Nesting Ecology and Conservation of Marine Turtles in the Commonwealth of Dominica, W.I.

2007 Annual Project Report

Submitted to the Ministry of Agriculture and the Environment (Forestry, Wildlife and Parks Division)

Prepared by

Seth P. Stapleton

Project Manager, Rosalie Sea Turtle Initiative

Karen L. Eckert

Executive Director, WIDECAST

November 2007

RSTI Rosalie Sea Turtle Initiative

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

For bibliographic purposes, this report should be cited as follows:

Stapleton, S. P. and K. L. Eckert. 2007. Nesting ecology and conservation biology of marine turtles in the Commonwealth of Dominica, West Indies: RoSTI 2007 Annual Project Report. Prepared by WIDECAST for the Ministry of Agriculture and the Environment (Forestry, Wildlife and Parks Division). Roseau, Dominica, West Indies. 45 pp.

ACKNOWLEDGEMENTS

We are profoundly grateful for the support and encouragement of the people of Dominica. The Rosalie Sea Turtle Initiative relies upon partnerships with various sectors of society, and support from all sectors is necessary to make the project successful. We sincerely appreciate all of your contributions, and we apologize for any inadvertent exclusions!

First, we sincerely thank our dedicated field staff and volunteers. Working long, nighttime hours under stressful conditions and occasionally in inclement weather is incredibly challenging. Patrolling requires dedication and a passion for the job. We appreciate the efforts of all project staff and volunteers, including John Alexander, Alexander Beaupierre, Jerome Bruno, Jackson Cadette, John Cadette, Osmond Cadette, Stephen Durand, Nelly Felix, Gracien Fontaine, Andre George, Dexter George, Vernon George, MacDonald Greenaway, Bradley Guye, Julian Frances, Clarisant Joseph, Frances Lawrence, Wenslaus Lawrence, Zuane Prescott, Charles Richards, Dennis Roman, Martin Sorhaindo, Charles Watty, Edward Watty, Jolly Williams, Hannah Williams, and Joelle and Glen of the Northeast.

We extend our gratitude to Hon. Yvor Nassief, Minister of Tourism, and Hon. Dr. John Collin McIntyre, Minister of Agriculture and the Environment, for their continued support of sea turtle conservation and their foresight regarding sustainable development in general. RoSTI enjoyed the support of various government agencies in Dominica during 2007. We are particularly grateful for our long-term partnership with the Forestry, Wildlife and Parks Division and especially thank Stephen Durand, David Williams, Ronald Charles, Arlington James, and Charles Watty for their contributions to the project over the years. We also appreciate the ongoing assistance, encouragement and expertise of Andrew Magloire and his Fisheries Division staff, especially Harold Guiste. Finally, we benefited from collaboration with Marcia Baron and the Southeast's Youth Development Division.

RoSTI thanks the district Government officers from the Northeast and Southeast of Dominica, as well as numerous village councils, notably Riviere Cyrique / Morne Jaune, Grand Fond, and La Plaine, for the working relationships maintained in 2007. We enjoyed the support of Parliamentary Representatives Hon. Ronald Green (La Plaine constituency) and Hon. Abraham Brown (Grand Fond constituency), as well as Government Sen. Peter St. Jean (La Plaine constituency). We thank the individual communities of the Southeast for their support throughout the season, and in particular the project benefited from collaborations with community-based conservation groups LEAP, NET, WCCA, and the newly formed Northeast conservation group, as well as with the SETDC. We also acknowledge our friendship and collaboration with the schools of the Southeast and across the island.

We greatly appreciate the guidance provided by Albert 'Panman' Bellot of COMPACT/ UNDP GEF-SGP. We thank the Dominica State College's Environmental Club for their interest in the beach monitoring efforts and their willingness to lend a hand! We also acknowledge the support of the Dominica Hotel and Tourism Association (DHTA).

We are profoundly grateful to Mrs. Beverly Deikel who, through her abiding passion for the local communities of the Southeast coast and her commitment to a sustainable tourism product in Dominica, was responsible for initiating RoSTI. In addition, we are indebted to Mr. Patrice Oscar and the staff and associates of the Rosalie Bay Nature Resort for their innumerable contributions.

We appreciate the support of the private sector, including Sam and Glenda Raphael, Laura Ell, Christine Tinker, and other Jungle Bay Resort and Spa staff; John Robin and Benjo's Seamoss and Agro Processing Ltd.; Neville Graham of Quality Caribbean Homes, Irvin Durand of PhotoWorld; Harris Paint; Anthony John and Digicel; O.D. Brisbane and Sons; Sunset Bay Club; Tamarind Tree Hotel and Restaurant; East Carib Dive; and Al Dive. These are just some of the representatives of the private sector who provided support in many creative ways for the benefit of sea turtle conservation in Dominica.

We extend our thanks to the national media for helping to share the importance of sea turtle and marine conservation with the people of Dominica. Our acknowledgements include Mr. Brenton Henry and Ms. Shermaine Green-Brown of DBS, Ms. Kamala Jno. Baptiste of Kairi FM, Ms. Royette Greenaway of GIS, Mr. Tim Durand of Marpin, Mr. Joelle Paris, and the editors and staff of the Sun, the Chronicle, and the Times newspapers.

We are grateful for the support and encouragement provided by local NGOs including Mr. Errol Harris and the Dominica Sea Turtle Conservation Organization, Ms. Nancy Osler and the staff of the Springfield Guesthouse and Archbold Tropical Research and Education Center, the Waitikubuli Ecological Foundation, and Dr. Sasha Steiner of the Institute for Tropical Marine Ecology.

Finally, we appreciate the technical guidance, resources, and training provided by other members of the WIDECAST network including Mr. Dennis Sammy, Ms. Suzan Lakhan, and the entire Nature Seekers organization in Trinidad; Dr. Julia Horrocks of the Barbados Sea Turtle Project at the University of the West Indies (Barbados); and Dr. Scott Eckert of Duke University. Finally, we are grateful for the support provided by the EarthWatch Institute which, in partnership with WIDECAST and the Government of Trinidad and Tobago, facilitated a sea turtle conservation training course in Matura, Trinidad.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

Nesting Ecology and Conservation of Marine Turtles in the Commonwealth of Dominica, West Indies March – September, 2007

EXECUTIVE SUMMARY

The Rosalie Sea Turtle Initiative (RoSTI) is a community-based sea turtle research and conservation project based in the Commonwealth of Dominica. The project partners with government agencies, NGOs, the private sector, and coastal communities to collect scientifically sound data addressing sea turtle nesting ecology and to educate the public on the importance of marine conservation. In 2007, RoSTI completed its 5th season of research and conservation work, utilizing regular foot patrols and identification tagging to study the leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and green turtles (*Chelonia mydas*) nesting on the beaches of Dominica. RoSTI's geographic focus remained Rosalie Bay (i.e., Rosalie and La Plaine Beaches); the project also regularly monitored Londonderry Beach in the Northeast and conducted irregular patrols on other beaches around the island.

RoSTI documented an increase in total nesting activity in 2007, with leatherback nesting on the beaches of La Plaine and Rosalie accounting for nearly 80% of the total nesting attempts this year. A total of 109 leatherback turtles were documented an average of 3.3 times; 103 of these individuals nested at least once in Dominica, depositing an average of 2.6 observed nests. (*Note*: The actual number, had all nestings been observed, would have been much higher. Leatherbacks nest as many as 12 times per year; the typical average is 6-7.) Leatherbacks exhibited a well-defined primary nesting season, spanning March to July and peaking in May. RoSTI recorded numerous individuals tagged in other countries – including Trinidad and Tobago, Grenada, St. Lucia, Martinique, Guadeloupe, and Puerto Rico – nesting in Dominica this year.

Heightened levels of poaching accompanied increased nesting; at least 14 egg-bearing leatherback females were illegally slaughtered in 2007.

Occasional nesting by green and hawksbill turtles was also recorded during the 2007 season, but small sample sizes did not permit identification of seasonal trends and geographic patterns or calculation of relevant summary statistics.

The volume of leatherback nesting activity recorded in Dominica reflected trends across the Central Western Atlantic region. Fluctuations in the number of females becoming reproductively active in any particular year are believed to be linked to primary productivity in highseas feeding grounds. Additionally, airport construction led to extremely high levels of sedimentation off the northeast coast, seemingly creating an unsuitable environment for nesting and pushing egg-laying further south.

The development of 'Turtle Watching' as an ecotourism product and revenue generator, the restructuring of RoSTI (including improved scientific and administrative components), and a creative, community-centric education and outreach programme will greatly assist future sea turtle conservation efforts in Dominica.

I. INTRODUCTION

The Rosalie Sea Turtle Initiative (hereafter RoSTI), a project of the Wider Caribbean Sea Turtle Conservation Network (hereafter WIDECAST), was launched in the Commonwealth of Dominica in 2003 as a community-based research and conservation project. The project, executed in partnership with the Forestry, Wildlife and Parks Division, the Fisheries Division, and communities in the eastern and northern regions of Dominica, represents the first comprehensive attempt to research and conserve internationally endangered sea turtles (IUCN 2007) on the island. RoSTI was conceptualized as a practical example of how the sustainable management of depleted sea turtle stocks can be accomplished at both community and national levels in Dominica. Since its inception, RoSTI has strived to achieve this objective by collecting data on Dominica's nesting sea turtle populations through the use of sound scientific methodologies, by employing a strong public awareness component, and by enlisting the assistance and support of local communities.

Additionally, the establishment of a low-impact 'Turtle Watching' venture – providing for sustainable, non-consumptive use and generating economic benefits for participating communities – has remained a fundamental objective of RoSTI since 2003. Ultimately, 'Turtle Watching' programmes will be essential to the long-term sustainability of Dominica's nesting sea turtle populations.

As a member of the WIDECAST network, RoSTI has benefited from the expertise of sea turtle programs throughout the region. For more than a quarter century, WIDECAST, which embraces the largest network of sea turtle research and conservation projects in the world, has pioneered science-based and community-led sea turtle research, conservation, management, and education in the Caribbean region. RoSTI has received technical guidance and support from WIDECAST-affiliated scientists, managers, educators, and conservationists in the form of field techniques, models for data collection forms and outreach materials, and training opportunities for community staff and government officials. Such assistance has enabled RoSTI and the divisions of Fisheries and Forestry, Wildlife and Parks to raise Dominica's national consciousness regarding marine turtle conservation.

