four had no tags when first observed; one, however, had a single flipper tag in her right front flipper (Tag number WE25). When the Programme Co-ordinator checked the data base from previous years it was found that this turtle had originally been tagged on Zeelandia Beach on 7 August, 2002; this was the first record of a returning turtle for the Sea Turtle Conservation Programme. All tagging of turtles was performed by the Programme Co-ordinator.

Carapace Measurements

Standard carapace measurements were taken for each female that was tagged; some individuals were measured more than once, if they were encountered multiple times during the season. Table 2 & Table 3 show the curved carapace length (CCL) and width (CCW) measurements for each leatherback and green turtle encountered, and the mean for each species.

As can be seen from Table 2, the three leatherback turtles encountered were similar in length; CCL measurements ranged from 145.2cm to 151.7cm, with a mean of 148.2cm. Width measurements showed similar variation between females; CCW = 108.5cm – 114.6cm, with a

mean of 111.6cm. Only one leatherback was measured more than once (WC326); there was up to 5cm variation in the CCL measurements taken (Range = 150.9cm – 155.2cm), but CCW measurements differed by only 1cm (Range = 111.3 cm – 112.3cm).

Table 2. Carapace measurements of all leatherback turtles encountered in 2005.

Turtle Identification Number	Curved Carapace Length¹ (CCL) / cm	Curved Carapace Width¹ (CCW) / cm
WC326	151.7	111.8
WC332	147.5	114.6
WC336	145.5	108.5
Species Mean	148.2	111.6

Table 3. Carapace measurements of all green turtles encountered in 2005.

Turtle Identification Number	Curved Carapace Length¹ (CCL n-t) / cm	Curved Carapace Width¹ (CCW) / cm
WE7	100.6	93.4
WE15	106.6	95.3
WE22	113.5	106.8
WE24	112.0	106.0
WE26	111.5	98.4
Species Mean	108.8	100.0

Individual green turtles showed much more variation in both carapace length and width than leatherbacks (See Table 3); CCL n-t ranged from 100.6cm – 113.5cm, with a mean of 108.8cm; CCW ranged from 93.4cm – 106.8cm, mean = 100.0cm. For females observed more than once the difference between successive CCL n-t measurements was less than for CCW measurements, possibly due to clearer defined end points for length measurements than for width, which were more subjective and open to greater observer bias.

Nest Survival and Hatching Success

Twenty-eight nests were marked for inclusion in the nest survival and hatching success study; 11 leatherback, 15 green and two hawksbill. Tables 4 and 5 provide a summary of the nest survival data obtained from each marked nest of 2005; each table details, for leatherbacks and hard shell species respectively, nest code, turtle identification number, location of the nest, fate of the nest, incubation period in days (if known), and whether the nest was excavated or not.

¹ If a turtle was encountered on more than one occasion the average of all measurements taken are shown

Table 4. Summary of nest survival data for each marked leatherback nest.

Nest Code	Turtle Id Number	Location	Fate of Nest	Incubation / days²	Nest Excavated
DC1	Unknown ³	Zeelandia Beach	Partly hatched	60	Yes
DC2	WC326	Zeelandia Beach	Partly hatched	Unknown	Yes
DC3	WC326	Zeelandia Beach	Partly hatched	Unknown	Yes
DC4	WC326	Zeelandia Beach	Partly hatched	Unknown	Yes
DC5	WC326	Zeelandia Beach	Partly hatched	Unknown	Yes
DC6	WC332	Zeelandia Beach	Washed away	N/A	No
DC7	WC326	Zeelandia Beach	Unhatched	N/A	Yes
DC8	WC326	Zeelandia Beach	Partly hatched	Unknown	Yes
DC9	WC337	Zeelandia Beach	Unhatched	N/A	Yes
DC10	Unknown ²	Zeelandia Beach	Could not find ⁴	N/A	No
DC11	Unknown ²	Zeelandia Beach	Could not find ³	N/A	No

The survival of nests on Zeelandia Beach was very high, of 25 nests laid on that beach only two did not survive; one leatherback nest was lost due to erosion before it could be relocated to a safer location, and one green turtle nest was buried underneath a cliff fall. One green turtle nest was relocated in the middle of the incubation period as high tides posed a serious threat to the survival of the eggs if left *in situ*. Only one nest was laid on Turtle beach; that nest could not be found when it was time to excavate; both nests laid on Kay Bay survived the entire incubation period and hatched successfully.

Evidence of hatching was only observed for nine marked nests; either hatching tracks in the sand or hatchlings on the beach, and therefore it was only possible to calculate the incubation period for these nests. For both leatherbacks and hawksbills incubation period was determined from one nest only; 60 days and 63 days, respectively. Seven green nests showed visible signs of hatching; the mean incubation period for this species was 58.6 days, shorter than the two other species.

Excavations were conducted on 20 of the 28 marked nests; eight leatherback, 10 green and both hawksbill nests. Six nests, two leatherback and four green, could not be found by researchers when it was time to excavate the nest; on some occasions the nest was marked after the turtle had left the beach, and so only an approximate location of the egg chamber was known. For all of these nests no signs of hatching were observed, thus exacerbating this lack of information about the exact location of the eggs; when excavating each nest several holes were dug in the vicinity of

² “Unknown” indicates that no signs of hatching were observed and the hatching date was not known, so it was impossible to calculate an incubation period.

³ Turtle not observed and so identity unknown.

⁴ Egg chamber was not located during excavation.

where the triangulation measurements crossed, to try to find the eggs. Only when this procedure had been performed, and no eggs were encountered, was the attempt abandoned and the nest classified as “Could not find”.

Table 5. Summary of nest survival data for each marked nest of hard shell species.

Nest Code	Turtle Id Number	Location	Fate of Nest	Incubation / days⁵	Nest Excavated
CM1	Unknown ⁶	Turtle Beach	Could not find ⁷	N/A	No
CM2	WE7	Zeelandia Beach	Unhatched	N/A	Yes
CM3	WE24	Zeelandia Beach	Hatched	Unknown	Yes
CM4	Unknown ²	Zeelandia Beach	Could not find ³	N/A	No
CM5	Unknown ²	Zeelandia Beach	Hatched	62	Yes
CM6	WE22	Zeelandia Beach	Lost ⁸	N/A	No
CM7	WE7	Zeelandia Beach	Relocated ⁹	N/A	N/A
CM8	WE24	Zeelandia Beach	Hatched	57	Yes
CM9	WE22	Zeelandia Beach	Hatched	50	Yes
CM10	WE26	Zeelandia Beach	Could not find ³	N/A	No
CM11	WE22	Zeelandia Beach	Hatched	58	Yes
CM12	WE22	Zeelandia Beach	Hatched	62	Yes
CM13	WE22	Zeelandia Beach	Could not find ³	N/A	No
CM14	Unknown ²	Kay Bay	Hatched	67	Yes
CM15	Unknown ²	Zeelandia Beach	Hatched	54	Yes
CMR1 ⁴	WE7	Zeelandia Beach	Hatched	Unknown	Yes
EI1	Unknown ²	Kay Bay	Hatched	Unknown	Yes
EI2	Unknown ²	Zeelandia Beach	Hatched	63	Yes

The excavation data from all marked nests are detailed in Appendix 5; some of those data are summarised in Table 6. The depth of nests differed considerably between the three species, with

⁵ “Unknown” indicates that no signs of hatching were observed and the hatching date was not known, so it was impossible to calculate an incubation period.

⁶ Turtle not observed and so identity unknown.

⁷ Egg chamber was not located during excavation.

⁸ This nest was buried under a large cliff fall which occurred on 12 October, 2005; it was impossible to find or excavate the nest.

⁹ Nest CM7 was relocated on 18 September, 2005 due to the risk of being washed away because of high tides; given new identification code CMR1.

leatherbacks digging much deeper nests than either greens or hawksbills; mean depth to bottom of egg chamber was 73.5cm compared to 57.5cm for greens and 44.5cm for hawksbills. Leatherbacks laid much fewer yolked eggs per nest than greens or hawksbills; range was 30 – 102 for leatherbacks, 32 – 136 for greens and 143 – 151 for hawksbills. Mean number of eggs per nest for each species was 77.8 eggs for leatherbacks, 101.2 for greens and 147 for hawksbills, although the sample size for this species was only $n = 2$ (See Table 6). All leatherback nests excavated contained yolkless eggs (small-sized eggs which have no yolk); four greens and one hawksbill nest also had a very small number of these yolkless eggs (See Appendix 5).

Table 6. Summary of excavation data from 2005

Species	Mean Depth to Bottom/cm	Mean # Eggs / Nest	Mean % Hatching	Mean % Emergence
Leatherback	73.5	$77.8 + 48^{10}$	3.5	2.1
Green	57.5	101.2	76.8	70.1
Hawksbill	44.5	147	41.1	41.1

The three species showed great variability in both hatching and emerging success; hatching success was calculated as the number of hatchlings that made it out of the shell into the egg chamber; emerging success was the number of hatchlings that made it out of the nest. Leatherbacks showed very poor hatching and emerging success; only 3.5% of hatchlings made it out of the shell and just 2.1% managed to leave the nest. Two leatherback nests contained only unhatched eggs indicating that no hatchlings survived; one green nest was also completely unhatched. Green and hawksbills were much more successful; hatching success was 76.8% and 41.1%, respectively; emerging success was 70.1% and 41.1%, respectively. All hawksbill hatchlings that managed to leave their shells made it out of the nest successfully, no hatchlings were found during excavations. During the excavation of two green turtle nests (CM5 and CM12) a large number of dead hatchlings were found in the egg chamber (26 on both occasions), which suggested that they encountered a major problem while trying to leave the nest that prevented many of them emerging (See Appendix 5).

When the unhatched eggs were opened it was found that leatherbacks had fewer eggs with no visible embryo present; these eggs were assumed not to have been fertilised properly and so no embryo developed. The mean percentage of eggs with no embryo for each species was 49.5% for leatherbacks, 67.6% for greens and 78.5% for hawksbills. One leatherback nest contained 30 eggs with full embryos and a further 29 with developed embryos; suggesting that the event which happened was very late in the incubation period.

Several nests contained pipped eggs; two leatherbacks, seven greens and two hawksbills, with a total of 31 eggs, all of which were dead. One hawksbill hatchling managed to break out of its shell but entered another unhatched egg where it died. Very few eggs showed signs of predation; only 12 in total from green and hawksbill nests; it was not possible to determine the type of predator. Deformed embryos were rare; one green and one hawksbill hatchling had incompletely

¹⁰ Normal and yolkless eggs calculated separately for leatherbacks.

formed eyes but no shell or limb deformities were recorded. One green turtle egg contained twin embryos, one significantly smaller than the other; they were brought back to the STENAPA office for inclusion in the sea turtle display. One albino green turtle hatchling was also found.

Only one nest was relocated during 2005, due to the likelihood of it being washed away if left in place; this green turtle nest was moved from stake 50 to stake 39, approximately 200m north. The only nest lost to erosion was a leatherback nest laid at stake 56, just 120m away from the site of the relocated nest. In future any nests laid in this area will be relocated as it appeared to be a section of the beach particularly prone to erosion. The nest was relocated during a night patrol as the eggs were visible in a bank of sand being eroded by waves. The eggs were moved 25 days after they were laid, and it is possible that some of them had already been washed away as only 87 eggs were relocated. When excavated the nest had a hatching and emerging success of 76.4%, higher than the mean value for this species, thus showing that the removal and relocation process had not unduly harmed the eggs in any way.

In-Water Turtle Sightings

A total of 28 completed data forms were collected by the Programme Co-ordinator, or delivered to the STENAPA office. Two of the three dive centres returned forms; Dive Statia and Golden Rock Dive Centre. Forty-two turtles were recorded, 37 hawksbills and 5 green turtles; on two occasions both species were observed during the same dive.

Turtles were reported from 11 dive sites within the Statia Marine Park; Anchor Point North, Aquarium, Blair's Reef, Chien Tong, Double Wreck, Hangover, House Reef, Ledges, Old City Pier, STENAPA Reef and Stingray. These sites ranged in depth from four – 20m; the majority of sightings were in water deeper than 15m. There appeared to be no particular time that turtles were more likely to be seen; observations were recorded between 09:00 and 19:00 hours.

Hawksbill turtles were recorded in either the 10 – 50cm or 50 – 100cm size ranges; none were reported as less than 10cm or greater than 100cm. The majority of hawksbills (28) were categorised as 10 – 50cm. Green turtles were all recorded as being larger than 10cm; one was 10 – 50cm, one was 50 – 100cm and two were over 100cm in length.

Very few turtles showed obvious injuries; only three forms classed the individual as “injured”. It was possibly the same hawksbill turtle seen on three different occasions; all the observations were at Anchor Point North, and the injury was described as “blind in the right eye” by each observer. One other hawksbill showed limited use of movement in the left flippers; it was “only using the right flippers to swim”.