RoSTI is but a first step in providing Dominicans with experience and knowledge in developing their own research priorities, crafting their own conservation successes, and creating a future that includes healthy sea turtle stocks. The information collected and the results obtained have set the stage for additional work in the coming years and the development of an integrated and science-based agenda for sustainable turtle management in the country. Here we outline objectives and methodologies, present results obtained during the 2007 research season, and provide conservation, management, and project recommendations regarding marine turtle conservation in the Commonwealth of Dominica.

II. STUDY SITES

Background

The Rosalie Sea Turtle Initiative is based in Rosalie Bay on the southeastern coast of Dominica, 'the Nature Isle' of the Caribbean. Dominica (754 km^2 in area) is situated in the Windward Islands, flanked by the French Departments of Martinique to the south and Guadeloupe to the north. The island's rugged, mountainous terrain reflects its volcanic origins. Dominica's landscape is largely forested and carved by numerous rivers and streams. The climate is tropical, with temperatures averaging about 27°C. Rainfall along the coasts averages about 180 cm, but in the mountainous interior rainfall may

exceed 1,000 cm annually. Rock falls and landslides, particularly in the more mountainous regions, are common during the rainy season. Dominica's location in the hurricane belt makes the island vulnerable to tropical storms and hurricanes during the June to November hurricane season.

Dominica boasts a wide range of flora and fauna. More than 1,000 species of flowering plants have been recorded on the island, including several endemic plant species (Govt. of Dominica 2002). Two island-endemic parrots, the Imperial parrot or 'Sisserou' (*Amazona imperialis*) and the red-necked parrot or 'Jacquot' (*Amazona arausiaca*), as well as 9 regional endemics are amongst the 175 avifauna species recorded on the island (Govt. of Dominica 2002). Other fauna found in Dominica include 18 mammalian species, 19 reptilian species, 4 amphibians, 11 freshwater shrimps, and 20 crabs, and a rich marine fauna (Govt. of Dominica 2002).

Politically, Dominica is a member of the Organisation of Eastern Caribbean States (OECS). The agriculture-based economy historically focused on bananas, but stricter standards and costs associated with the banana industry, coupled with a shift in government focus away from agriculture into areas such as tourism, have diminished the importance of the banana crop. Unfortunately, the development of the tourism industry remains slow, attributed to the Dominica's lack of sandy beaches, rugged coastline, and absence of an international airport. Still dependent on agriculture, the island remains highly vulnerable to climatic conditions and international market and economic developments. These factors have contributed to sluggish overall economic development in recent years.

Rosalie Bay

RoSTI's specific geographic focus is Rosalie Bay, an area that encompasses 4 distinct sandy beaches: Rosalie (Coffee), La Plaine (Bout Sable), and 2 much smaller pocket beaches, W'avine Cyrique and Secret Beach (Bord la mer). These black sand beaches are typical windward, high energy beaches located on Dominica's southeastern Atlantic coast (Figure 1). Four villages (Grand Fond, Riviere Cyrique, Morne Jaune, and La Plaine) surround Rosalie Bay. Each village is at least a 15 minute walk to the closest beach.

Rosalie Beach adjoins the Rosalie Estate, a former copra (coconut) plantation, and is the northernmost and one of the larger, more popular beaches in Rosalie Bay (Figure 2). The Rosalie River forms the northern border of the beach, and a high cliff face creates the southern boundary; two small streams cross the beach. The beach may be accessed by a footpath or vehicle.

Rosalie Beach, like other beaches along the east coast of the island, is dynamic and its profile changes rapidly. Cycles of sand deposition and erosion are primarily fueled by the rough Atlantics waves. The beach ranges from rocky or pebbly substrate to a sandy

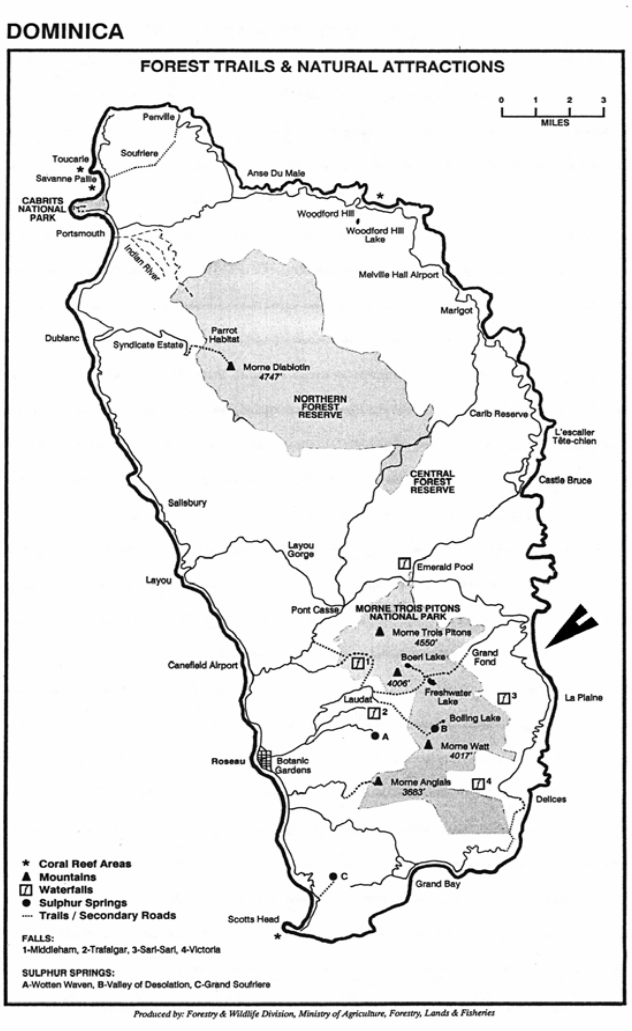


Figure 1. Rosalie Bay, denoted by the arrow, is located in southeastern Dominica

substrate of varying length, width, and depth. The south-central portion of the beach is typically the least susceptible to erosion of sand, whereas the northern and extreme southern stretches of the beach are frequently marked by exposed rocks. A coral reef located in Rosalie Bay protects the beaches from the powerful ocean swells and may provide important foraging habitat for resident sea turtle populations.

Figure 2. Rosalie Beach is a high energy, Atlantic-facing beach susceptible to dramatic changes in its profile. The photograph here was snapped facing northward from the central portions of the beach in mid-March and shows a wide sandy beach.

Both W'avine Cyrique and Secret Beach are small pocket beaches located near the village of Riviere Cyrique. W'avine Cyrique, which is directly south of Rosalie Beach, lies at the bottom of a cliff with a high waterfall. Secret Beach lies south of W'avine Cyrique; a small stream flows along the southern edge of the small beach. Tracks from Riviere Cyrique and Morne Jaune provide access to Secret Beach; W'avine Cyrique may be accessed via a single track and cliff.

La Plaine Beach is the southernmost and largest beach in Rosalie Bay. The profile is highly variable and can changing dramatically within a few days, with powerful waves eroding massive amounts of sand to expose a rocky substrate. The southern and northern reaches of the beach typically contain the greatest amounts of sand, while the central portion of the beach is usually narrow and highly susceptible to erosion, at times making the section impassable. Small streams cross both the southern and northern portions of the beach. Steep, vegetated hills and cliffs create an impressive backdrop for the La Plaine beach. The beach is accessible by vehicle at the southern end and via a footpath in the north.

Traditionally, the rivers and forests of the national landscape have been among the most important natural resources in Dominican culture. Historically, the coastal area of Rosalie has been very important to the people of the surrounding villages. Years before the present settlements of Grand Fond, Riviere Cyrique, Morne Jaune, and La Plaine, a single village existed in Rosalie. Most of the villagers still maintain a cultural link to Rosalie, as it remains a very popular area for picnics and activities on weekends and public holidays. During the summer months, the absence of school brings children and villagers to the beaches. Line fishermen also frequent the Southeast's beaches.

Northeastern Dominica

In 2006, RoSTI expanded its research and conservation to northeastern Dominica. Like the beaches of southeastern Dominica, Londonderry and the other beaches of the Northeast are high-energy, Atlantic-facing beaches. Londonderry (Cabana) Beach, the focal point for the region's monitoring efforts, lies adjacent to the Melville Hall airport. A river bisects the northern extent of this long, narrow beach, and the adjacent terrain is relatively flat. A primary road connecting the villages of Marigot and Wesley borders the southern stretch of beach and directs vehicle headlights along the beach. The beach is easily accessed by vehicle, and an access road runs along the length of the beach lying south of the river.

Numerous other beaches are located in the Northeast and are irregularly monitored by the project, including Hampstead, Woodford Hill, Walker's Rest, Big Bottom, and Hatten Garden. These beaches vary in length and adjacent topography varies from small pocket beaches bordering cliffs to large, flat stretches of sand several hundred

meters in length. Proximity to development similarly ranges from difficult to access, isolated beaches to beaches directly bordering roads and communities. Villages in the northeastern study area include Calibishie, Woodford Hill, Wesley, and Marigot. As in the Rosalie Bay region, the Northeast's beaches are popular sites for weekend and public holiday activities.

As a people very reliant upon and maintaining close ties to the land, Dominicans see harvesting their natural resources as their birthright. The fertile soil produces abundant crops, the rivers and streams crayfish, the forests manicout or opossum (*Didelphys marsupialis insularis*), agouti (*Dasyprocta leporinus*), and crapaud (*Leptodactyllus fallax*), and the sea fish and marine turtles. RoSTI is framed within this geographic, historical, and cultural context.

III. PROJECT OBJECTIVES

RoSTI was planned as a three-year pilot project; Phase I was completed in 2003 – 2005, and Phase II, which began in 2006, is ongoing. To guide project development, several general goals were established to address Research, Education, Conservation, and Community considerations. These objectives were outlined in previous reports (e.g., Franklin et al. 2004) and the 2007 research permit:

Research: To establish baseline information and lay the foundation for obtaining the necessary scientific information for national management and conservation efforts. These data will focus on the distribution, abundance, seasonality, and species of sea turtles nesting in the southeast region and major threats to their survival. This information will support development of a 'Sea Turtle Recovery Action Plan for Dominica' and the designation of the Rosalie Bay Nature Reserve.

Education: To inform adults and children of the complex biology of sea turtles, their role in local ecosystems, and the importance of managing threats to their survival with an aim to ensure stable populations and sustainable use options for the future.

Conservation: To identify current threats and make recommendations to local community organizations and to Government regarding mitigating options and alternatives. In addition, the project will emphasize the involvement of local hoteliers in designing and implementing "turtle friendly" beach management protocols, such as finding alternatives to artificial lights that shine directly on nesting beaches.

Community: To raise awareness of the biology and status of depleted sea turtle populations, as well as to facilitate the involvement of Dominicans in the design and implementation of locally run "Turtle Watching" ventures. The project will work with community leaders to recruit residents, including current poachers, to contribute information to the project, to patrol nesting beaches, to safeguard nests, and to conduct outreach (e.g. media, schools, public events).

To fulfill these goals, RoSTI was charged with the following tasks during Year 5 (March – August 2007):

Research

- Monitor the sea turtle population nesting at Rosalie Bay and expand field monitoring methods to Londonderry Beach.
- Evaluate the relative importance of monitored beaches to sea turtle species.
- Design and implement a regular schedule of beach patrols for the purpose of estimating the abundance, distribution, and seasonality of nesting activity.
- Design and implement a nest monitoring program sufficient to estimate annual reproductive success.
- Maintain a national *Sea Turtle Hotline* for residents to report sea turtle sightings.

Education

- Visit at least one school each month of the school term, at their request and convenience.
- Participate in at least two media-covered events to promote the project and involvement by the community; and give at least 6 print and/or radio interviews on the project, the sea turtles of Dominica, and current conservation issues, typically executed with Government partners.

- Print and distribute, locally and nationally, at least two public education items, such as a teacher's activity guide, slide show, brochure, poster, and / or leaflet.
- Establish objectives and materials needed for a school-based education program.
- Regularly distribute an informative "RoSTI Bulletin" to interested national and international stakeholders.

Conservation

- Identify major causes of nest mortality.
- Document and report incidents of adult mortality (e.g., poaching, stranding resulting from incidental capture and drowning offshore).
- Collaborate with law enforcement agencies to develop strategies to effectively address illegal activities.

Community

- Provide technical training (in Trinidad) to at least two local persons (nominated by DomSeTCO), along with the RoSTI project manager, on the biology and conservation of leatherback sea turtles. Training will also address integration of sea turtle field research with ecotourism, focusing on the nation's primary nesting beaches (initially Rosalie Bay and Londonderry) for the purpose of providing livelihood and income to rural communities.
- Encourage community support for conservation efforts by sharing information about the biology and status of sea turtles in Dominica, involving communities in research and profit-making ventures, and giving hiring preferences to members of the local communities.
- Sponsor local community groups and functions, and participate in public events to promote conservation objectives.
- Develop recommendations to stakeholders, including Government and communities, based on field research, literature, and other resources, concerning management and conservation of sea turtles and the organization, implementtation, and sustainability of community-based ecotourism on Dominica's sea turtle nesting beaches.

IV. METHODS

Patrols

Regular foot patrolling, a well-established research technique, is useful to assess nesting activity of individual beaches (Schroeder and Murphy 1999) and formed the foundation of RoSTI research in 2007. Nightly foot patrols permit the tagging of nesting females for long-term identification and the collection of basic biological data (e.g., eggs per clutch and size metrics). Additionally, foot patrols may function as a deterrent to poaching activities. Because the nesting process typically lasts about 1.5 hours, beaches were patrolled at least every hour in an effort to ensure that each nesting female was observed at some stage of the nesting process. Patrols generally lasted from 8PM to 5AM; although sea turtles occasionally nest during daylight hours, nesting activities are concentrated during the night.

From 15 March to 1 April, staff patrolled the principal study beaches [Rosalie (Coffee), La Plaine (Bout Sable), and Londonderry (Cabana)] approximately 4 nights per week. During the primary leatherback nesting season (1 April – 1 July), these beaches were patrolled nightly. Due to resource constraints and the concentration of nesting activities in the Southeast, nightly foot patrols continued only at Rosalie and La Plaine beaches after 1 July; Londonderry Beach was patrolled irregularly after 1 July. Patrol intensity at the Southeast's beaches diminished according to declines in nesting activity. La Plaine was patrolled nightly until 15 July, about 5 nights per week until 31 July, and irregularly thereafter. Rosalie was patrolled nightly until 15 July, and for 5 nights per week until mid-August. In the Southeast, morning patrols were used to gather nesting activity data on those days when beaches were not patrolled the previous evening. Following the passage of Hurricane Dean on 17 August and the corresponding loss of much of the Southeast's sands, all patrols were shifted to early mornings at Rosalie Beach.

Additionally, less frequent evening patrols and morning crawl counts were conducted at Secret Beach and W'avine Cyrique in Riviere Cyrique, Castle Bruce, Hatten Garden, Walker's Rest, Big Bottom, the Woodford Hill beaches, and Hampstead.

Nesting Activity Categorization

RoSTI monitors the 3 species of internationally endangered marine turtles – the leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and green (*Chelonia mydas*) turtles – known to currently nest in Dominica. When the turtle was not directly observed, species identity was determined by crawl width, crawl symmetry (or asymmetry), and other distinguishing features such as the characteristically deep body pit of the green turtle (see Pritchard and Mortimer 1999).

Activities were also classified according to the result of the nesting attempt. A "false crawl" was defined as an unsuccessful nesting attempt (i.e. a nesting attempt in which eggs were not deposited). A "suspected nest" was defined as an attempt that likely resulted in a nest, but eggs were not visually confirmed. An activity was defined as a "nest" only when eggs were visually confirmed.

Tagging and Morphology

Individual turtles were thoroughly examined for identification tags. Tagging methods adhered to protocols outlined in Eckert and Beggs (2006). Flipper tags (Monel size 49 or Inconel size 681 from the WIDECAST Marine Turtle Tagging Centre) were typically applied to females during the egg-laying stage to ensure proper tag application. Tags were applied to leatherbacks in the loose skin located between the tail and rear flippers; tags were applied to hard-shelled turtles in the most proximal flipper pad.

Staff obtained size measurements including curved carapace length notch to tip (CCLn-t), defined as the distance from the nuchal notch along the midline to the most posterior tip of the carapace, and the curved carapace width (CCW), defined as the maximum carapace width (Bolten 1999) (Figure 3). Any injuries, deformities, or other distinguishing characteristics (e.g., barnacles) were noted as well.

All information was recorded on RoSTI 2007 data sheets (Appendix 1), amended from the 2003 - 2006 template to simplify and increase the accuracy of data recording.

Figure 3. RoSTI staff members Dexter George and Seth Stapleton measure the curved carapace width of a nesting leatherback while patroller Frances Lawrence collects eggs and visitors observe.

Nest Relocation

Egg poaching and beach erosion compel the RoSTI project to relocate nests every year. Relocation methods followed international best practices (Boulon 1999). Eggs were collected, counted, and carefully transferred in plastic bags to the hatchery at Rosalie Beach or to a less susceptible location on the beach in which they were deposited. Nest dimensions of the relocation chamber were to reflect original chamber dimensions.

Hatchlings typically emerge following an incubation of 55 – 72 days; hatchery nests were thus closely monitored during this emergence window. When possible, nest contents were exhumed and nest contents categorized to estimate hatchling release success rate and identify potential causes of nest failure such as predation, entrapment by roots, erosion, and over-wash. Unhatched eggs were opened to determine stage of development when mortality occurred, and hatched egg shells were counted. Eggs were categorized according to categories detailed on the RoSTI 'hatching' data sheet (Appendix 2).

Education and National Sea Turtle Hotline

RoSTI operated 2 national *Sea Turtle Hotlines* (767 225-7742 and 767 616-8684) in 2007. Concerned citizens used the hotlines to notify project staff of nesting activities on the island. Although maintaining multiple phone numbers was a logistical nuisance, the 2 hotlines allowed citizens using either of the 2 primary service providers (i.e., Digicel and Cable & Wireless) to call within network at lower rates – and most likely increased the probability of hotline calls.

RoSTI staff employed a variety of educational strategies to meet the education and outreach objectives, including traditional classroom talks, print and radio media outlets, and distribution of educational materials and regular 'RoSTI Information Bulletins'. More creative outlets such as 'Sea Turtle Summer Camp' and community meetings and reports were also helpful in disseminating information regarding sea turtle ecology and conservation.

Data Analyses

Data were summarized to assess annual cohort size, seasonal and geographic distributions of nesting activities, fecundity (e.g., number of clutches per individual and clutch size), remigrations, international tag returns, nest site fidelity, and individual size. Results are presented graphically with appropriate summary statistics.

V. RESULTS

Nesting: Annual Trends

RoSTI documented an increase in total nesting activity during the 2007 field season in comparison to 2003 – 2006 (Figure 4). The 322 total confirmed nests recorded in 2007 represent a more than 6-fold increase over the number of confirmed nests recorded in 2006, the nesting season in which the most nests were previously recorded. This surge in overall nesting activity was completely driven by a surge in leatherback nesting activity, specifically.

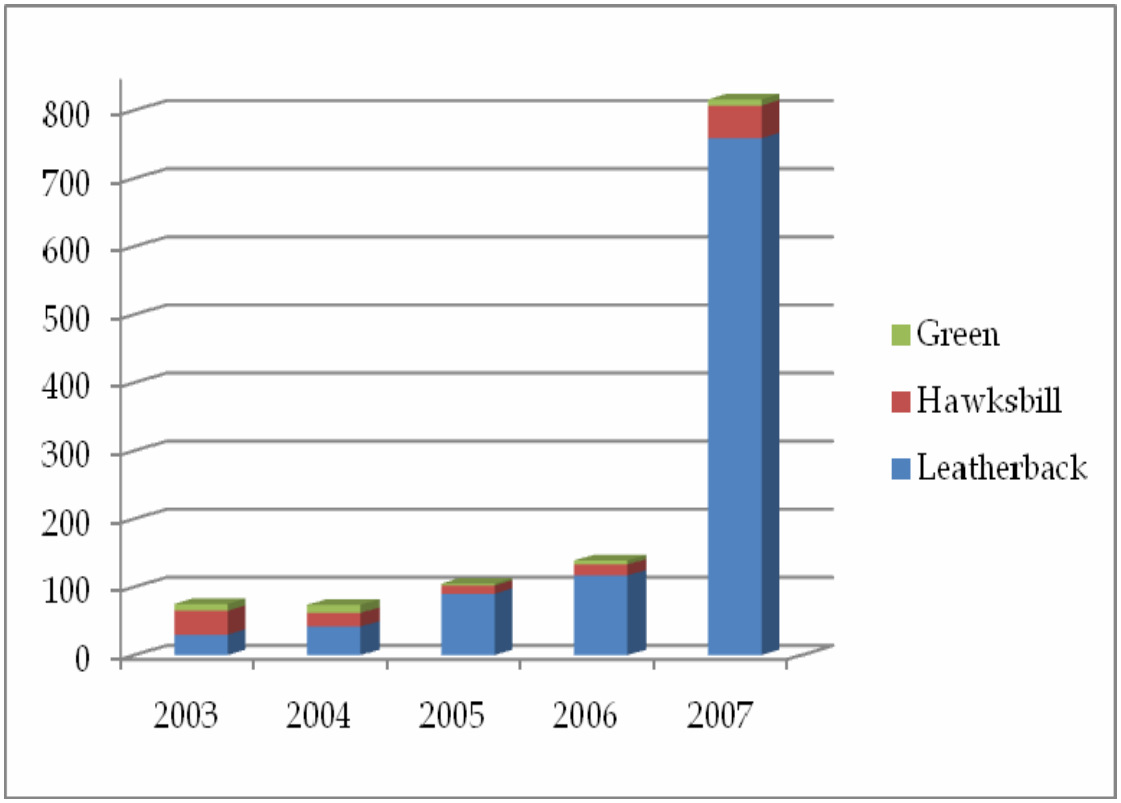


Figure 4. Total sea turtle nesting activities recorded during 2003 – 2007 in the Commonwealth of Dominica, W.I. (earlier data from Franklin et al. 2004, Byrne and Eckert 2006, Byrne 2006).