On all but one occasion turtles were on or close to the bottom substrate, not at the surface or in the water column. The surrounding substrate was most frequently classified as coral reef, although turtles were observed close to rocks, sand and around wrecks. Turtles were frequently encountered either resting or swimming; on only seven occasions were they observed eating, and no mating was recorded. Only three hawksbill turtles were recorded as having a tail that protruded more than 15cm beyond the end of the shell (indicative of an adult male); many observers answered “Don't Know” for that question.

Sea Turtle Satellite Tracking Project 2005

The following is a summary of the research activities that were conducted as part of the Sea Turtle Satellite Tracking Project 2005; see also Harrison (2005).

Research Activities

Sea turtle biologist Dr Robert van Dam came to St Eustatius 27 – 29 July, 2005 for a short preliminary trip to visit the primary nesting beaches and discuss logistics for the research trip scheduled for later in the nesting season; at this time he also visited St Maarten and liaised with Dominique Vissenberg to co-ordinate logistics. He joined track surveys on Zeelandia Beach, Turtle Beach and Lynch Bay with the Programme Co-ordinator, and discussed in detail how the attachment of the transmitters would proceed. A short training session on the methods for applying the transmitters was given to the Programme Co-ordinator and STENAPA manager, and researchers in St Maarten. The preliminary schedule for attachments was organised for September; with an initial plan for five transmitters to be deployed. Three were proposed for St Eustatius, ideally on greens and hawksbills, and two on hawksbills on St Maarten. Dr van Dam left instructions on equipment to purchase and the design of a wooden holding box that was to be constructed.

Data from the daily track surveys conducted in August were used to calculate potential emergence dates for each turtle that had been encountered on St Eustatius; females usually nest every 9 – 14 days depending on the species and are fairly predictable, thus it was hoped to minimise the length of time that Dr van Dam would need to spend on each island to perform the attachments. As night patrols are not conducted on St Maarten, track surveys of two nesting beaches were organised to gather similar emergence information to use to predict when turtles might be nesting.

Dr van Dam returned to St Eustatius on 20 September, 2005. A night patrol on Zeelandia Beach was conducted with the Programme Co-ordinator and a Working Abroad volunteer, Hanna Linner. A green turtle was encountered emerging from the seas at approximately 10.45pm; she dug one unsuccessful nest cavity and then moved locations and nested successfully, just north of Smith's Gut. When she had laid her eggs the Programme Co-ordinator checked for tags, measured her carapace and marked the location of the nest for inclusion in the hatching success study. She had been observed nesting on three previous occasions; she was first seen and tagged on 19 August, then again on 30 August and 10 September. She was the biggest green turtle encountered during the 2005 nesting season; CCL n-t = 113.5cm, CCW = 106.8cm (See Table 3).

On her return to the sea she was intercepted and had a restraining box placed over her to limit her movements during the transmitter attachment; unfortunately due to her size she barely fit inside the box and had to be restrained within it by the Working Abroad volunteer. When she was calm the attachment process began; Dr van Dam, aided by the Programme Co-ordinator and STENAPA Manager, first cleaned the carapace carefully with water, rubbed it with an abrasive pad and removed excess grease and moisture with alcohol. Fortunately her carapace was free from algae or barnacles that are sometimes present and so the cleaning was easy to accomplish. The second phase was to mix the elastomer which acted as a cushioning layer between the transmitter and the carapace; this was then poured on to the base of the transmitter and it was positioned on the flat part of her carapace behind the nuchal notch (ARGOS ID number 60722). The final stage was to fix the transmitter in place with fibreglass resin. Unfortunately as Dr van

Dam was mixing the resin a heavy rain storm began, hampering activities as we had to continue with the attachment underneath a protective tarpaulin placed over the holding box. Despite this, and the fact that the fibreglass resin did not set as quickly as expected, the attachment was completed. After the resin was allowed to dry for a further 30 minutes, the turtle was released back to the sea at 3.15am. Photographs of the attachment and release of this turtle can be seen in Appendix 6. Location data were received the following day, indicating that the transmitter was working correctly; the turtle was remaining close to Zeelandia Beach, suggesting that she may return to nest again before starting her migration to feeding grounds.

Morning track surveys continued each day following the first successful transmitter attachment, but no green or hawksbill tracks were recorded; daily night patrols were conducted throughout the remainder of Dr van Dam's visit but no turtles were encountered. Prior to his departure from St Eustatius on 28 September, 2005, Dr van Dam gave a detailed training session on transmitter attachment procedures and potential problems to the Programme Co-ordinator and STENAPA Manager; this would allow a transmitter to be deployed without the need for Dr van Dam to be present on the island. Night patrols continued until 20 October, 2005, but no new turtles were encountered; on 1 October, 11 days after her transmitter was attached the green turtle returned to Zeelandia Beach and nested successfully. She was seen by the Programme Co-ordinator and a STENAPA intern; the transmitter was examined and appeared to be in good condition.

Following her nesting emergence on 1 October it was assumed that the green turtle would leave the vicinity of the island and travel to her feeding grounds. However, Dr van Dam and the Programme Co-ordinator were surprised to see that the signals being received indicated that she was remaining in the same general area off the nesting beach. A map showing some of the high quality location points received from her transmitter during October is shown in Appendix 6. It is evident from the data that this turtle did not make any long migration journey to a feeding ground away from St Eustatius; the furthest distance recorded from the nesting beach was approximately 5km from the release site at Zeelandia Beach, off the north-east coast of the island. This is very unusual behaviour, and possibly the first time it has been recorded for an adult female green turtle to remain at the nesting site after the end of the nesting season. The final transmission from this turtle was on 15 November, 2005; almost two months after her release in September.

On St Maarten, following a report from Dominique Vissenberg of a hawksbill false crawl on a monitored beach the night of 23 September, the Programme Co-ordinator and Dr van Dam travelled to St Maarten to attach a transmitter should she return the following evening. Unfortunately, upon their arrival they found that the turtle had in fact nested successfully the previous evening; this did, however, provide a date for when she might be expected to nest again, when Dr van Dam planned to try and intercept her for transmitter attachment. He returned to St Maarten on 6 October and conducted night patrols on two monitored beaches with Dominique Vissenberg and a volunteer. A hawksbill female was encountered making a false crawl on 9 October; researchers successfully attached her transmitter (ARGOS ID number 60726) (See photographs in Appendix 7). The following day signals from the transmitter suggest that she returned to nest, and then immediately began her migration to feeding grounds. Location data were received from this turtle until 14 December, 2005 (See map in Appendix 7); her movements suggest that she nested the night after her transmitter was attached and then started her migration. Initially she passed around the island of Anguilla before heading towards the open ocean for

several days; she adjusted her course southwards when she was close to Anegada and her final transmission was between St John Island (US Virgin Islands) and Norman Island (British Virgin Islands). She swam approximately 330km, with a straight-line distance from her release site of 173km.

Education and Media Activities

A series of public awareness activities were organised in conjunction with the satellite tracking project, to showcase turtle migratory behaviour as a means of increasing community interest in their conservation. The primary focus was on the local schools; students had been introduced to sea turtles during the “Help Out or Sea Turtles Miss Out” initiative and so this project was ideal to extend their knowledge and further motivate them to become active in nature conservation.

Prior to the start of the research activities the Programme Co-ordinator visited five of the island schools; Golden Rock School, Governor De Graff School, Seventh Day Adventist School, Statia Terminal School and Gwendolyn van Putten High School. She gave presentations to students from Cycle 1 through Grade 12 (ages five – 13); the level of detail and complexity of the presentation was varied depending on the age and comprehension of the student group. The main aim of these presentations was to introduce the basic principles of satellite telemetry to the students and show how researchers can use technology to learn more about turtle behaviour.

At the same time they were also given details about the “Name the Turtle” Competition; depending on the age or grade of each student they were asked to either draw a picture of a turtle, write an essay about the turtle’s journey to her feeding ground, or construct a model of a turtle using recyclable materials. Students also had to include a name for their turtle. All of the school principals received a letter informing them of the competition and given a copy of the competition details and deadline for entries.

Students had approximately two weeks to send in their entries; these were collected by the Programme Co-ordinator on 19 September, 2005. A total of 106 entries were received, from students in Grades 1 – 10; four of the five schools participated, no-one from the Gwendolyn van Putten High School took part in the competition. The competition was judged by Dr van Dam and the winners notified at school during the following week. The winners were:

- Evan Hassell, Grade 3, Governor de Graff School – for his picture of “Lisa” the turtle
- Naomi Smith, Grade 4, Homeschool – for her essay about “Grace”
- Krystell Statie, Grade 7, Statia Terminal School – for her model of “Miss Shellie”

The winner from each category was given the opportunity to name one of the three turtles that was to have a transmitter attached. They also received a subscription to STENAPA’s Snorkel Club, a Marine Park t-shirt, a boat trip around the island and a certificate. As only one turtle from St Eustatius had a transmitter attached only one of the names was used; the green turtle was christened “Miss Shellie”. The other two names will be used when the remaining transmitters are deployed, hopefully during the 2006 nesting season. St Maarten held a similar contest to select a name for their hawksbill turtle; she was called “Archy” by the winner of the competition.

Due to the quality of entries and the number of participants, runners-up were chosen from each category. The runners-up were:

- Faraha Ishmael, Grade 3, Statia Terminal School – for her picture of “Elizabeth”
- Edrieenna Brandao, Grade 5, Golden Rock School – for her essay about “Lara Turtle”

- Kimberly Statie, Grade 7, Statia Terminal School – for her model of “Adventure”
- Erick Espino, Grade 7, Statia Terminal School – for his model of “José”.

Each runner-up won a boat trip around the island and a certificate. Everyone who entered the competition was given a badge featuring “Scout”, the mascot of the “Help Out or Sea Turtles Miss Out” campaign.

To inform the community in general about the satellite tracking project several media activities were organised. An exhibit was installed at the local library; this featured information about satellite telemetry and how it can be used to track sea turtle migration. All of the “Name the Turtle” Competition entries were also displayed (See Appendix 8), as were details for a second competition that was introduced after the turtles had started transmitting data. The concept of this competition was to make students think about where turtles go once they leave St Eustatius or St Maarten, and how far they travel. A map of the Caribbean was produced and marked with a numbered grid; each student who wanted to participate picked a number that corresponded to one of the grid squares. When the turtle had finished her migration the student with the square closest to her final destination was the winner. Each entrant was also asked to guess how far they thought the turtle would swim during her migration; the winner was the person whose guess was closest to the actual distance travelled by the turtle, as calculated by Dr Robert van Dam.

Students from all five schools, aged five – 13, took part in the competition; a total of 256 entries. There were two winners for each turtle; one for the location at the end of the migration, the other for the total distance travelled. The winners were:

- For green turtle “Miss Shellie” who swam 56km around the island of St Eustatius:
 - Michelle Ocana, Cycle 1, Golden Rock School – for guessing 49km; this was the closest guess to the actual distance travelled by “Miss Shellie”.
 - Jason Lall, Class 1C, Gwendolyn van Putten High School – for selecting the grid square on the map closest to St Eustatius, where “Miss Shellie” remained during the entire tracking period.
- For hawksbill turtle “Archy”, who swam 330km from St Maarten to the Virgin Islands:
 - Devlin Lake, Cycle 1, Seventh Day Adventist School – for guessing 330km, the exact distance that “Archy” travelled.
 - Malaika Brown, Grade 5, Golden Rock School – for choosing the grid square closest to the Virgin Islands where “Archy” ended her migration.

The four winners were notified by the Programme Co-ordinator in March 2006; each received a Marine Park t-shirt and a certificate.

Several newspaper articles were published that featured the satellite tracking project (See Appendix 9). In September an interview with Dr van Dam and the Programme Co-ordinator was printed, that explained the reason why the project was so important for researchers. Winners of the “Name the Turtle” Competition were announced in October, and in November updates of the location of the two turtles were published.

In addition to the newspaper articles two programmes on the local radio station in August and September featured interviews with Dominique Vissenberg and the Programme Co-ordinator. They discussed the project and informed people about the competitions, the library display and how they could follow the turtles during their migration either on-line or via newspaper updates.

Beach Erosion

Of 52 stakes that had been placed in 2004 only 29 still remained at the start of 2005; 23 had been lost. For the remaining 29 the distance between the stake and the cliff was measured as an indicator of beach erosion along Zeelandia Beach. Six stakes were in exactly the same location as 2004; 15 (20.7%) were less than 1m from their 2004 location; eight (27.6%) were over 1m from their original site. Of these eight, six (20.7%) were more than 2m in front of where they had been located in 2004. The mean distance between the stake and the cliff was 0.9m; the range was 0m – 2.81m. Two areas of the beach seemed to show the most erosion; from stakes 12 – 14 and between stakes 25 – 27. The first of these areas is close to the public access at the northern end of Zeelandia, the second is about half-way along the beach, before Smith's Gut.