We note that regular monitoring of Londonderry Beach only began in 2006 (Byrne 2006) and that nesting activities at other locations have been sporadically reported over the past several years. However, an examination of nesting activities only at Rosalie Bay during 2003 – 2007 reveals the same trend (Figure 5); nesting activity was phenomenally higher in 2007 than in previous seasons as a result of heightened leatherback nesting.

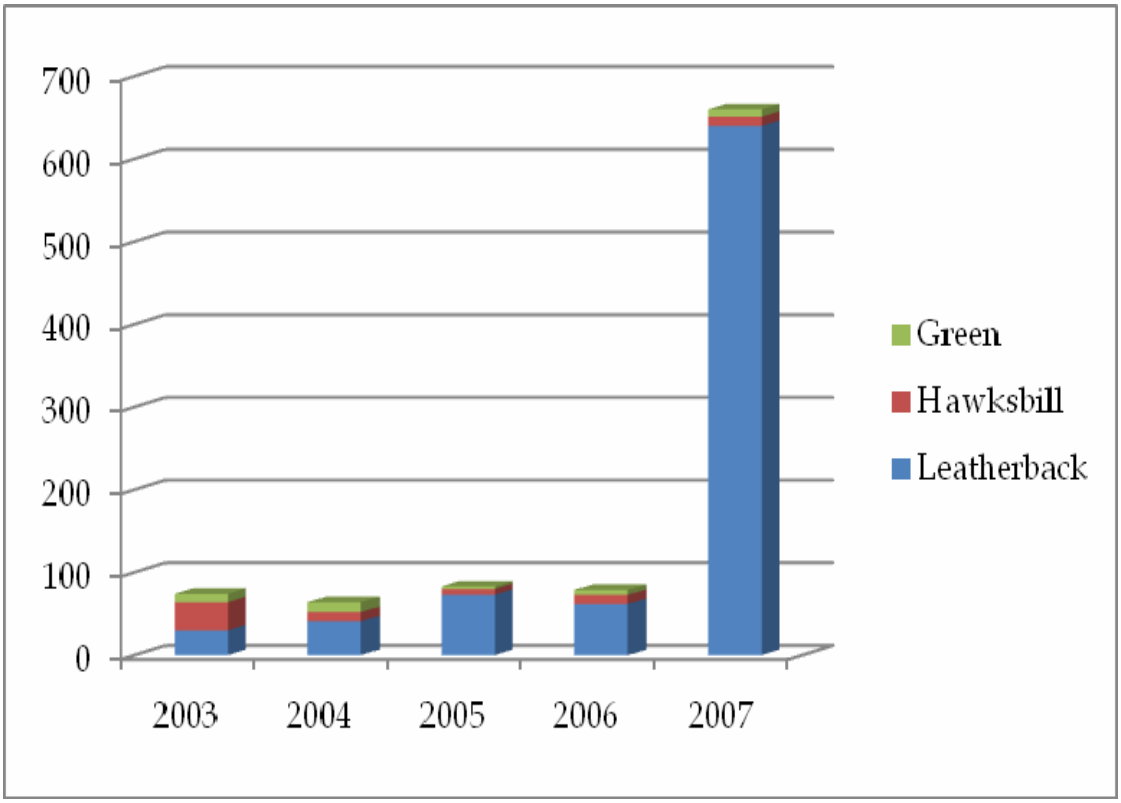


Figure 5. Total sea turtle nesting activities recorded during 2003 – 2007 at Rosalie Bay in the Commonwealth of Dominica, W.I. (earlier data from Franklin et al. 2004, Byrne and Eckert 2006, Byrne 2006).

Nesting: Geographic Distribution

The Rosalie Sea Turtle Initiative recorded 690 leatherback nesting attempts and 109 individual leatherbacks on the principal study beaches of Rosalie, Londonderry, and La Plaine, as well as 69 total activities on other beaches (Figure 6). A total of 278 confirmed nests and 24 suspected nests were recorded on the primary beaches, and the vast majority of this leatherback nesting activity occurred in the Southeast. More than 95% of nests confirmed on the primary study beaches occurred in the Southeast (i.e., Rosalie and La Plaine). Conversely, during 2006, nesting activities were much more evenly distributed among Rosalie, La Plaine, and Londonderry (Figure 7).

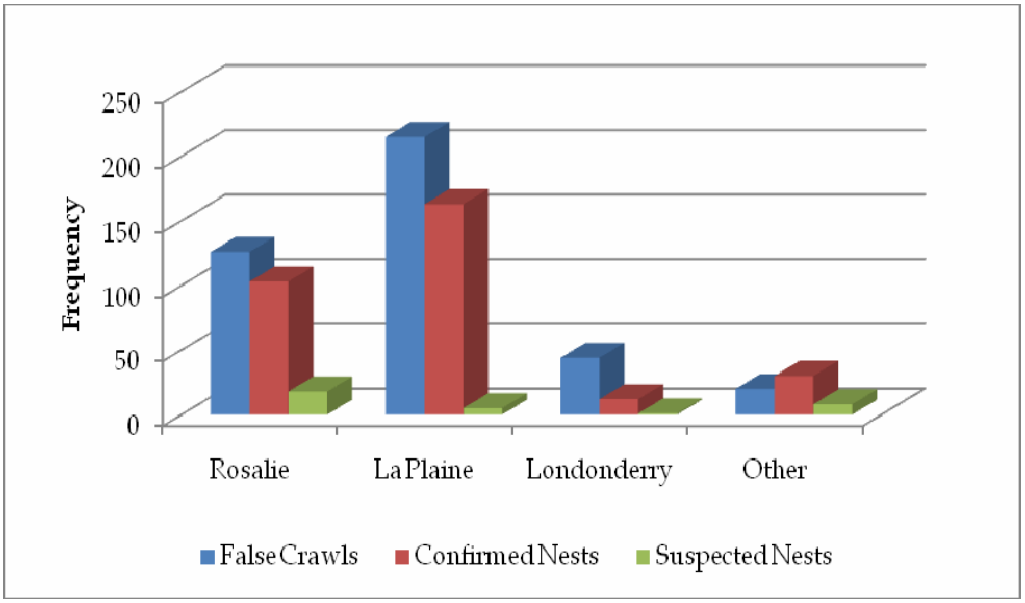


Figure 6. Leatherback nesting attempts by location documented during March – September, 2007 in the Commonwealth of Dominica, W.I. Data exclude poaching events in which nesting activity results were incomplete or unknown.

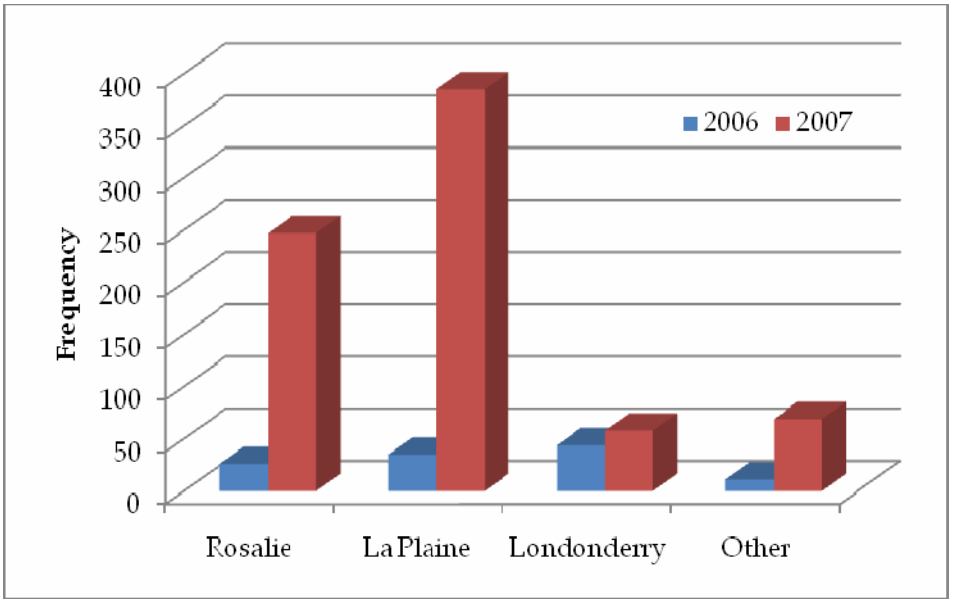


Figure 7. Total leatherback nesting activities by location documented during the 2006 (cf. Byrne 2006) and 2007 field seasons in the Commonwealth of Dominica, W.I. Londonderry data include three activities recorded at adjacent Melville Hall Beach in 2006.

Green and hawksbill turtle nesting was occasionally recorded on the primary study beaches (Tables 1 and 2). RoSTI also noted evidence and received numerous reports of hawksbill nesting activity on various West Coast beaches, as well as Castle Bruce.

Table 1. Green turtle nesting activities by location documented during March – September, 2007 in the Commonwealth of Dominica, W.I.

	False Crawls	Nests	Suspected Nests	Total Activities
Rosalie	2	1	4	7
Bout Sable	0	1	0	1
Other Beaches	1	0	0	1
Total Activities	3	2	4	9

Table 2. Hawksbill nesting activities by location documented during March – September, 2007 in the Commonwealth of Dominica, W.I. Data exclude 5 suspected poaching events.