During 2005 five major cliff falls were observed on Zeelandia Beach, in addition to one smaller landslide. They occurred in June (Figure 12), July (Figure 13), August, September and October and usually happened following periods of heavy rain; one was discovered while monitoring at night, shortly after the patrol had passed by that area.



On each occasion the section of cliff which fell was more than 10m in length; the largest (of 12 October, 2005) was approximately 35m long. Sometimes very large boulders were found (See Figure 14. Rock from fall on 6 August, 2005), and the beach was impassable for several days afterwards.

Figure 12. First cliff fall recorded on 16 June, 2005.



Figure 13. Cliff fall observed on 21 July, 2005.



Figure 14. Rock from fall on 6 August, 2005

Community Outreach Events

School Activities

In January, Dominique Vissenberg came to St Eustatius for an orientation visit. She went to four schools; Governor de Graff, Golden Rock School, Seventh Day Adventist School and Gwendolyn van Putten High School. The purpose of these initial visits was to distribute questionnaires she had formulated to discover the local knowledge of young people about sea turtles in the area.

In March, Dominique Vissenberg returned for her monthly visit to the island. She gave a presentation about turtle conservation at five schools, the four previously visited in January and the Statia Terminal School, and organised interactive activities for the students. In addition she joined children participating in STENAPA's Snorkel Club.



In May 2005 the Programme Co-ordinator and two STENAPA interns assisted Dominique Vissenberg with a puppet show at three schools; Governor de Graff School, Golden Rock School and the Seventh Day Adventist School. Students from Cycle 1 – Grade 6 watched performances of the show, which depicted a tourist, local fisherman and a turtle discussing how human activities can negatively impact turtles on land and sea (See Figure 15). In addition to the puppet show, students took part in interactive games focusing on different types of predation during the life cycle of a turtle.

Figure 15. Puppet show performed at local schools

The Programme Co-ordinator and two STENAPA interns were asked to lead an activity at the library as part of the summer vacation activity programme in July, 2005. They worked with groups of approximately 40 children of varying ages, teaching them about different turtle species present in the Caribbean, their diet and basic biology (See Appendix 10).

School Vacation Programme

Antonio Flemming joined STENAPA for the month of July. He graduated from Gwendolyn van Putten High School in June 2004 and participated in the School Vacation Programme in July of that year prior to starting studies in Curaçao; during his 2005 summer vacation he requested the opportunity to work with STENAPA again. He participated in a variety of ranger tasks during the month he worked, including several night patrols for the Sea Turtle Conservation Programme.

Beach Clean-Ups

Six beach clean-ups were organised during the 2005 turtle nesting season; in April, May, June, August, September and October. All clean-ups were conducted on Zeelandia Beach as this is the primary turtle nesting beach on the island and the site of most research and monitoring.

Throughout the season a total of 12 truckloads of full rubbish bags were removed from the beach; other items collected included a fridge, large rope, huge fishing net and five car batteries (dumped on top of the cliff behind the beach).



Clean-ups were conducted by the Programme Co-ordinator with the assistance of STENAPA staff, interns and Working Abroad volunteers (See Figure 16).

Figure 16. After the first Zeelandia Beach clean-up in April, 2005.

To elicit support from the public flyers were posted to advertise the date and time of each event (See Appendix 11). Unfortunately the response from the local community was disappointing; in the six clean-ups only 18 volunteers participated, the majority were foreign students from the island medical school.

On two occasions school children were involved with clean-up activities; a group of 17 students and teachers from the island schools, and also a group of 13 students and staff from the United States, who were working with STENAPA as part of the Broadreach Programme.

Media Exposure and Public Presentations

To ensure that the Sea Turtle Conservation Programme reaches as wide an audience as possible, the Programme Co-ordinator tried to maintain regular exposure in the press and on local radio. Many press releases were published in the local newspaper, the Daily Herald, during 2005; the majority relating to the Sea Turtle Satellite Tracking Project (See Appendix 9). As mentioned above, this project was also featured in radio interviews in August and September.

To maximise the exposure that the Sea Turtle Conservation Programme receives internationally as well as locally the STENAPA newsletter also featured several articles about turtles in 2005 (See Appendix 12); this quarterly newsletter is sent electronically to interested parties and ex-volunteers. The STENAPA website (www.statiapark.org) has several pages dedicated to the Sea Turtle Conservation Programme activities, and focused on the Sea Turtle Satellite Tracking Project in 2005, with links to location maps on www.seaturtle.org.

Dominique Vissenberg gave a presentation about sea turtles and conservation issues to the residents of the Auxiliary Home in June and the Lion's Club in August, and the Programme Co-ordinator spoke during the Creation Day service at the Methodist Church in October.

Participation in Meetings, Workshops and Symposia

Annual International Sea Turtle Symposium

The 2004 Programme Co-ordinator, Rozenn le Scao, and a teacher (Mr Etienne de Vries) and student (Genilio Hassell) from the Gwendolyn van Putten High School attended the 25th International Sea Turtle Symposium held in Savannah, Georgia, USA, 16 – 22 January 2005. The 16-year old Exam Class student was selected following a competition held in the school. They also participated in the WIDECAST Annual General Meeting, held prior to the main symposium.

Cuban Workshop

The Programme Co-ordinator was invited to attend a workshop in Cuba entitled “Second International Guanahacabibes Sea Turtle Conservation Workshop: Engaging Local Communities in Conservation”. This meeting was organised by the Ocean Conservancy as a follow up to the first workshop that was held in 2002 to develop the Cuban sea turtle research programme. International sea turtle biologists from the United States, Puerto Rico and Brazil were invited to discuss the Cuban programme and suggest ways in which it could be developed in the future; many Cuban biologists, students and members of government departments were also present. A primary focus was community outreach in turtle conservation projects; several of the invited speakers had specific experience in this field.

The workshop was originally scheduled for the 11 – 15 July, 2005; however, due to Hurricane Dennis passing directly over Cuba the week before the workshop was rescheduled for the 12 – 16 September, 2005. The first two days were spent at the Institute for Marine Research in Havana, whose staff co-ordinate turtle research on the island. Each person gave a short presentation about their own turtle project; the Programme Co-ordinator gave a presentation entitled “Three Years of Sea Turtle Conservation on the Island of St Eustatius, Netherlands Antilles”. This included information about the Sea Turtle Conservation Programme, with specific reference to our community outreach activities. The presentation was extremely well received and highlighted the importance of the project on St Eustatius, despite the fact that the population of turtles is very small. Students from Havana University also gave papers on their individual undergraduate and graduate research being conducted as part of the larger turtle conservation programme.

The remainder of the week was spent at the research site; Guanahacabibes National Park, on the western tip of Cuba. We were due to visit the primary nesting beaches being monitored as part of the project, and also visit the local community within the national park where researchers are conducting public awareness activities. However, due to logistical problems obtaining entry permits to the national park our itinerary had to be altered as none of the Cuban biologists were given permission to enter the park, despite prior notification of this international event to the authorities involved. A film crew from a major US network joined the workshop during this field trip; to record US and Cuban collaboration through science.

This workshop was an ideal opportunity for the Programme Co-ordinator to meet other sea turtle biologists working in the region, and establish a network of contacts for future research initiatives as part of the Sea Turtle Conservation Programme. An informal invitation was extended by Carlos Díez of Puerto Rico for the Programme Co-ordinator to participate in their annual in-water

survey and tagging of juvenile hawksbills; this opportunity would provide ideal training for in-water methodologies, which could be modified for use in St Eustatius.

Sea & Learn on Saba

In October the Programme Co-ordinator was approached by the organisers of the “Sea & Learn on Saba” programme. This is a month-long event of lectures and workshops led by prominent international scientists in a range of different biological fields. The Programme Co-ordinator was invited to give an evening lecture on the monitoring and research activities of the Sea Turtle Conservation Programme on St Eustatius. The presentation was held at the Saba Eco-Lodge, and was attended by tourists, visiting scientists and local residents. The Programme Co-ordinator also took the opportunity to discuss with a dive centre owner the possibility of completing turtle sighting forms for inclusion in the database with those collected from St Eustatius dive centres.

Discussion

Pre-Season Preparations

Selection of New Programme Co-ordinator

The new Programme Co-ordinator arrived on St Eustatius in time to organise the schedule of activities for the 2005 research programme. Prior to the start of beach monitoring patrols she was able to review the data collection methodology, assess the beach protocols and make necessary amendments, such as extending the night patrol schedule to seven nights a week, not five, thus maximising the chances of encountering any nesting females. Similarly, her previous experience co-ordinating other turtle monitoring programmes and training volunteers was beneficial in updating the data collection sheets and creating a new volunteer orientation session, with theoretical and practical components.

Beach Preparation

The system of marking the primary nesting beach (Zeelandia Beach) with numbered wooden stakes remains the most cost effective method, due to the high probability of losing the markers as a result of high tides outside the nesting season. They are easy to replace or repaint at the start of each season; the reflective tape is very beneficial at night and greatly facilitates finding the stakes when measuring nests in the dark. A recommendation for 2006 is to extend the markers to include all of Turtle Beach, as several green turtles used that beach during the 2005 season and temporary stakes had to be positioned to mark nests.

Updating of Data Collection Sheets and “Guidelines for Visitors” Information

The updated data collection sheets for tagging and nest marking included PIT tag data, and so that information is more likely to be recorded than on the old forms. The creation of a data collection sheet for nest excavations helps standardise the data collected at each excavation; they simplify the data collection procedure and ensure that observers record the same data for each nest inventoried.

The revised “Guidelines for Visitors” flyers were a useful source of information for all visitors, and formed a basis for the orientation they received from the Programme Co-ordinator prior to

participating in beach patrols. The regulations were formalised and provided a baseline of expectations for visitors and researchers alike. In future years visitors should definitely be required to read and sign these regulations, thus ensuring that they are adequately prepared before undertaking a beach patrol.

Training of Volunteers

A thorough revision of the volunteer training materials was undertaken before the arrival of the first group of Working Abroad volunteers in April, 2005. The Programme Co-ordinator wanted to ensure that everyone involved in night patrol activities was given sufficient training in all aspects of the data collection protocols, both theoretical and practical. Additional training in tagging methods was provided for interns who were expected to lead patrols when the Programme Co-ordinator was not available. The level of training given to all volunteers was adequate for them to be able to collect the required data, as under normal circumstances they were not expected to undertake patrols without the Programme Co-ordinator or an intern present. It is suggested that the same training and orientation activities continue in 2006.

Monitoring and Research Activities

Track Surveys

In 2005 it was not always possible to conduct track surveys every morning, due to schedule conflicts and lack of personnel; however, surveys were completed for Zeelandia Beach most morning throughout the nesting season. They are an effective method for surveying nesting beaches not patrolled at night, to give an indication of spatial distribution of nesting around the island. Similar to previous years, three species of turtle were recorded nesting on St Eustatius; leatherback, green and hawksbill, no evidence of loggerhead turtles was found. As also observed previously, Zeelandia Beach remains the primary nesting beach for all three species, indeed it is the only beach where leatherback nesting was recorded. Very little nesting occurred elsewhere on the island; Turtle Beach had only one nest and several false crawls, and no nesting attempts were seen on either Lynch Bay or Oranje Bay, possibly due to the fact that neither of these beaches was particularly stable during the 2005 nesting season. Kay Bay was the only other beach where nesting was reported in 2005; these emergences were observed by residents living close to the beach.

Fewer nests and false crawls were recorded for all three species in 2005 compared to 2004; 16 leatherback nests in 2005 compared to 16 in 2004; 15 green nests in 2005, 22 in 2004 and just two hawksbill nests in 2005 compared to 12 in 2004. Nothing can be inferred from just two years of data; continued long-term monitoring is essential before any assessments can be made about population trends on the island. With the implementation of regular surveys throughout the nesting season it will be possible to start between-year comparisons in the future.

As for many locations in the Caribbean, leatherbacks on St Eustatius nest earlier than either of the hard shell species; between March and June, compared to June to October for greens and hawksbills. In 2005 all three species were reported nesting earlier than in 2004, by up to a month for hawksbills; in both years, however, nesting terminated in the middle of October. The earlier start to the season may be the result of differing environmental conditions between the years; in 2005 water temperatures in the Caribbean were higher than normal, marked by extensive coral bleaching in the region from August 2005 (Esteban, Kooistra and Caballero, 2005). With just two

years of data, however, it is difficult to determine a “normal” nesting season for St Eustatius, and so further monitoring is required.

With this in mind it is proposed that for 2006 more attention is given to morning track surveys; they should be conducted as early as possible in the day to ensure that all tracks and nests are undisturbed, and carried out as extensively as possible on all identified nesting beaches on the island. They should only be conducted by the Programme Co-ordinator or trained personnel in her absence, this reduces observer bias in the data and minimises data collection errors by untrained observers. No unidentified tracks were recorded in 2005; all tracks could be identified as a particular species, showing that sufficient training in track recognition had been received.