	False Crawls	Nests	Suspected Nests	Total Activities
Rosalie	5	2	2	9
Bout Sable	2	0	0	2
Londonderry	1	2	0	3
Other Beaches	11	8	10	29
Total Activities	19	12	12	43

Nesting: Seasonal Patterns

Leatherbacks exhibited a well-defined nesting season during 2007, peaking from mid-May to early June (Figure 8). The first nesting attempt of the season was recorded on 13 March, although anecdotal reports suggest some leatherback nesting activity several weeks prior. The 16 – 31 May was the most active single block, with 91 confirmed nests and 239 total activities recorded. We did not detect any temporal differences in geographic distribution of leatherback nesting attempts during the 2007 reproductive period (Figure 9).

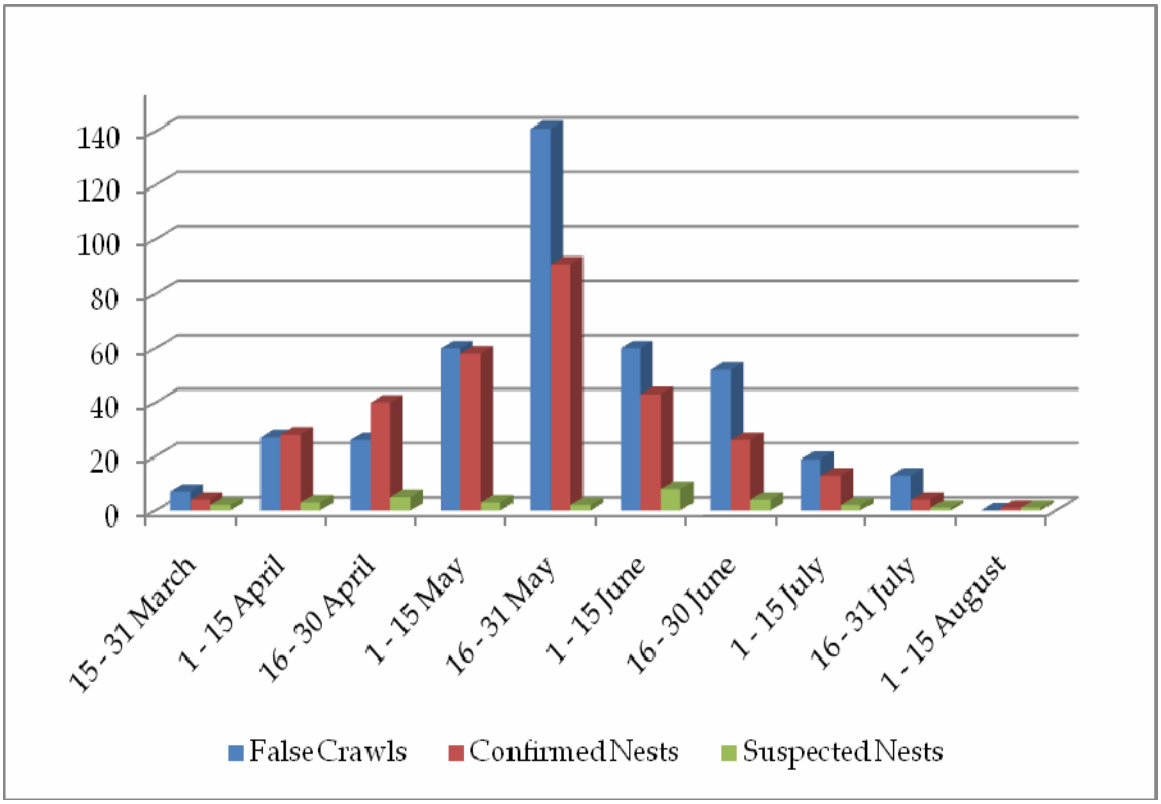


Figure 8. Leatherback nesting attempts by season recorded during March – September, 2007 in the Commonwealth of Dominica, W.I. One suspected nest was noted prior to 15 March. Data exclude poaching events in which nesting activity results were incomplete or unknown.

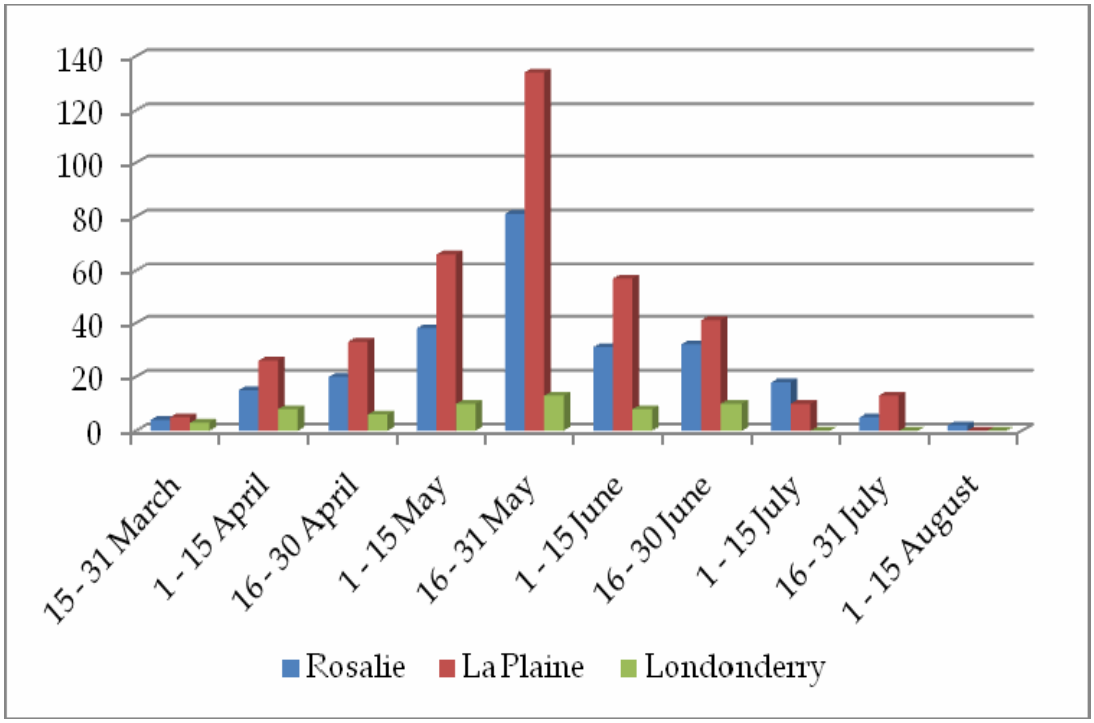


Figure 9. Total leatherback nesting activities by location and season recorded during March – September, 2007 in the Commonwealth of Dominica, W.I. One suspected nest was noted prior to 15 March.

Hawksbill and green turtle nesting occurred at low densities throughout the season (Figure 10). All green turtle nesting activities were recorded in the Southeast. We note that hawksbill nesting attempts apparently increased during June – August; however, this trend is at least partially an artifact of increased West Coast patrols and greater reporting of nesting attempts by West Coast community members, as suggested by the primary beaches seasonal trends.

Fecundity

We confirmed 322 nests, including 308 leatherback nests, during the 2007 nesting season. One-hundred three of 109 documented (tagged) leatherbacks were confirmed to have deposited at least 1 nest. Leatherbacks were seen an average of 3.3 times (SD: 2.5; range: 1 to 15) and laid an average of 2.6 confirmed, observed nests (SD: 1.8; range: 0 to 7) (Figure 11). Additionally, identity was confirmed for 2 of the 14 leatherbacks that were illegally slaughtered this season (See *Poaching*). No individual hawksbill or green turtle was identified on more than one occasion.

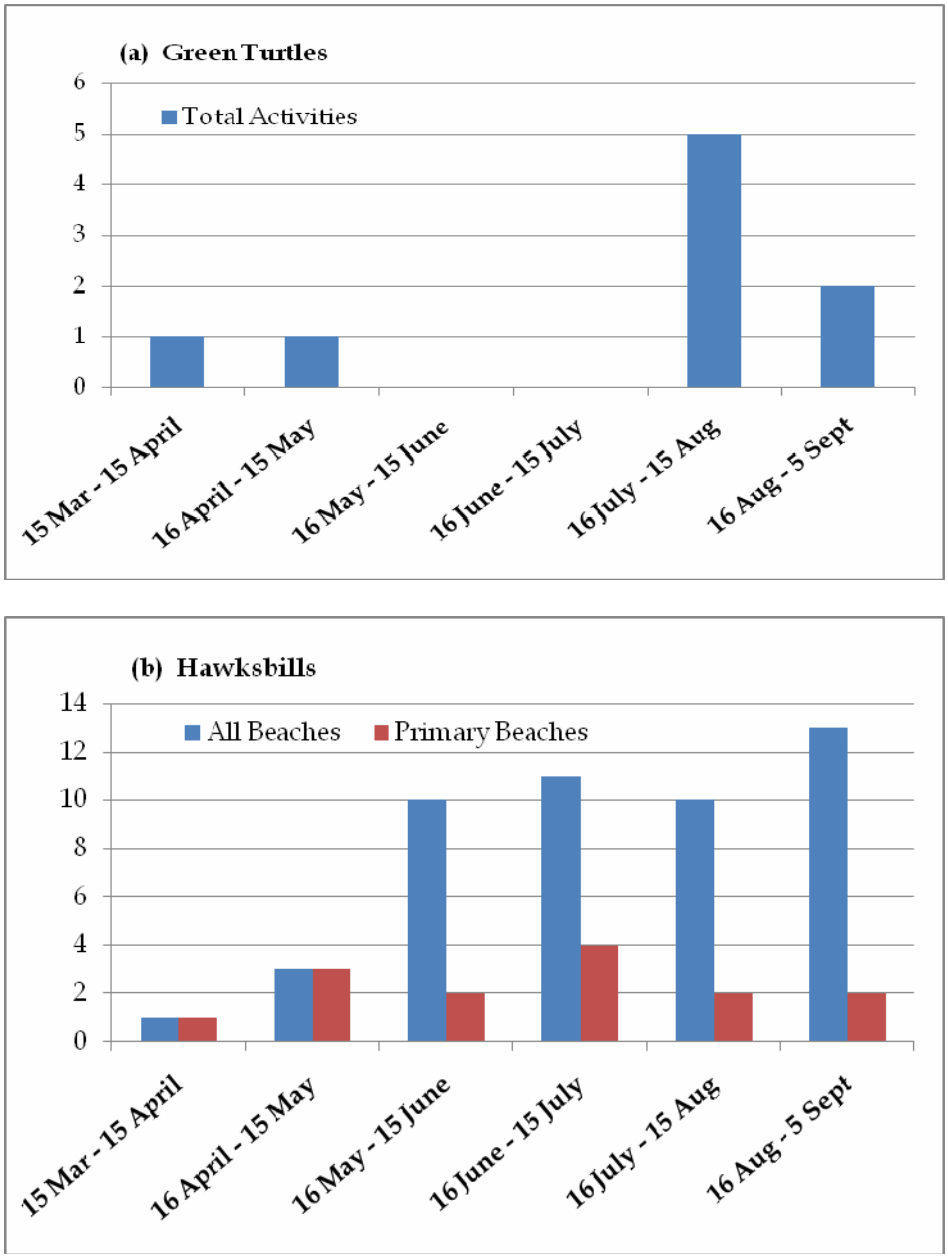


Figure 10. (a) Green and (b) hawksbill turtle nesting activities by season recorded during March – September, 2007 in the Commonwealth of Dominica, W.I. Data include two hawksbill nests discovered upon hatching for which egg deposition dates were approximated.

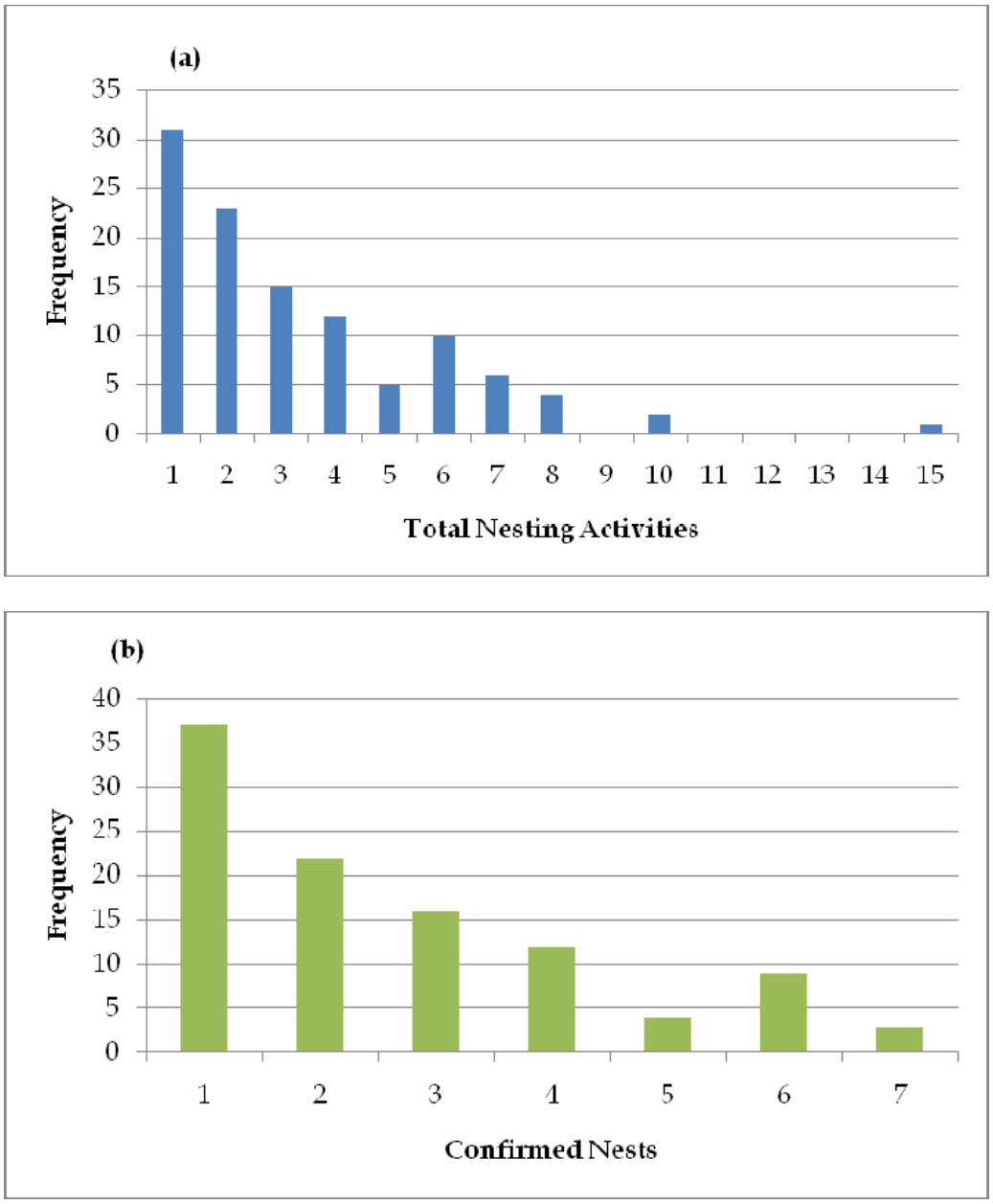


Figure 11. Total number of (a) nesting activities and (b) confirmed nests per individual leatherback recorded during March – September, 2007 in the Commonwealth of Dominica, W.I.

Mean clutch size was calculated for leatherback nests for which an egg count was obtained: 247 nests averaged 79.1 yolked eggs (SD: 21.6; range: 0 to 132) and 108.1 total eggs (SD: 24.7; range: 5 to 168) (Figure 12). Four hawksbill nests averaged 146.5 (SD: 33.9) yolked eggs and 1 unyolked egg (SD: 2), while two green turtle nests contained 111 and 116 eggs.

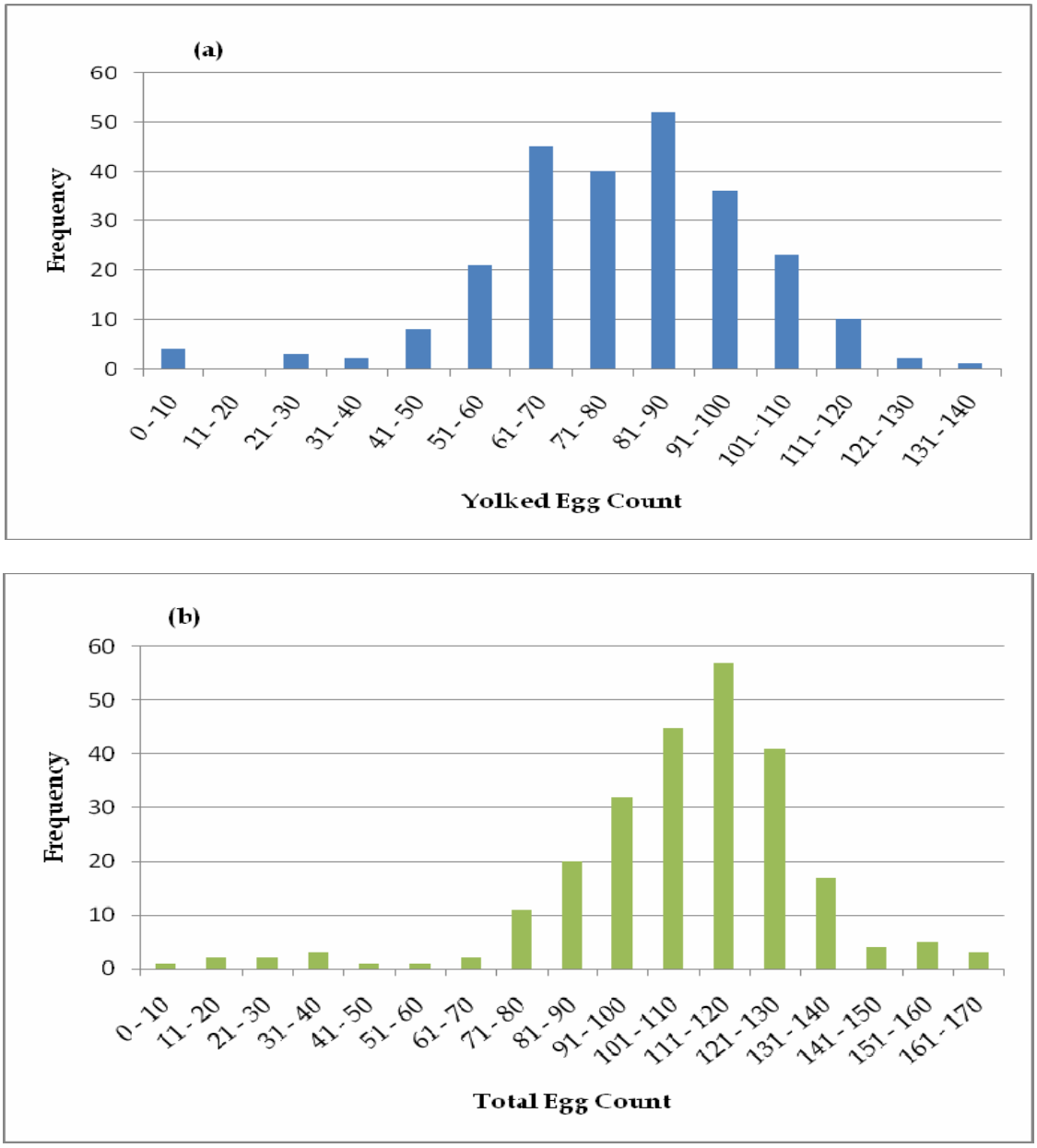


Figure 12. Clutch size of leatherback nests including (a) yolked eggs only and (b) all eggs recorded during March – September, 2007 in the Commonwealth of Dominica, W.I.

We completed 35 nest excavations during the 2007 field season to estimate hatch success. Hatch success, defined as number of hatchlings successfully released from the nest divided by the number of yolked eggs, averaged 26% (SD: 28; range: 0 to 90%). Numerous additional hatchings were documented during the season, but logistical con-

straints and difficulties in relocating some nests obscured by vegetation did not permit additional excavations.

Remigrants, International Tag Returns, and Beach Fidelity

Of the 109 individual leatherbacks recorded in Dominica in 2007, at least five can be classified as remigrants; that is, as individuals tagged by RoSTI staff in a previous year. One of the two green turtles identified in 2007 was also a remigrant; this individual was initially tagged in 2005.

RoSTI documented turtles from across the Caribbean crawling upon Dominica's beaches and, conversely, turtles initially tagged in Dominica were documented on other islands. At least five turtles originally tagged in Trinidad, Grenada, St. Lucia, or Puerto Rico were documented in Dominica this season. Additionally, at least eight turtles were recorded moving among nesting beaches in Guadeloupe, Martinique, and Dominica. One such turtle was first marked on the northeast coast of Trinidad in 2004 and returned to the Caribbean in 2007 to nest in Martinique and later Dominica.