Beach Patrols

The expansion of the night patrol schedule to cover weekends proved successful as several females were encountered on Friday and Saturday nights during the 2005 season; four leatherbacks and 10 green turtles. In previous years these turtles would not have been observed and the data assigned to “unknown” female. The Programme Co-ordinator offered to work the weekend shifts and the Working Abroad volunteers accepted working occasional weekend nights, as each volunteer only had to surrender one weekend during their two-month stay. Daily patrols should be continued in future nesting seasons.

A similar number of turtles were encountered on night patrols in 2005 and 2004 (eight compared to 12, respectively), despite an increase in the number of nights patrolled per week. This indicates that fewer nesting females emerged in 2005 as it was unlikely that any turtles that nested were missed by patrol crews.

The patrol schedule, of one patrol every hour between 9.00pm and 4.00am, remains feasible, and almost guarantees that any turtle nesting during the patrol period will be encountered. For future years, however, it might be worthwhile trying to determine hours of peak emergence activity, as it may be possible to contract the duration of patrols if there are predictable periods of activity and minimum likelihood of missing turtles emerging outside of these times. In 2005 the turtle encounter rate was quite low, they were observed on only 17.6% of night patrols, comparable to previous years.

Another suggestion is to extend the section of beach patrolled at night; although tide conditions often prohibit patrols along Turtle Beach, whenever possible, particularly during months when green turtles and hawksbills are nesting, patrols should cover this beach in addition to Zeelandia Beach.

Tagging Methods

In 2005, the tagging protocol was changed slightly from 2004; all turtles, irrespective of species, were double tagged with external flipper tags. This was to maximise the probability of being able to positively identify the individual if she returned to nest and thus minimising the effect of tag loss. If only one flipper tag is applied a turtle could be categorised as a new recruit in error if that tag is lost. Leatherback turtles also had one internal PIT tag inserted, in addition to the two flipper tags; to standardise the protocol, each PIT tag was placed in the right shoulder. No previously tagged leatherbacks were encountered, and none of the females showed scars from old

tags. Only one green turtle had tags when first encountered; she carried a single flipper tag that had been originally applied on Zeelandia Beach in 2002.

More females were tagged during night patrols in 2005 than in 2004; all turtles that were encountered had tags when they left the beach, the majority were double tagged, although on one occasion there was only time for a single flipper tag to be applied.

As leatherback turtles are often prone to high levels of flipper tag loss it is advisable to continue double flipper tagging as well as using PIT tags which are less likely to be lost. Green turtles and hawksbills should also have two flipper tags applied, proximal to the last scale on the trailing edge of the front flippers; this tag location causes least drag and hence improved tag retention.

Only trained personnel should be allowed to apply tags, either flipper or PIT; this will usually be the Programme Co-ordinator or a STENAPA intern. The procedure established in 2005 to cover the nights when the Programme Co-ordinator was not scheduled for beach patrol was that she would be on radio stand-by and could join the patrol crew to assist with tagging and data collection if they encountered a turtle. This worked well for most patrols, but requires careful co-ordination of equipment and radios to ensure that they are fully charged prior to the patrol. It is recommended that this system continue to be implemented in future, particularly as the Programme Co-ordinator plans to reduce the number of night patrols she conducts in order to focus on other aspects of the monitoring and research programme, such as the daily track surveys and education activities.

Carapace Measurements

Leatherbacks encountered in 2005 were shorter than those observed in 2004; mean CCL was 1.48m in 2005 compared to 1.55m in 2004; however, CCW was almost identical both years (1.13m in 2004 and 1.12m in 2005). The same situation was shown for green turtles; mean CCL n-t in 2004 was 1.23m compared to 1.08m in 2005; mean CCW measurements were very similar in both years 1.03m in 2004 and 1.00m in 2005.

This difference may be a result of observer bias, or a genuine difference in the size of turtles observed; it will be interesting to compare these results with 2006, as the Programme Co-ordinator will be a constant variable from 2005 and so should minimise observer bias. There was also some minor confusion by the Programme Co-ordinator as to what CCL measurements had actually been taken in 2004, as the description in the annual report did not correspond to the actual measurements taken; this could account for the quite large differences observed between the two years. Hopefully, this minor problem not affect measurements taken in the future, as the current Programme Co-ordinator has considerable experience in carapace measurements and is keen to minimise errors in data collection.

Great care must be taken when training volunteers how to take carapace measurements, as there is scope for considerable variation in the placement of the tape measure, particularly for CCW where there are no clearly defined end-points to measure between. Measurements of leatherback turtles should be taken by two people, as it is impractical for one person to reach the front and rear of the carapace. It is also important to carefully position the tape measure alongside the central ridge, not along the top of it, as this can also greatly effect measurements.

Practical training with a real carapace was conducted with volunteers in 2005, to give them an indication of the position of the tape measure on the carapace during measurements. This should be repeated in future seasons to ensure accurate measurements are being taken. Another recommendation for 2006 is to use fibreglass tape measures for carapace measurements, not the metal tapes that have been used to date. Fibreglass tape measures are more flexible and therefore fit better to the curve of the carapace and give a more accurate measurement. Also, they do not rust as readily and hence are less likely to “stick” during measurements.

Nest Survival and Hatching Success

Nest survival for all species was good on Zeelandia Beach, with just two nests not surviving the incubation period; one leatherback nest was washed away with exceptionally high tides and a green turtle nest was buried under a cliff fall. However, hatching and emerging success showed extreme differences between the species; mean hatching success for leatherbacks was 3.5% compared to 76.8% for greens and 41.1% for hawksbills. Emerging success was lower still for leatherbacks, just 2.1%, greens was still high, 70.1% and hawksbill was the same, 41.1%. Although no figures were calculated for hatching and emerging success from the 2004 nest excavation data, an examination of the raw data suggests that leatherback nests had a hatching success much higher than that of 2005; green and hawksbill nests appeared to show similar success in both years.

One possible reason that might explain both the poor hatching success for this species and the reduced success when compared to the other two species is the depth of the egg chamber. Leatherbacks have larger flippers and so dig a much deeper nest than either greens or hawksbills (See Table 6. Summary of excavation data from 2005); it is possible that leatherback eggs are therefore at a greater risk of inundation at this greater depth than those laid closer to the surface. Many of the leatherback nest excavated had unhatched eggs containing embryos, so the eggs were obviously fertile. Some major event must have occurred during incubation that killed the embryo and prevented its complete development and hatching. Figure 10 clearly shows that all leatherback nests were laid within a very small section of the beach and there was almost no distributional overlap in nests between the species. This area of the beach was very prone to flooding during 2005; following heavy rains there were two very large run-off channels flowing in this stretch of the beach, which could have influenced the subterranean water levels. If this rose to less than 75cm from the surface then it could affect any leatherback nests laid in that region; they would be inundated and unhatched embryos will die if the sand around their eggs becomes flooded with water. The nests of the other species, being laid closer to the surface, would not be affected unless the water levels rose significantly. In future years it would be beneficial to record precipitation levels throughout the nesting season, to determine if hatching success is correlated to rainfall. In addition, it might also be worthwhile monitoring subterranean water levels on the beach, particularly in areas prone to flooding, such as the northern 250m of Zeelandia Beach.

In-water Turtle Sightings

It was encouraging to receive a considerable number of diver turtle sighting forms from the dive centres on St Eustatius; the support of the local community for the Sea Turtle Conservation Programme is always appreciated. These forms provide important information about the turtles using the near-shore waters around the island; such data collection has, to date, not been incorporated into the monitoring schedule of the Programme. It is interesting to observe that at

several dive sites turtles are seen on a regular basis, indicating that they are possibly residing within a relatively limited area. Some of the observations from 2005 were undoubtedly of the same individual on different dates; the dive centres reported that it was possible to identify individuals, or at least the locations where turtles were frequently found.

An important consideration when analysing these data is the fact that they are recorded by untrained observers, thus the opportunity for error in, for example, species identification, is relatively high. Also, it is easy to overestimate the size of turtles underwater; frequently people will classify a turtle in a size range larger than its actual size. Despite these limitations valuable data can be obtained, and the diver sighting surveys will be continued in 2006; it is also hoped to include dive centres on Saba, to gain data from a wider area within the Netherlands Antilles.

These data do, however, indicate that turtle sightings are relatively common in the waters around St Eustatius, and it is from these observations that it is planned to develop an in-water surveying programme in 2006. Using the data from the diver sighting forms, locations will be chosen to conduct regular dive surveys to collect data on species composition, size classes and habitat utilisation. If feasible an in-water tagging programme of juvenile turtles will also be initiated; the Programme Co-ordinator plans to participate in training with regional turtle projects to gain experience of in-water protocols and capture techniques that could be adapted for the marine conditions around St Eustatius.

Sea Turtle Satellite Tracking Project 2005

The implementation of a satellite tracking project in 2005 was a major development for the Sea Turtle Conservation Programme on St Eustatius. This joint initiative with St Maarten, funded by the DCNA, was planned to not only provide information on the feeding grounds and migratory pathways of turtles that nest in the Netherlands Antilles, but also to engage the local communities on both islands in sea turtle conservation issues.

Dr van Dam was asked to lead the project as he has considerable experience tracking turtles using satellite telemetry; he trained researchers in Bonaire and they now run an extremely successful tracking project from the island. On St Eustatius and St Maarten there were new challenges as both islands have very small nesting populations of green and hawksbill turtles; the Programme Co-ordinator had some experience of satellite telemetry with hard shell species, and so was at least aware of the basic methodology.

The preliminary visits to the island were useful to determine the principal nesting sites and organise logistics for the attachments; track surveys were arranged on St Maarten as they have no established monitoring procedures in place. The data from these surveys were useful in calculating expected emergence dates for green turtles on St Eustatius; the green turtle that was encountered on 20 September had been predicted to nest on that date. None of the other four turtles that had been observed nesting in August, and were due back during Dr van Dam's visit, were encountered. This suggests that either they had finished nesting for the season, which is doubtful as most of them were observed only once, or they were also nesting elsewhere. No nesting was observed on Kay Bay or Turtle Beach during that time period, and it is therefore unlikely that turtles were using other beaches on St Eustatius. Turtle projects on St Kitts and Nevis record green turtle nesting on their beaches; the Programme Co-ordinator contacted researchers on both islands to enquire if they had encountered any tagged turtles during their

patrols. Unfortunately, most of their efforts are during the leatherback nesting season, and they only conduct morning track surveys later in the season, so identification of individuals would be impossible to determine from those data. They did, however, inform the Programme Co-ordinator that no green turtle nesting was recorded during the specified dates, indicating that the turtles were probably not visiting those islands to nest.

The successful deployment of the first transmitter on a green turtle, on the first night of patrols with Dr van Dam, gave the impression that it was going to be relatively easy to attach all three transmitters on St Eustatius. However, this assumption was not fulfilled, as no other turtles were encountered during Dr van Dam's visit, which was very disappointing for all those involved in the project. On St Maarten, the 2005 season was very slow, with few nesting attempts reported; hence the importance of trying to intercept the hawksbill female that had made the recorded false crawl on 23 September, as she was possibly the only turtle that would be available for the study. While it was frustrating to discover that she had nested the night of 23 September, it did highlight the need for adequate training for all personnel, to be able to distinguish between false crawls and successful nesting attempts.

The two turtles showed completely different migratory behaviours; the green turtle from St Eustatius did not move far from the nesting beach in the two months following attachment of her transmitter. Initially this was because she had not finished nesting for 2005, but after her final nest on 1 October she would have been expected to leave the area almost immediately and begin her migration to the feeding ground. It was most unexpected for her to remain close to Zeelandia Beach well into November; this behaviour has not been documented previously and it may be the first record of an adult female green turtle being resident in the area close to her nesting beach. Presumably she was able to find sufficient food to sustain her near Zeelandia Beach and therefore had no immediate need to search for a suitable feeding site away from St Eustatius. Most of the high quality location points received all showed her off-shore from Venus Bay; a small bay to the north of Zeelandia Beach. It was planned to visit the area to determine if there is suitable feeding for green turtles at that location; this trip has been postponed until a later date due to inclement sea conditions. She was moving very short distances, less than 5km from her release site; while other turtles have been recorded swimming considerable distances each day while migrating. It will be interesting, therefore, to see if she returns to nest in 2006; having invested very little energy in migrating to a distant feeding ground she might be able to attain reproductive condition faster than would be expected and so be ready to nest in consecutive years, which is unusual for this species as the typical inter-nesting interval is two or three years.

The hawksbill from St Maarten, however, showed much more "typical" behaviour; her location data suggest that she nested within a day of having the transmitter attached and then immediately afterwards left the vicinity of the nesting beach and began her migration. Her journey at first appeared to be heading out towards the open ocean, but she seemed to alter her path for a more southerly direction close to Anegada. It is feasible that she was using this island as a visual cue and was correcting her course in relation to this landmark. Her average speed was around 5km per day (she travelled a total of 330km in 66 days); although she reached up to 60km per day during her migration. Researchers in the Virgin Islands have informed Dr van Dam that the area in which "Archy" is residing consist of coral reefs, algal plains and sea grass beds (R. Boulon, Pers. Comm.). This supports the observed condition of her carapace; she had lots of barnacles

which suggest that she is residing in an area that is not exclusively composed of coral reef (R. van Dam, Pers. Comm.).