As demonstrated by the international tag returns, some leatherbacks do not exhibit high fidelity to a particular beach or country. Similarly, some leatherbacks were observed moving between beaches across the island, from La Plaine in the Southeast to Mero on the West Coast. We recorded 57% of individual leatherbacks on more than one occasion moving between the 'human-defined' beaches during the 2007 nesting season.

Poaching

Unfortunately, heightened poaching threats accompanied the greater levels of nesting activities in 2007. At least 14 leatherbacks were illegally slaughtered at beaches around Dominica: two turtles were killed at La Plaine (Bout Sable), three at Secret Beach in Riviere Cyrique, one at Castle Bruce, one at Londonderry, five at Big Bottom in the Northeast, and two in the Woodford Hill area. Reports additionally suggest that at least one leatherback was slaughtered at La Plaine prior to the commencement of the 2007 field season. Suspected poachings were documented by RoSTI staff and reported by concerned community members around Dominica. Eggs, too, were illegally harvested around the island, with poachers frequently using shovels to excavate an entire site in search of the eggs.

Size of Nesting Females

We first computed mean individual size for those individuals in which multiple measurements were obtained. Extreme outliers were considered to be measurement or recording errors, and were excluded from calculations. We obtained and included measurements from 98 individuals to calculate mean leatherback size (Figure 13). We computed mean leatherback CCLn-t as 150.2 cm (SD: 6.7) and mean leatherback CCW as 111.7 cm (SD: 6.1).

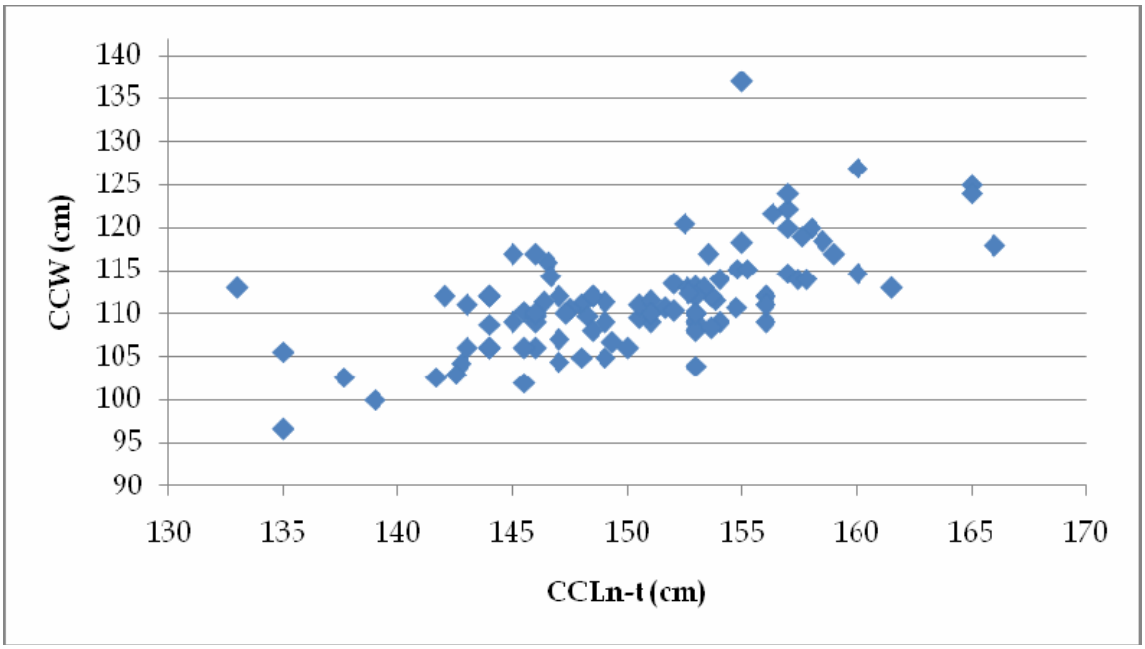


Figure 13. Curved carapace length versus curved carapace width of individual leatherbacks recorded during March – September, 2007 in the Commonwealth of Dominica, W.I.

Hawksbill (n= 4) CCLn-t averaged 90.3 cm (SD: 7.6) and CCW averaged 75.3 cm (SD: 0.6). As with clutch size, small sample sizes of green (n=2) precluded calculation of meaningful summary statistics. Green turtle CCLn-t varied from 103 to 108 cm and CCW from 85 to 95 cm.

Outreach and Education

Project staff and partners utilized a variety of strategies during the 2007 season to educate local communities and the general public about sea turtle ecology and marine conservation. RoSTI conducted numerous presentations across the island for school, community, university, and volunteer groups including Scott's Head Soufriere Marine Reserve Day; met regularly with conservation organizations, village councils, and Government officers (particularly in the Southeast); participated in community meetings and programmes; and educated the public during informal 'Turtle Watches.' The project continued to make use of Dominica's radio, print, and television media outlets to disseminate pertinent information. RoSTI worked to forge relationships with organizations such as the Dominica State College Environmental Club and maintained private sector partnerships. The project established an educational collection (i.e., preserved eggs, embryos, and hatchlings) and, as in previous years, hired local staff to conduct beach patrols and complete other tasks as necessary.

RoSTI also pursued new avenues for information-sharing and fostering positive community relationships. In partnership with the Southeast's Youth Development Division, RoSTI presented 'A Day at the Beach,' allowing children to participate in summer camp-style sea turtle games and activities to reinforce classroom lessons (Figure 14). RoSTI enlisted the services of a Morne Jaune artist to create a mural at the Jones-Beaupierre Primary School in La Plaine to provide a reminder of the importance of marine conservation (Figure 15). Additionally, the project was pleased to provide assistance to conservation organizations in Riviere Cyrique, La Plaine, and the Northeast to help facilitate national registration and to the Riviere Cyrique Preschool.

RoSTI was proud to continue to sponsor the Riviere Cyrique rounders team and the La Plaine cricket team (Figure 16). Additional game sponsorships were provided to the Southeast Rounders All-Star team as they traveled to Antigua for an inter-island tournament, to the Grand Fond village council for a village-wide cricket 'knock-out' tournament, and to the Riviere Cyrique / Morne Jaune village council for a local Dominoes tournament.

(a) (b)

(c) (d)

Figure 14. Children (a) queue, (b) swim, (c) crawl, and (d) dig as part of a relay race to learn more about the sea turtle nesting process during 'A Day at the Beach' summer camp activities.

Figure 15. A new marine conservation mural decorates a wall outside the Jones-Beaupierre Primary School in La Plaine.

Figure 16. Teams participate in the Southeast Rounders Bowl-A-Rama in August in Delices. Riviere Cyrique's RoSTI *Turtle Doves* had another strong showing in the 2007 Rounders season.

WIDECAST-donated sea turtle books and educational materials were distributed to all primary schools in the Southeast, as well as to organizations including the Southeast's Youth Development Division and conservation groups in the Southeast and Northeast. T-shirts and bumper stickers bearing the national *Sea Turtle Hotline* number remained popular items island-wide, and 'Turtle Watching' guidelines were also distributed.

VI. DISCUSSION AND RECOMMENDATIONS

Nesting

The 2007 research season documented a surge in nesting activity in comparison to the previous four years of RoSTI research. This surge, entirely a product of heightened leatherback nesting activities, was not unique to Dominica. The entire Caribbean region witnessed elevated nesting in 2007 (D. Sammy, Nature Seekers, unpublished data; K. Eckert, WIDECAST, personal observation). Like all animals, sea turtle fitness is dependent upon resource availability. A boom in populations of jellyfish, the primary leatherback food source, occurred two years ago in the leatherback's highseas Atlantic feeding grounds and is believed by many experts to have played a role in the increase in nesting activity region-wide (S. Eckert, WIDECAST, personal communication). Nesting surges should not be expected to recur on an annual basis.

Despite the explosion of leatherback activities in Dominica in 2007, Londonderry Beach in the Northeast did not witness the same trend. Dominica's nesting was highly concentrated on the southeastern beaches of La Plaine and Rosalie. The relative absence of nesting on Londonderry Beach in 2007 is likely a result of sedimentation in adjoining waters caused by airport construction and runway expansion (Figure 14). This sedimentation, coupled with intense artificial lights occasionally used by nighttime construction crews, appears to have created an environment largely unsuitable for leatherback nesting. Possible nearshore navigation methods such as auditory, olfactory, and/or visual cues (Gulko and Eckert 2003) may have been impaired by the sediment, and artificial lights act as a strong deterrent to nesting activities (Witherington and Martin 2000). Completion of the airport renovations will remove sedimentation and artificial lights and may encourage the return of leatherback nesting on Londonderry.

Figure 17. Sedimentation of the waters around Londonderry Bay was created by construction at the Melville Hall airport near Marigot.

The May peak of leatherback nesting activities documented during 2007 reinforces the seasonal nesting trends documented in previous years of the project (e.g., Franklin et al. 2004). Additional reports of leatherback nesting activities included areas suspected to be leatherback nesting beaches in the East (e.g., Castle Bruce) and Northeast (e.g., Woodford Hill and Hampstead).

RoSTI received numerous reports of hawksbill nesting activities from the West Coast during 2007, particularly along the beaches of Macoucherie, Salisbury, and Batalie. Unfortunately, poaching of both adults and eggs continues to present a significant problem to Dominica's hawksbill nesting population. Concerned proprietors and community members have expressed an interest in starting a sea turtle conservation project in an effort to better monitor West Coast nesting activities and reduce the threat of poaching. RoSTI and its partners, including the Forestry, Wildlife and Parks Division and the Fisheries Division, must provide full technical guidance to support a fledgling West Coast. Collaborations with the Dominica State College Environmental Club and the Dominica Youth Environmental Organization to assist with West Coast monitoring efforts were explored in 2007 and should be revisited in the coming year.

Tag returns

Flipper identification tags applied by research and conservation projects throughout the Caribbean provide valuable data regarding the life histories and regional movements of marine turtles. The 2007 nesting season, with numerous international tag returns, Dominican remigrants, and inter-nesting movements, serves as an excellent example of the movement data that may be gained through tagging programmes and its direct application to conservation initiatives. These 2007 tagging data reinforce the well-documented concept that leatherbacks do not exhibit the same strong degree of nest site fidelity as do other sea turtle species (Eckert 1987, Bräutigam and Eckert 2006). Rather, the island of Dominica, or perhaps a larger geographic region, functions as the 'nesting beach' for leatherbacks. Continued information collection (including beach patrols and tagging) and sharing should help correct popular misconceptions that create opposition to common conservation practices, such as egg relocation among adjacent beaches.