In future years it may be advisable to try to attach transmitters slightly earlier in the nesting season; it is not desirable to do so right at the beginning of the season, for they will be close to the nesting beach for several months and will not be providing data on their migratory pathways. However, to ensure that there are still sufficient turtles nesting it would be advantageous to start searching for females at the beginning of September, a couple of weeks earlier than in 2005. While this technology is being used primarily to determine migration pathways and foraging grounds for turtles nesting on the Windward Islands, the unusual situation on St Eustatius of possible resident breeding adults and females using different beaches to nest is worth investigating by attaching a transmitter to a female who is known to be only mid-way through her nesting season, to determine inter-nesting habitat use.

The three transmitters not used in 2005 will be available for deployment in 2006; the training received by the Programme Co-ordinator will allow her to attach transmitters with the aid of the STENAPA Manager and volunteers. If necessary she will also be able to assist Dominique Vissenberg with the attachment of another transmitter on St Maarten, thus eliminating the need for Dr van Dam to return to the island. Another satellite tracking project that has been proposed for 2006 would be the attachment of transmitters to nesting leatherback turtles; as the methodology for this is very different to that used for hard shell species another turtle biologist, Dr Scott Eckert, will hopefully lead this research initiative, aided by Dr van Dam and the Programme Co-ordinator. It is hoped that funding will be secured to conduct this research as it will further develop the Sea Turtle Conservation Project here on St Eustatius and increase the knowledge of turtle migration from the Netherlands Antilles islands.

The educational component of the Sea Turtle Satellite Tracking Project was incredibly successful; all the schools involved in the activities were very supportive, and the students were keen to participate in the competitions organised by STENAPA. The “Name the Turtle” Competition received over 100 entrants, more than any contest held by STENAPA previously. Some of the teachers even let their students complete their entries during class, or as homework; this level of active participation was very encouraging for the Programme Co-ordinator and demonstrates that there is genuine interest in sea turtle conservation issues. It is hoped that the tremendous potential of the community outreach projects will be fulfilled as the satellite tracking research programme continues to develop in the future.

Beach Erosion

Erosion continued on Zeelandia Beach in 2005; during the pre-season preparations the numbered markers that had been lost were replaced and the distance from their 2004 location measured; it was worrying to see that only one-fifth of the stakes were in the same place as the previous year. Even more disturbing was the fact that the cliff in front of several stakes appeared to have receded by more than two metres in less than 12 months. The lower part of the cliff is extremely soft and it is readily eroded by wave action during high tides. Erosion was exacerbated by several large cliff falls in the middle of the nesting season (June – October). These are not only extremely hazardous to researchers (several occurred at night when beach patrols were being undertaken), but also a risk to turtles and nests laid close to the cliff; one green turtle nest was buried under the rocks that fell in October. One of the cliff falls was directly in front of the

landfill site at Smith's Gut; heavy machinery is used to regularly compress the rubbish at the site, it is feasible that the vibrations of these machines, in conjunction with heavy rain weakening the structure of the cliff, could cause the cliff to give way. Most of the cliff falls were observed following periods of intense rain; this is another reason why it is worth monitoring precipitation levels at the nesting beach, to determine if there is any correlation between these land slides and high rainfall.

In 2006 further detailed investigations will be conducted on the extent of beach erosion on Zeelandia Beach. The marker stakes are a useful method of rapidly assessing erosion along bottom of the cliffs; but it is also proposed to monitor erosion rates at the top of the cliff by placing supplementary stakes at known distances from the cliff edge and recording any changes observed at regular intervals throughout the year. These studies will be complemented by photograph documentation of the beach, showing sand deposition and erosion during the year. The findings from these surveys will be presented in a report that will discuss rates of beach erosion in the last two years; this report should be finalised in the summer of 2006.

Another compounding factor affecting beach erosion in one particular section of Zeelandia Beach is sand mining. Although illegal since 2001 it still occurs regularly, the sand being used in construction around the island. Most sand is taken from behind the beach, in a gulley that has been created from storm water run-off; this is close to the main public access at the north end of Zeelandia Beach. Some sand, however, is still being taken directly off the beach in front of the access area, as it is possible to drive a truck right on to the sand at this point. On numerous occasions in 2005 the Programme Co-ordinator witnessed people excavating sand, both in the gulley and on the beach; she reported each incidence to the STENAPA manager and the police were informed several times; no-one was charged for these offences. The Programme Co-ordinator approached several people who were observed taking sand; she told them that it was a prohibited activity, that it was increasing erosion on the beach and also endangering sea turtle nests in the area.

On another occasion the Programme Co-ordinator spoke to a group of men who were driving four-wheel-drive vehicles up and down the banks of the gulley; she explained that while this was not illegal, it was definitely having a negative impact on the area and increasing the risk of erosion. Unfortunately, they were not receptive to her point of view and continued with their activity.

The beach close to the access point is where the majority of leatherback nests were laid in 2005; their poor success is hardly surprising considering that this area shows a dramatic loss of sand after heavy rains, caused by the run-off from the gulley, and is often also flooded after storms. It is also the site of the majority of sand mining. To prevent further beach degradation in this area, and to improve hatching success of nests laid in this zone of the beach, a concerted effort is required to eradicate sand mining both on the beach and in the gulley directly behind the sand. Only through improved enforcement of regulations can the situation improve; several members of STENAPA staff have completed a Special Agent of Police course that will give them the authority to charge people in breach of the law. Hopefully with additional personnel to assist them, the police will be better able to regulate these illegal activities. A recommendation for 2006 is to monitor sand mining activities more comprehensively, especially in months outside the nesting season when it is known that STENAPA personnel are not actively patrolling Zeelandia

Beach and mining is observed to intensify. An extensive database of information about the frequency of sand mining, and the damage caused, will be gathered and passed on to the relevant authorities to investigate.

In addition to reducing erosion caused by sand mining, some regime to fortify the area behind the disturbed section of beach is also required; the vegetation has been destroyed and so there is little protection for the cliffs, which are eroding at an alarming rate. One proposal is to protect the remaining vegetation, another idea is to investigate the feasibility of initiating a renourishment scheme; such proposals will need the support of external researchers with specific knowledge and experience. If nothing is done, and the situation continues as at present, then the erosion rates being observed currently will result in a drastic loss of suitable nesting habitat along the Atlantic coast of the island, with obvious negative consequences for all the turtle species that utilise that beach, in particular leatherbacks.

Community Outreach Events

School Activities

While the schools continued to support the Sea Turtle Conservation Programme during 2005, with the puppet show, vacation activity and satellite tracking projects, there is still scope for further active participation among the students. Principals and teachers were extremely supportive of all involvement with the programme, facilitating the activities whenever possible. The students all enjoyed the activities, and appear to be remembering the underlying messages being given; their knowledge of turtles, their biology, threats and the need to conserve them is vastly improving. However, it is hoped that in 2006 there will be further involvement of students in research and monitoring activities. One area that has been suggested is to take small groups of students on night patrols whenever possible; obviously this would require careful organisation, planning and supervision, but the impact that would be achieved by having students witness a turtle nesting would be overwhelming. Another possibility is to have students participate in sunset patrols to search for emerging nests; this would be easier to arrange than a night-time activity, but affording another opportunity to see an amazing natural phenomena as hatchlings crawl to the sea.

Engaging students in other activities, such as the monthly beach-cleans is also proposed for 2006; this would coincide with another educational programme being planned for schools in 2006, which will teach students about pollution and its impact on the environment. Following the success of the satellite tracking competitions in 2005, it is hoped to establish an inter-school contest to see which school collects the most rubbish over the year.

Hopefully, a continued effort to teach about sea turtles will furnish students with a better awareness of the marine environment and a deeper understanding of the need to protect it; also it is hoped that they will appreciate what nature has to offer in general, and how they can be personally involved in conservation initiatives on their own island.

School Leaver Internship

The return of Antonio Flemming for his second internship with STENAPA in 2005 was very encouraging; he showed great interest in the Sea Turtle Conservation Programme in both 2004 and 2005, actively participating in beach patrols, clean-ups and nest excavations. It is hoped that

the participation of STENAPA in this intern project continues, as it is an ideal opportunity for school-leavers to gain an understanding of the work of the organisation. Hopefully it will result in more local interest in STENAPA's activities in the Marine and National Parks, and greater community support for education, conservation or research initiatives on the island.

Beach Clean-Ups

Regular monthly clean-ups of Zeelandia Beach were organised during the 2005 turtle nesting season. Prior to the start of beach patrols no clean-ups had been conducted for several months and so the first activity in April was difficult as a lot of rubbish had accumulated on the beach. In the future it is planned to continue the beach clean-ups throughout the year, not just during the nesting season, so that the level of rubbish does not become so unmanageable. The majority of the rubbish collected was plastics, and household waste that had presumably come from the landfill site at Smith's Gut, although large fishing nets and lines were also encountered; these are extremely hazardous to turtles as they can easily become entangled and die.

To encourage the participation of the local community in the clean-ups, flyers were posted around town in advance of each event. Unfortunately the only volunteers were students from the medical school and foreign island residents; no members of the local community joined clean-ups, other than STENAPA staff, which was incredibly disappointing. To rectify this in 2006, the Programme Co-ordinator is hoping to improve notification of clean-ups, possibly by publicising events in the local press or on the radio. She also plans to approach large employers on the island, such as the oil terminal, to enquire about their support for such activities, by donating man-power or resources. Additionally, the Programme Co-ordinator would like St Eustatius to participate in the International Coastal Clean-up organised each September by the Ocean Conservancy. This global event highlights marine pollution problems, and would hopefully be a great means of generating local support for the beach clean-ups on the island.

In relation to the beach clean-up activities, with respect to waste management on the island in general; it is vital that STENAPA remains committed to trying to raise awareness in the community about recycling, reducing waste and other associated waste issues. Their "Eco-bag" campaign that came to fruition in 2005 is one positive move, and the upcoming "Waste Watchers" programme will help educate children about pollution and its impact on the natural environment. One big problem on this island, however, is the Smith's Gut landfill site; it requires immediate and drastic attention for, if an alternative solution is not found quickly, it could rapidly become an uncontrollable disaster.

Media Exposure and Public Presentations

The Sea Turtle Conservation Programme received a considerable amount of exposure in the media during 2005. The arrival of a new Programme Co-ordinator at the start of the nesting season was the first of eight articles that were published in the Daily Herald featuring the research and monitoring activities of 2005; the majority focused on the satellite tracking project and the associated competitions organised for students. The two radio interviews with the Programme Co-ordinator also gave good publicity to the programme.

It is important for all significant events to be broadcast to the local community, to ensure that they remain fully informed about all the work being achieved as part of the Sea Turtle Conservation Programme. In addition, any activities that allow the results of the monitoring and

conservation programme to be published to locally should be encouraged, such as public talks or presentations with different sectors of the community, such as church groups.

The STENAPA newsletter and website also provide the ideal forum to reach an international audience, and inform them about the work of the Sea Turtle Conservation Programme; the website in particular is a great medium in which to inform the wider public about the work being done for sea turtle conservation on St Eustatius, as it can be regularly updated with news, research activities and data.

Participation in Meetings, Workshops and Symposia

Participation in local, regional and international events is important for the work of the Sea Turtle Conservation Programme on St Eustatius to be recognised within the wider sea turtle community.

The Annual International Sea Turtle Symposium is an ideal forum to exchange information with leading experts in all fields of sea turtle biology and conservation; the WIDECAST meetings, held at the same time as this symposium, bring together the majority of the sea turtle projects from the Caribbean. They facilitate contact with other turtle conservation and research organisations from the area, and serve as a perfect arena in which develop and maintain regional contacts. The affiliation that the Sea Turtle Conservation Programme has with the WIDECAST network is a beneficial one, as it provides this small island initiative access to more established projects, who can share their experiences with developing programmes such as ours. In future it is hoped that the Programme Co-ordinator can continue to attend the symposium, and it is anticipated that, as the Sea Turtle Conservation Programme develops, we will be able to present our research findings at this important event. An abstract has already been accepted for a poster presentation about the Sea Turtle Satellite Tracking Project 2005 for the Symposium to be held in Greece in April 2006. Preliminary discussions have also taken place between the Programme Co-ordinator and researchers in Bonaire about the possibility of a joint presentation at the 2007 Symposium to feature all the satellite telemetry projects in the Dutch Caribbean.

The Cuban workshop in September, although a smaller meeting, with a more defined focus, was still advantageous to the Sea Turtle Conservation Programme. While it was acknowledged that the population of turtles nesting on the island is very small and that monitoring activities are in their infancy, all of the participants recognised that the extensive community outreach activities undertaken as part of the programme are highly significant to its success. It was another opportunity to disseminate information about the project to researchers working in the region, and important international contacts were made.

The invitation of the Programme Co-ordinator to participate in the Saba “Sea and Learn” programme was also a great opportunity to represent STENAPA at a small scale international event, and to share the results of the Sea Turtle Conservation Programme with a slightly wider audience, although still within the Netherlands Antilles. Such links with neighbouring islands should be actively encouraged, to facilitate the flow of information within the region. It is hoped that in 2006 exchange trips can be made to St Kitts and Nevis, and Bonaire to visit other turtle research programmes, conduct training and share knowledge and experiences between projects.

Recommendations for 2006

Several recommendations are proposed for the Sea Turtle Conservation Programme in 2006; these suggestions are given following an assessment of the achievements and deficiencies of the project in 2005. Many of these recommendations have been mentioned previously in the relevant section of the discussion; however, those that were not, which relate more to the programme in general, are listed below.

Participation of volunteers

The STENAPA Internship Programme started in 2001 and the Working Abroad – Statia Conservation Project began in 2003. Without the continued assistance of volunteers from these two programmes the Sea Turtle Conservation Programme could not conduct its intensive research and monitoring activities. It is therefore recommended that for 2006 volunteers continue to participate in all aspects of the project; care should be taken to ensure that all volunteers receive adequate training prior to participating in any research activities. Also, local volunteers should be actively recruited and invited to participate in beach patrols or other project events, thus increasing local involvement in the programme.

Beach patrols

The daily monitoring of the nesting beaches should continue in 2006. The introduction of patrols seven nights a week in 2005 was very successful, and should be maintained providing that sufficient personnel are available to assist the Programme Co-ordinator and STENAPA staff. As mentioned above, more focus should be placed on morning track surveys, especially on beaches other than Zeelandia Beach, which are not monitored at night.

Sunset patrols during hatchling season were not performed in 2005; this is one activity that should be reinstated for 2006. Not only does it provide increased data on the hatching dates of marked nests, thus enabling the incubation period to be determined more accurately, but it is an ideal means of involving interested members of the public in research activities. In particular, students could be invited to participate in these patrols, which would be logistically much easier to organise than a night-time patrol. Patrols could be organised for days close to the predicted hatching date of a nest, especially if signs of imminent hatching have been witnessed during morning track surveys. They also provide an excellent education opportunity; the chance to teach the public about what to do, or not to do, if they observe a turtle nest hatching.

Development of the research programme

In addition to the monitoring activities conducted on the nesting beaches it is hoped to expand the research programme of the Sea Turtle Conservation Programme in 2006. To date the focus has been on adult females nesting on the island's beaches; however, it is known that there are juvenile turtles using the in-shore waters within the Marine Park. An in-water survey of these turtles is proposed for 2006; this will quantify the data currently being received from divers about turtle sightings in the area. The objectives of this study will be to determine what species of turtle are present; to assign individuals to size classes and hence calculate their approximate age; to investigate habitat use by these turtles and, if possible, study their behaviour in greater detail. Ideally an in-water tagging programme would be developed to monitor movement of individuals from juvenile feeding grounds to adult foraging areas; this would require extensive training on in-water methods, which would be facilitated by the closer links being developed with other turtle projects in the region.

Acknowledgements

The St Eustatius Sea Turtle Conservation Programme wishes to acknowledge the contributions made by many organisations and individuals during 2005.

The project recognises the continued assistance of STENAPA staff and board members, without whom it could not continue its research and conservation efforts.

The intensive monitoring schedule could not be accomplished without the hard work and dedication of STENAPA interns, international Working Abroad participants and local volunteers.

We received financial assistance during 2005 from the Prince Bernhard Culture Fund, the Travel Committee of the International Sea Turtle Society, WIDECAST, Working Abroad and the World Turtle Trust; these awards and donations covered operational expenses and travel costs to participate in international meetings and symposia.

For sharing his expertise, and providing training on satellite telemetry methods, we wish to especially thank Dr Robert van Dam, without whom the Sea Turtle Tracking Project 2005 would not have been possible.

For her guidance and continued support of the St Eustatius Sea Turtle Conservation Programme in her role as WIDECAST Director, we would also like to thank Dr Karen Eckert.

Special thanks to Dr Jan and Corrie van Duren, for their assistance in monitoring Kay Bay.

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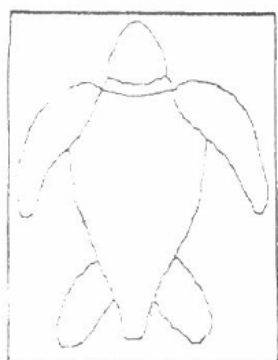
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Appendices

Appendix 1

Examples of data collection sheets updated or created in 2005.

Tagging and Nest Location Data

Record Number <input type="text"/>	Turtle Identification, Size and Health		Nesting/Sighting Information	
Observer <input type="text"/>	Species <input type="text"/>	Gender <input type="text"/>	Longitude (W) <input type="text"/>	Latitude (N) <input type="text"/>
Date <input type="text"/>	PIT Tag # <input type="text"/>	PIT Tag Location <input type="text"/>	Locale name <input type="text"/>	Triangulation <input type="text"/>
Time <input type="text"/>	Tags Present <input type="text"/>	Tag #s <input type="text"/>	Landmark 1 <input type="text"/>	Landmark 2 <input type="text"/>
Weather <input type="text"/>	Tag Locations <input type="text"/>	New Tag #s <input type="text"/>	Highwater (m) <input type="text"/>	Vegetation (m) <input type="text"/>
Moon Phase <input type="text"/>	Activity <input type="text"/>	New Tag Locations <input type="text"/>	Unsuccessful Nest Cavities <input type="text"/>	Result <input type="text"/>
 Waxing Crescent  First Quarter  Waxing Gibbous  Full Moon  Waning Gibbous  Last Quarter  Waning Crescent	Emerging, Searching, Body pitting, Digging egg chamber, Laying, Covering, Disguising, Leaving, Gone	Carapace Length (m) <input type="text"/>	Nest Relocation New Longitude (W) <input type="text"/> New Latitude (N) <input type="text"/> Triangulation <input type="text"/> Landmark 1 <input type="text"/> Landmark 2 <input type="text"/> Highwater (m) <input type="text"/> Vegetation (m) <input type="text"/> Number of Eggs <input type="text"/> Yolked <input type="text"/> Yolkless <input type="text"/> Time Laid <input type="text"/> Time Repaired <input type="text"/>	
	Parasites/Ectobiota <input type="text"/>	Injuries <input type="text"/>		
	Notes <input type="text"/>			
	In absence of turtle			
	Track width (m) <input type="text"/>			

Nest Excavation Data

NEST EXCAVATION DATA SHEET

Nest Code

Observers

Date - Laid
 - Hatched
 - Excavated

Number of Empty Shells (> 50%)

Number of Hatchlings - Alive
 - Dead

Number of Unhatched Eggs - No Embryo
 - Embryo
 - Full Embryo

Number of Pipped Eggs

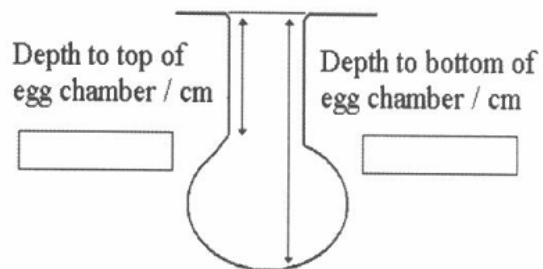
Number of Depredated Eggs

Number of Deformed Embryos

Number of Yolkless Eggs

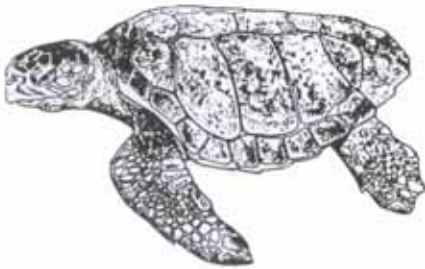
Notes

Depth of Nest



Appendix 2

Example of the in-water turtle sighting form given to dive centres in St Eustatius in 2005.



Sint Eustatius Marine Park
Sea Turtle Sighting Form

Sea turtles are endangered throughout the Caribbean. Research is done to plan and implement effective conservation and management programs. You can help the sea turtles by filling out this form. Thank you!

Name: Date: Day: Month: Year:
Location / Divespot: Time:
Dive Shop / Dive Master:

What species of turtle did you see ?

☐ Green Turtle
☐ Hawksbill Turtle
☐ Loggerhead Turtle
☐ Leatherback Turtle
☐ I could not determine the species, but it was probably a

What was the turtle's shell length ?

☐ less than 4 inches (<10 cm)
☐ between 4 and 20 inches (10-50 cm)
☐ between 20 and 40 inches (50-100 cm)
☐ more than 40 inches (>100 cm)

Did the turtle's tail extend more than 6 inches (>15 cm) beyond the shell ?

☐ yes ☐ no ☐ I don't know

Was the turtle:

☐ alive ☐ injured ☐ dead

If injured, how was the turtle injured ?

What was the turtle doing ? Was it

☐ resting ☐ mating ☐ swimming ☐ eating

At what depth was the turtle seen

☐ feet or ☐ meters

Was it

☐ on the surface ☐ at the bottom ☐ in the water-column

What was the immediate environment?

☐ sand ☐ sea grass ☐ coral reef
☐ rocks ☐ other (cave, wreck, etc.)

Did you notice anything else ?

The Sint Eustatius Marine Park can be contacted at Lower Town, or P.O.Box 59 Sint Eustatius, Netherlands Antilles.
Telephone: (--) 599 3 82884 Fax: (--) 599 3 82913

Appendix 3

Updated “Guidelines for Visitors” fact-sheet.



Guidelines for visitors to the St Eustatius Sea Turtle Monitoring Programme at Zeelandia Beach

St Eustatius National and Marine Parks Foundation (STENAPA) started its sea turtle monitoring programme in 2001. In the Netherlands Antilles all sea turtles and their habitats are protected. The Marine Park is part of the Wider Caribbean Sea Turtle Conservation Network and follows WIDECAST protocols to monitor female turtles nesting on Statia. As a visitor and guest of the programme we ask that you please read these guidelines and sign the waiver below, PRIOR to participating in a beach patrol:

- A maximum of 2 guests are allowed on the beach per night because the patrols are conducted for research purposes not as a tour. You need to register at the National Parks office so that researchers know when they have guests accompanying a patrol.
- Patrols are conducted nightly on Zeelandia beach between 9.00pm and 4.00am. You will need to make your own way to and from the beach, as the Marine Park cannot organize transportation. Please arrive by 8.50pm so that the patrol can start promptly at 9.00pm.
- Visitors must remain with the group at all times and follow the advice of the patrol leader.
- NO PHOTOGRAPHY or VIDEO RECORDING is allowed. The Marine Park personnel may take photographs, but only if necessary for research purposes. You are welcome to leave your e-mail with the Marine Park and we will gladly forward pictures of sea turtles to you.
- NO WHITE LIGHT is used on the beach; visitors may only use flashlights that have a red filter attached (Please provide your own filters). Improper use of lights may deter a nesting female or disorientate hatchlings.
- A long-sleeved top and long trousers are suggested clothing, bring an extra layer as it often gets windy on the beach. Shoes, not sandals or bare feet, are recommended, as there are obstacles on the sand that can injure your feet.
- You are advised to bring water, and possibly snacks, for rest periods between patrols. Please note that alcohol is NOT permitted.
- During hatchling season be aware that hatchlings are emerging from nests and you will be asked to walk right behind researchers so that you do not disturb them. Note that hatchlings will only be handled if they are trapped or have flipped over on their back; this will be performed by Marine Park personnel.
- We ask that you closely follow any requests by Marine Park researchers. For instance, you will be asked to stand behind a nesting turtle and there will be no contact with the turtle until after she has finished laying her eggs.
- Anyone who disregards the wishes of Marine Park researchers during a patrol will be asked to leave the beach.

Finally, we would like to thank you in advance for observing these guidelines. Remember, Zeelandia beach hosts a low number of nesting sea turtles and you may not see any turtles while on patrol.

I would like to participate in the beach patrol on the night of _____

I have read and acknowledge these guidelines and will respect these regulations.

Name: _____

Signature: _____

Date: _____

Public awareness turtle watches are neither commercialized (conducted for profit) nor exploited for commercial endeavor. Do not accept reservations made by commercial enterprises that may charge a fee for their services.

There is no fee in place to join patrols, however donations are accepted! Thank you. Manager, Statia Marine Park

Appendix 4

Flyer produced to inform the local community about the Sea Turtle Conservation Programme.

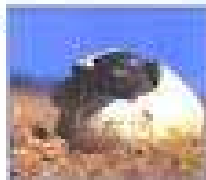


STENAPA SEA TURTLE CONSERVATION PROGRAM

EVER SEEN A SEA TURTLE LAYING EGGS?



EVER SEEN BABY TURTLES HATCHING FROM A NEST?



EVER STAYED UP ALL NIGHT WALKING THE BEACH LOOKING FOR TURTLE TRACKS?

IF THE ANSWER TO THESE QUESTIONS IS NO, BUT YOU WANT TO FIND OUT MORE ABOUT SEA TURTLES, WHY NOT COME ALONG AND JOIN US OUT ON PATROL?

VOLUNTEERS ARE ALWAYS WELCOME. JUST COME DOWN TO THE STENAPA OFFICE IN GALLOW'S BAY AND SPEAK TO THE TURTLE CO-ORDINATOR (EMMA), OR CALL HER ON 318-2884 TO FIND OUT MORE ABOUT HOW YOU CAN HELP US CONSERVE STATIA'S TURTLES.

WE LOOK FORWARD TO SEEING YOU SOON!!

Appendix 5

Excavation data for leatherback nests

Nest Code	Hatchlings		Empty Shells	Unhatched Eggs			Pipped Eggs	Yolkless Eggs	Total Eggs	% Hatched	% Emerged	Depth ¹ / cm	
	Alive	Dead		No Embryo	Embryo	Full Embryo						Top	Bottom
DC1	0	2	3	20	7	0	0	22	30	10.0	3.3	60	70
DC2	0	1	3	76	5	0	0	51	84	3.6	2.4	50	70
DC3	0	0	4	9	29	30	4	52	76	5.3	5.3	49	75
DC4	0	0	1	21	64	0	1	63	87	1.1	1.1	40	71
DC5	0	3	3	43	40	0	0	35	86	3.5	0	32	71
DC7	0	0	0	53	36	0	0	55	89	0	0	56	75
DC8	0	0	0	38	64	0	0	42	102	0	0	44	72
DC9	0	0	3	27	32	6	0	64	68	4.4	4.4	63	84

Excavation data for hawksbill nests

Nest Code	Hatchlings		Empty Shells	Unhatched Eggs ²			Pipped	Predated	Deformed	Yolkless Eggs	Total Eggs	% Hatched	% Emerged	Depth ¹ /	
	Alive	Dead		NO	E	FE								Top	Bottom
EI1	0	0	46	66	29	3	2	5	0	0	151	30.5	30.5	29	50
EI2	0	0	74	61	7	0	1	0	1	3	143	51.7	51.7	30	39

¹ Depth from surface of sand to first egg (Top) and bottom of egg chamber.

² NO = No Embryo; E = Embryo; FE = Full Embryo.

Appendix 5 Continued

Excavation data for green turtle nests

Nest Code	Hatchlings		Empty Shells	Unhatched Eggs ¹			Pipped	Predated	Deformed	Yolkless Eggs	Total Eggs	% Hatched	% Emerged	Depth ² /	
	Alive	Dead		NO	E	FE								Top	Bottom
CM2	0	0	0	25	1	0	0	6	0	0	32	0	0	7	30
CM3	0	3	90	6	7	0	5	0	1	0	108	83.3	80.6	-	-
CM5	2	26	86	10	8	0	1	0	1	0	105	81.9	55.2	65	77
CM8	1	0	106	6	0	0	3	0	0	0	115	92.2	91.3	59	67
CM9	0	5	74	4	15	11	1	0	1	2	105	70.5	65.7	47	57
CM11	3	0	123	9	4	0	0	0	0	2	136	90.4	88.2	54	54
CM12	4	26	95	4	3	0	9	0	0	2	111	85.6	58.6	31	46
CM14	0	0	88	8	2	0	0	0	0	1	98	89.8	89.8	-	-
CM15	2	1	111	1	0	0	1	0	0	0	113	98.2	95.6	44	55
CMR1	0	0	68	10	7	0	3	1	0	0	89	76.4	76.4	56	64

¹ NO = No Embryo; E = Embryo; FE = Full Embryo.

² Depth from surface of sand to first egg (Top) and bottom of egg chamber.

Appendix 6

Photographs of the attachment of a satellite transmitter to a green turtle on 20 September, 2005.

Green turtle in the holding box, showing her size and the location of the transmitter on her carapace. Her head was covered to help calm her down and minimise her movements.

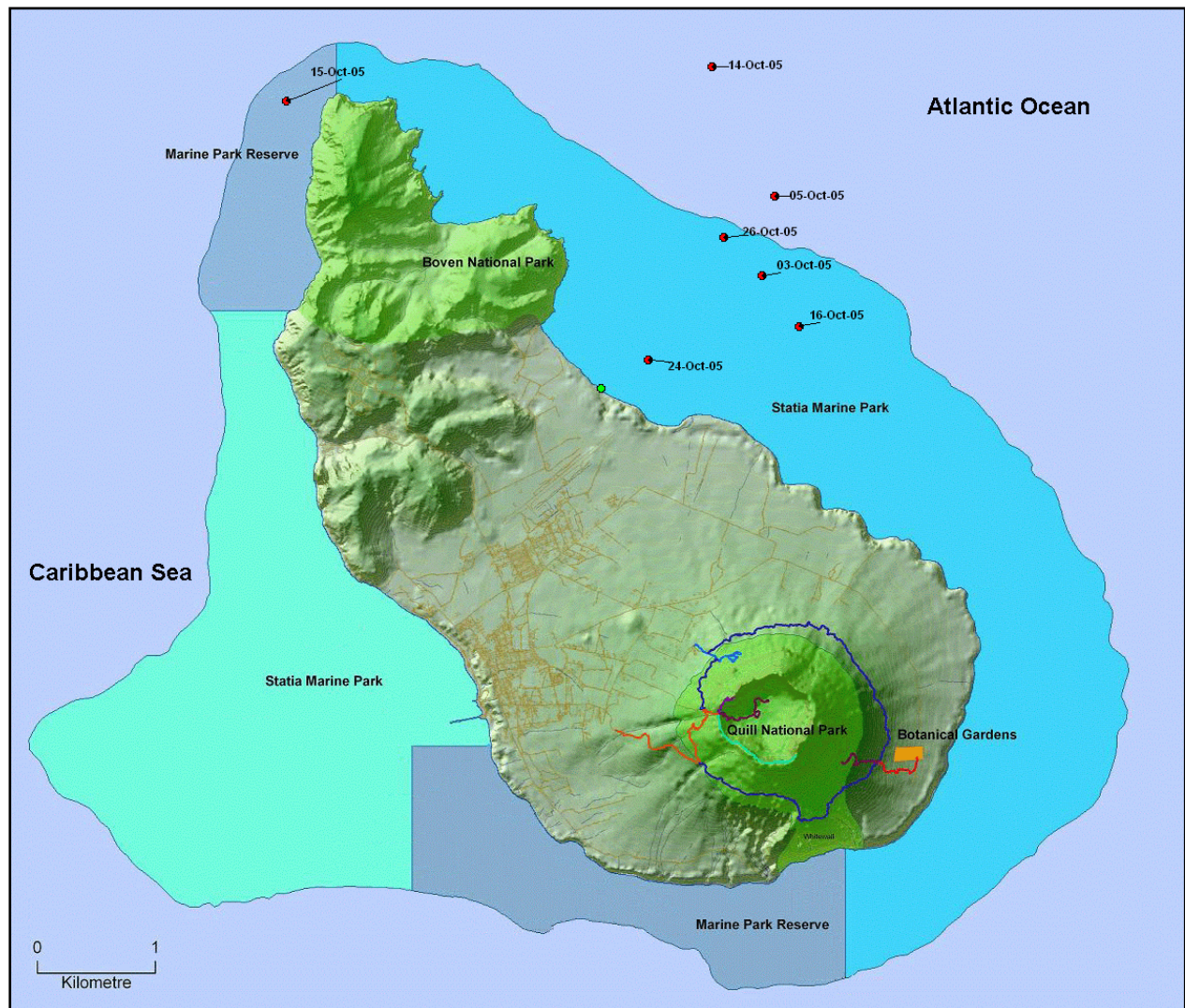


Working Abroad volunteer Hanna Linner, STENAPA Manager Nicole Esteban and Programme Co-ordinator Emma Harrison with the green turtle, waiting for the fibreglass to dry.



Appendix 6 Continued

Map showing some of the high quality location points received during October 2005 from the green turtle “Miss Shellie” from St Eustatius; points are clustered just off the release site at Zeelandia Beach (Indicated by green circle). Map produced by Dr Robert van Dam.



Appendix 7

Photographs of a hawksbill turtle “Archy” attached with a transmitter on 9 October, 2005.

Dominique Vissenberg and volunteer Arjen Hilhorst with hawksbill turtle in holding box; waiting for fibreglass to dry.

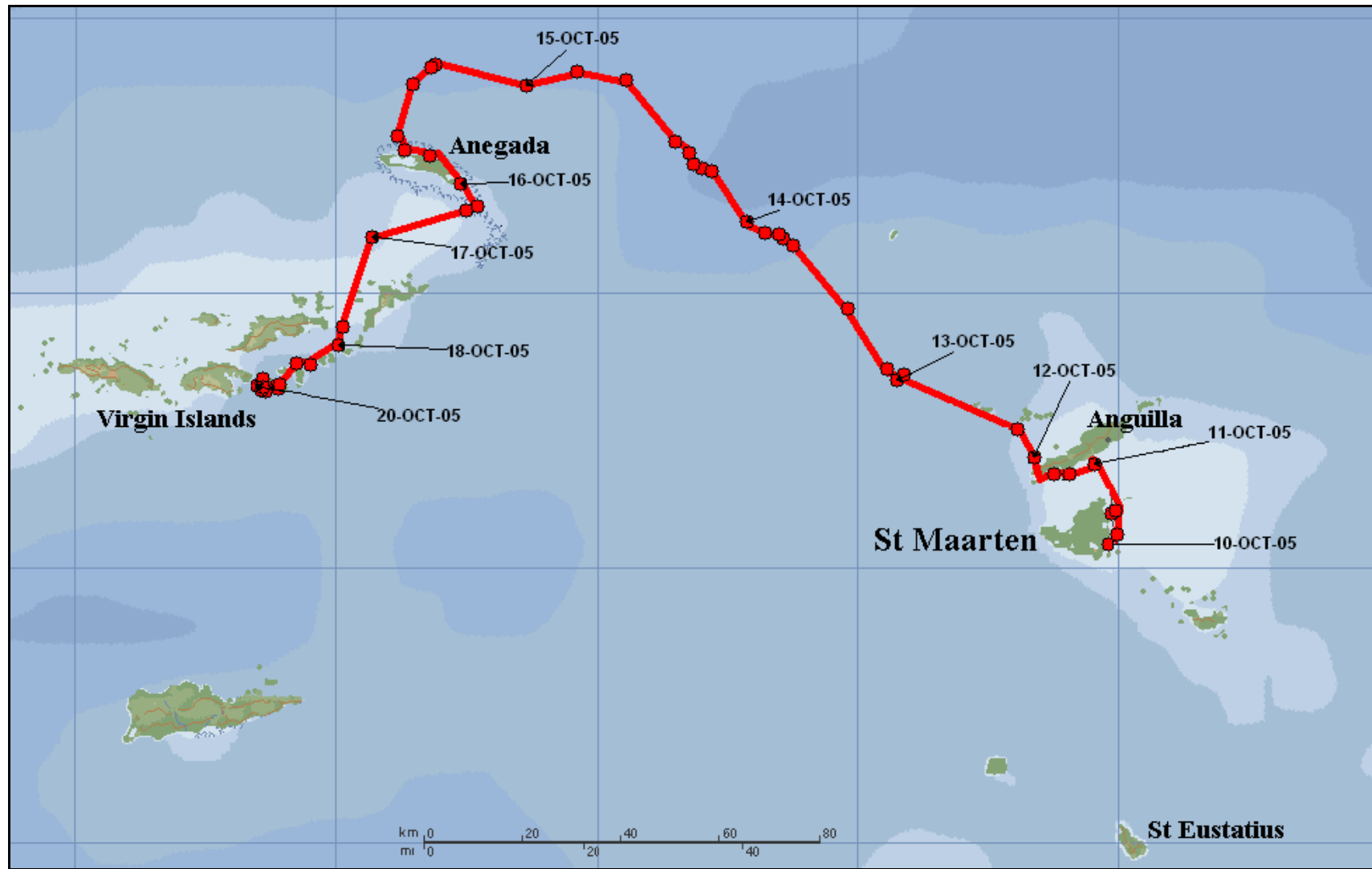


Hawksbill turtle with transmitter attached returning to the sea.



Appendix 7 Continued

Map of the migration route of hawksbill turtle “Archy” from St Maarten. Map produced by Dr Robert van Dam.



Appendix 8

Photographs of the library display featuring information about satellite telemetry, entries for the “Name the Turtle” Competition and details of the “Where’s the Turtle?” Competition.



Appendix 9

Copies of some of the newspaper articles featuring the Sea Turtle Satellite Tracking Project 2005.

Daily Herald article of 24 September, 2005



Turtle experts Robert van Dam and Emma Harrison. Harrison is holding one of the small transmitters used to track turtle migration.

Turtles on Statia are fitted with transmitters to track migration

ST. EUSTATIUS--Robert van Dam from the Netherlands, an expert in sea turtle tracking, is in St. Eustatius this week to help turtle project manager Emma Harrison.

Van Dam and Harrison are attaching specially made transmitters to the backs of turtles that come to Statia beaches to nest.

Van Dam, who is currently living in Mexico, is a free-lance consultant on turtles and turtle migration. He will spend this week in Statia, then next week will work in St. Maarten. The Dutch Caribbean Nature Alliance is funding Van Dam's work.

Van Dam explained that the transmitters, which are fastened to the turtle's shell with fibreglass and epoxy, are activated by a special salt water switch, which turns the transmitter on when the turtle comes to the surface to breathe.

The signal is picked up by a satellite, which automatically posts the data to a Website. Researchers and others can then access the site to determine the location of the turtle at any time.

The transmitters are expected to continue transmissions for ap-

proximately six months.

The turtle team, consisting of van Dam, Harrison, Parks Manager Nicole

Esteban and volunteer Hannah Linnert, recently was excited to discover a large green turtle nesting on Zandvliet Beach.

They attached a transmitter to her and have already received signals from this unit.

Harrison said that rain and thunder had enveloped the beach just as they had begun to work, but the team was undeterred.

Harrison is conducting a programme among the school children of Statia that has generated intense interest. Contests are being held, and children are making sea turtle models from recycled materials and drawing pictures of sea turtles, showing their expected migration patterns.

They are also proposing names for the turtles; one child suggested the name "Miss Shelley." The winners of the contests are to be announced next week.

Van Dam has brought five of the transmitters with him and hopes to install all of them in Statia and St. Maarten during his stay here.

Appendix 9 Continued

Daily Herald article of 7 October, 2005

Winners announced in Statia's Turtle Tracking Program contest

Keynote, Statia, Narel Smith, and Evan Russell are the winners in a contest held by Statia, the St. Eustatius National Parks Foundation, in part of its satellite turtle tracking program. Over 100 students from local schools participated in this art, craft, and essay contest held over the past few weeks.

The youngest students were asked to draw a turtle, showing where they might go on her migration. The contest for 5th and 6th graders consisted of a short essay about the journey a turtle might make, once she leaves the nesting beaches, while students in grades 7 and higher were asked to make a model of a turtle out of recyclable materials. The winners in each category chose the names given to the turtles that are being tracked with satellite transmitters attached to their shells. The winners also received a certificate, a bobble, membership in Statia's Seaside Club, and the opportunity to search for turtles on a boat tour around the island.

Smith, in grade 3 at Governor de Graaf School, was awarded first prize in the art category for his picture of "Lila," Smith, 10, wrote his essay about the journey of "Grace," while Smith, 12, of Statia Terminal School, made a model of "Miss Shellie" from plastic plates and a water bottle.

Russell, who received a certificate and also was invited on the boat tour, wrote "Eldorado Islands of Golden Rock School and Fanning Island, kindly Statia, and Erick Espino, all at Statia Terminal School.

A second competition will be announced to students during follow-up talks in the schools this week. This time, the students will be asked to guess where they think the turtles are going and how far they will swim. More details about this competition or the tracking project can be obtained by contacting turtle coordinator Emma Harrison at Statia, 318-2894.

All of the contest entries are now on display at the public library. A map of the Caribbean is also included in the display, which will be updated with the current location of each turtle during her migration to feeding grounds hundreds of miles from St. Eustatius.




Daily Herald article of 8 November, 2005

Miss Shellie stays in Statia waters, Archy still in the Virgin Islands

PHILIPSBURG/STATIA—Miss Shellie, the sea turtle that was tagged with a satellite transmitter in Statia in October, is proving to be a "true Statia girl," as she has stayed just a few kilometres from the beach where she was released, according to the tracking information.

Her behaviour is a bit of a mystery to the turtle experts, according to Nature Foundation St. Maarten Education Coordinator Dominique Visserberg. "It is a common belief that female turtles swim between feeding grounds and nesting habitats, and that those aren't in the same place. It seems as if Miss Shellie might have found a good sea grass bed just off Statia and for now at least, she is showing no signs of migrating elsewhere. She is a true Statia girl."

In contrast Archy, the St. Maarten hawksbill turtle, has shown more typical behaviour. She left the area almost immediately after her transmitter was attached in October and swam about 400km to the British Virgin Islands, about 180km from St. Maarten.


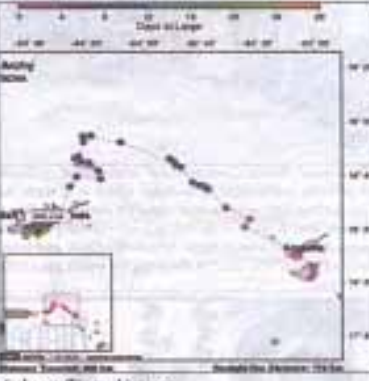
However, her track shows that she didn't go directly there. "Initially, she went North, but then seemed to correct herself and go South, swimming right around the island of Anguilla. Archy appears to reside in the 4km wide channel between St. John, US Virgin Islands, and Norman Island, British Virgin Islands."

Archy's pattern is "very illustrative of the navigational methods turtles use that probably rely on the Earth's magnetic field to guide their way. As they don't use maps as we would, they simply deal with any obstacles, such as islands, that they encounter en route. This is why their routes may not seem the 'shortest' from our perspective," Visserberg stated.

She continued, "The fact that Archy had lots of haircuts when she had her transmitter attached suggested that she lives in an environment other than coral reefs. There will show whether Fanning Island is her final feeding ground or if she will continue her journey."

The two female sea turtles were tagged with satellite transmitters by Statia in St. Eustatius and Nature Foundation in St. Maarten. Both organisations are excited to see where the turtles go since they left the island's waters at the end of the nesting season.

Keep track of Miss Shellie and Archy online at <http://www.seaturtle.org/tracking/> and click on their names on the list (Netherlands Antilles Turtle Tracking 2005).

Appendix 10

Copy of newspaper article from the Daily Herald published 23 July, 2005; featuring the Sea Turtle Conservation Programme and the school vacation activity held at the library in July, 2005.

12 JULY 23, 2005

WEEKENDER

THE DAILY HERALD

Sea Turtle Nesting Season Underway on Statia



by Emma Harrison*

The beginning of another turtle nesting season here on Statia happened in March with the discovery of leatherback tracks on Zeelandia beach. This female turtle first arrived very early in the season, and she nested even before the turtle program co-ordinator had set foot on the island to start work! Night-time beach monitoring started in April, and since then Marine Park staff and Working Abroad volunteers have been out on patrol every night from 9:00pm to 4:00am, watching for female turtles coming ashore to nest.

I Unfortunately, after the excitement of our "early

nesting process.

IT IS UNLIKELY that the first turtle we saw will come back to lay a seventh nest, but we hope that the second turtle will return several more times before the end of the season. The last week of patrols for the first group of volunteers saw the arrival of our third leatherback, this one with all flippers intact. Now we are waiting to see when she will return to lay more eggs.

Due to the early start to the season, there has already been one nest hatch and when researchers excavated to determine how successful the hatching had been, they discovered that the small clutch contained just 32 eggs, but only three eggs had hatched. Further, only one of the three hatchlings made it to the sea!

We do not know why this particular turtle's nest was so early and contained so few eggs. Perhaps she is very young or very old, or perhaps she had been driven away from her regular nesting place, and had only a few remaining eggs to deposit.

This was not a promising start to the season, although it does highlight why each female nests more than once during the season. She may lose one or more nests to natural causes (tides, storms, erosion) or to disturbance by predators, but she could still have others that hatch



Harrison, left, with assistants Emily Richardson and Katherine Owen, explains the sea turtle project to children in the Public Library summer activities programme.

presumed to have nested from the appearance of the nest site. It will be almost two months before we know for sure whether this assumption is correct.

On July 8, we spotted our first green turtle nest of the season on Turtle Beach. We have had just the one leatherback hatching, but we're

was the quantity of small plastic items that was most disturbing to observe.

Hundreds of plastic bottles used for motor oil, drinks, and household products were collected, along with Styrofoam food containers and plastic bags. The plastic bags, especially, are potentially deadly

will have to be collected in the next clean-up.

This cycle of events can only be broken, if the rubbish is effectively contained at the disposal site so that it doesn't end up on the beach or out at sea.

Note: Emma Harrison is an applied biological scientist from England who is working in St. Eustatius to co-ordinate this year's sea turtle monitoring program. She arrived at the beginning of April, and will remain through the seven months of the nesting season. Harrison is currently working with a number of volunteers in the Working Abroad program, as well as with several St. Eustatius National Parks Foundation (Stenapa) interns. Each night, at least two persons spend the hours from 9:00pm to 4:00am walking the Zeelandia Beach and watching for turtle activity.

Harrison co-ordinates all activities related to the tagging and monitoring of nesting turtles. She also conducts a beach cleanup drive about once per month, and visits schools to interest students in the turtle program. Harrison has previous experience, having co-ordinated a sea turtle program in Costa Rica for three years. Prior to that, she earned her degree

Appendix 11

Example of flyer advertising monthly clean-up of Zeelandia Beach.



VOLUNTEERS NEEDED!!

The turtles may be almost ready to leave Statia, but they aren't the only reason to keep our beaches clean.

We want people to enjoy the beach too!

We've planned another clean-up, but, we need **YOUR** help to make the beach a nicer place to visit.



Please come along and lend a hand!

When: **Wednesday 19th October**

What time: **3.00pm**

Where to meet: **Zeelandia Beach car park**


What to bring: **Garbage bags and gloves**

Appendix 12

Copy of the September issue of the STENAPA newsletter, featuring an article about the Sea Turtle Satellite Tracking Project on the front page.

St Eustatius National and Marine Parks and Botanical Gardens


September 2005
Newsletter 3/2005



STENAPA Update

Turtle Satellite Tracking Project


This year we are hoping to finally solve the mystery of where turtles go, once they leave Statia's nesting sites. With funding from the Dutch Caribbean Nature Alliance (DCNA), STENAPA and the Nature Foundation of St Maarten have started a satellite tracking study of Green and Hawksbill Turtles. The aim of this project is to track these animals on the way to their foraging grounds, once they leave the island's waters towards the end of October. Getting to know the turtle's movement pattern will give us a much clearer picture of their geographical range. This will allow us to improve protection and conservation efforts, not only on the nesting beaches, but also in other essential habitats. Satellite tracking will indicate the migration pathways turtles use, enabling us to determine any potential threats, such as fisheries interaction these animals may encounter on their way between nesting and feeding grounds.



The transmitter is a 12cm by 5cm by 3cm box, and weighs 200 grams with an antenna attached at one end. There is no danger of it hurting the turtle as its design is streamlined and therefore will not interfere with any normal behaviour and movements. Attachment procedure of the transmitter poses no risk to the animal. To limit movement during tagging, she is put in a holding box where her carapace is cleaned of any algae or barnacles before attaching the transmitter, plus a soft cushioning layer to her shell. It sits towards her head which will be out of water when she surfaces for air, enabling signals to be sent to satellites. Layers of hardened protective fiberglass encase the transmitter, protecting it from damage during the journey through the ocean, reefs and other obstacles the animal might encounter. All this is done after she is


finished with nesting. A very important aspect of this project has been the opportunity to increase public awareness of turtle conservation issues. Programme Coordinator Dr Emma Harrison visited Statia's schools in September to give presentations on satellite telemetry. At the same time a "Name the Turtle" competition was organised. Students were given the task of drawing turtles, projecting where their migratory path might lead them, writing an essay about a turtle's journey or making a model of a turtle using only recycled materials. Over a hundred entries were received and judging was no easy task. All winners were allowed to choose names for the tagged turtles, one of them being Miss Shellie. She and the other turtles can be followed on STENAPA's website www.statiapark.org

Good Luck to all turtles and a safe return to Statia!!



This is how it works

Under the supervision of Dr Robert Van Dam, a sea turtle biologist with many years experience using satellite telemetry to track turtles in the Caribbean,



Miss Shellie on her way

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Special points of interest:

Wednesday Oct. 19 at 3.00 PM
Join Beach Clean-up at Zeelandia

Saturday Oct. 29 and Sunday Oct. 30 at 8.00 AM
Hike on the Quill Trail with Author of Reptiles and Amphibians of Dutch Caribbean. Meet at the top of Rosemary Lane.

Saturday Nov. 05 and Sunday 06 at 9.00 AM
Help clear our large trees from Mexican Creeper Corallita (see flyers for detail)

• Guided tours at the Botanical Gardens are available from 8am-1pm every weekday. Contact the office if you want to have a guided tour outside of these hours. The Garden is open from sunrise to sunset everyday.

• Turtle nesting season is nearly over. Contact the office if you want to join a patrol.