Hatch Success

Hatch success for leatherback sea turtles averages about 65% (S. Eckert, personal communication), though egg relocation generally results in a decrease in success (Boulon 1999). For this reason, eggs should only be moved if the nest is considered to be at risk for a total loss (from erosion, poaching, predators). The 2007 field season marked the first attempt to quantify hatch success and identify sources of nest failure in Dominica. With a relatively small sample size (n=35), we documented a hatch success rate of about 26%, lower than the anticipated hatch success rate. Although multiple factors may have contributed, we believe that this lower than average success rate is largely a product of inadequate reburial techniques; in particular, inadequate nest depth. Dimensions of the relocated egg chamber should adhere to the original nest dimensions, typically about 70 cm in depth for leatherbacks. However, upon excavation, it became apparent that some nests were not buried at depths sufficient to permit full development and hatching. Future training must reemphasize the critical importance of proper relocation protocols to maximize hatch success.

The passage of Hurricane Dean in mid-August reshaped beaches around Dominica, significantly altering beach profiles. In the Southeast, all sand was lost from Bout Sable and Rosalie Beach experienced massive sand loss and wash-over. Although many nests

from the 2007 season hatched prior to this point, all nests which remained in the hatchery at Rosalie as well as those nests left in situ or relocated on La Plaine Beach – an estimated total of 55 – 70 nests – were likely lost to the storm.

Improving the Science

RoSTI, in partnership with Government partners and local communities, has collected valuable data addressing the nesting ecology of Dominica's sea turtles for the past 5 years. As a successful and growing research and conservation programme, the project should continually strive to improve data collection practices and answer new scientific questions.

As suggested in previous annual reports (e.g., Byrne and Eckert 2006), quantification of the beach profile would be useful to sea turtle conservation efforts. Weekly photographs, measurements of beach width at set locations, and substrate categorization will provide a better understanding of beach dynamics. More rigorous collection of nest site data via division of the beach into permanent sectors, measurement of distances to high tide line, vegetation, and permanent landmarks, and collection of GPS coordinates will better quantify nesting sites. Greater comprehension of beach dynamics and nest site selection will enable better management decisions regarding nest relocation.

Additionally, investment in PIT tags (i.e., computer microchips) would provide a more permanent marker than flipper tags, thereby reducing instances of tag loss and subsequent misidentification. Finally, nest monitoring research should require that a 'nest tag' including the nest deposition date and the turtle's identification tag numbers be placed (typically encased in a plastic bag) in all nests. Although project management hoped to implement many of the above protocols in 2007, these ideas were not fully put into practice. With the exception of PIT tags, for which funds are unlikely to be available, these methods should be incorporated in the 2008 research season.

Several alterations were made during 2007 to RoSTI data sheets to simplify and improve accuracy of data collection. Project management should make additional changes as necessary to facilitate collection of the best possible data. Recommended modifications include the addition of slots for nest relocation information (i.e., date of relocation, original and relocated nest depth, relocation beach and landmarks) for the

nesting form (Appendix 1) and reducing 'egg outcome' and date categories on the hatchery form (Appendix 2).

Poaching

Sea turtles engaged in nesting activities and their eggs are protected against harvest and disturbance in the Commonwealth of Dominica under the Forestry and Wildlife Act (Chapter 60:02, Act 12); however, anecdotal evidence suggests that poaching was widespread prior to the establishment of the RoSTI project in 2003. Public awareness campaigns initiated by RoSTI and project partners targeted the general public and specific communities; poaching subsequently declined.

Although illegal slaughter of adults and harvest of eggs likely remained lower in 2007 than the pre-RoSTI era, poaching continues to present a significant conservation problem. The 14 leatherbacks poached this season represent more than 12% of the entire nesting population documented in 2007. Poachers appeared to target beaches known to lack regular patrols, as only three slaughters occurred on routinely monitored beaches. Additional, unconfirmed poaching was reported in irregularly monitored portions of the island such as the West Coast and Castle Bruce regions.

Given that only an estimated 1 in 1,000 eggs survives the two to three decades required for sea turtles to reach sexual maturity (Frazer 1986), *each adult female is vital* to Dominica's small nesting colonies, as well as to regionally depleted sea turtle populations. Continued public awareness, expansion of monitoring efforts, increased law enforcement efforts, and establishing economic incentives via community-based 'Turtle Watching' ventures will be critical to combating poaching.

Community Considerations

Community emotions flared against sea turtle conservation efforts during the 2007 season. Resistance was rooted in segments of the La Plaine community, but frustrations spilled over to the entire nation as dissenting voices reached the national media. Multiple factors undoubtedly contributed, including increased nesting, pervasive misinformation regarding sea turtle ecology, engrained cultural traditions, and the economic troubles currently gripping the country. Moreover, discussions with various

community members made it clear that RoSTI was perceived by some as an entity that had historically operated independently of the surrounding communities.

Multiple strategies will be required to remedy this situation and ensure the sustainability of sea turtle conservation programmes in Dominica. The project should continue to focus on the development of sustainable 'Turtle Watching' ecotourism ventures, and should reconsider its role in community-level beach patrolling and data collection. Given that the project has created a great deal of capacity for sea turtle conservation in the country and served as impetus for the creation of a national Dominica Sea Turtle Conservation Organization (DomSeTCO), consideration should be given to strengthening DomSeTCO to assume a scheduling and data coordination role. In whatever form RoSTI might take in 2008, the project should be restructured (see *Restructuring the Project*, below) to more directly embrace and contribute to community life, and to utilize more effective community outreach programming. Community participation – beyond simply hiring local beach patrollers – must be reestablished and reemphasized as a core project objective.

Development of 'Turtle Watching'-- The development of community-based 'Turtle Watching' programs has remained a fundamental objective since RoSTI's beginnings in 2003. Communities with a vested economic interest in the well-being of nesting turtles should self-police and control local poaching threats to protect the resource and revenue generator. Massive crowds flocked to Southeast's beaches in 2007, illustrating that the market does indeed exist for 'Turtle Watching' in Dominica. Accordingly, communities from La Plaine in the Southeast to Woodford Hill in the Northeast continue to express interest in ecotourism project.

In 2007, USAID-granted projects implemented by DomSeTCO and WIDECAST offered comprehensive sea turtle training courses for communities historically involved in RoSTI's programs, particularly on the east coast. The programmes focused on capacity building by providing training and hands-on experience in conservation techniques, data collection, and best management practices. Follow-up exchange opportunities (between Dominica and Trinidad) are planned for early 2008. Communities thus will be better equipped to devise successful ecotourism programmes, with hopes that independent ecotourism groups will be functional in each interested community by 2008. Sea turtle conservation partners aspire to establish a cohesive, community-based

national monitoring programme. With oversight and technical guidance provided by DomSeTCO, this national programme will meet conservation needs and ultimately, with the creation of tour-guiding programs, generate revenue for the respective communities (See also *Restructuring the Project*).

'Turtle Watching' Considerations-- The volume of nesting activity in the Southeast, the enormous public interest in 'Turtle Watching,' and limited project and governmental resources created tremendous management challenges for research staff in 2007.

Sea turtles are highly vulnerable on land. Lights, excessive noise, and movements may result in a failed nesting attempt and force the turtle to attempt to nest at another time and/or location. Sharing information on proper 'Turtle Watching' etiquette became virtually impossible when scores of people had already assembled around a nesting turtle, and, in any event, it was exceedingly difficult to get large, excited groups to adhere to written guidelines or spoken instructions. The situation was exacerbated during peak leatherback season, when the presence of multiple turtles on the beach simultaneously required that a single staff member attend to a turtle, collect necessary data, manage numerous guests, and sometimes confront poachers.

Fortunately, solutions to help overcome these conservation obstacles are readily identifiable. Community-based groups, appropriate government agencies, and conservation partners must identify and enforce a particular beach's carrying capacity for 'Turtle Watchers.' A system must be able to monitor and regulate the number of persons visiting the beaches. Similarly, regulations stating that visitors need to obtain a permit and hire a certified tour guide will provide the communities some control of access to the nesting beaches – and to the tour guiding product – and ensure that they derive financial benefit from 'Turtle Watching.' Additionally, the establishment and enforcement of 'Turtle Watching' guidelines will be required to ensure a safe experience for both the turtle and guests.

The development of interpretive centers at 'Turtle Watching' beaches would be hugely beneficial to community-based 'Turtle Watching' programmes. Centers would help to organize and guide people to the beach and guarantee that all visitors paid appropriate fees, received information regarding proper behavior, and had shelter from the weather. These centers could function as a venue from which to view natural history

displays and movies and sell crafts and gifts. Additionally, the structure could serve as a base for other tourist operations in the Southeast such as surfing or hiking and/or as an eco-crafting center.

As an aside, the individual owning the land adjacent to the La Plaine beach is seeking to sell his land and would like to see positive community development on the land. A multipurpose community center that could serve as a 'Turtle Watching' base would seem to meet the landowner's desire to make a lasting contribution to the community. In the Northeast, the newly-formed community group is seeking permission to construct a center on government land adjacent to Londonderry. At these sites and elsewhere, education centers should to be a focus as 'Turtle Watching' develops.

Marine turtles generally do not nest every year, and nesting numbers fluctuate on an annual basis, reflecting both local conservation efforts and larger patterns of oceanic productivity. At sites (e.g. Trinidad) with historically large populations, ecotourism programmes have the luxury of being able to virtually guarantee that guests will see a turtle. In Dominica, where nest density is far lower, creativity will be the key to entrepreneurial success, including focusing on other interesting ecological and cultural elements indigenous to the Southeast. With this in mind, communities should be encouraged to structure an ecotourism product such that it provides an enjoyable and stimulating experience in the event that sea turtles are *not* seen on a given night. Food, music, local history, story-telling, viewing other organisms (such as crabs, night herons, and plants), star-gazing, camping, and educational videos could all be implemented with 'Turtle Watching' to provide a 'Night at the Beach' tourist package.

Finally, because turtle nesting is seasonal by nature, it would be beneficial to consider other means to generate revenue during the off-season. Pairing 'Turtle Watching' / 'Night at the Beach' tours with other low impact, revenue generating eco-activities such as surfing and hiking would provide much-needed income and employment to coastal communities. WIDECAST additionally is working to build eco-crafting expertise and in the future anticipates providing eco-craft training to community groups. Current craft training available from the WIDECAST network includes utilizing scrap glass to construct jewelry, weaving recycled plastic bags to create purses and baskets, wood carving, and more.

Restructuring the Project-- In the first 5 years of RoSTI, a biologist has filled the role of Project Manager. However, as the project enters a new phase and focuses on the development of ecotourism as a sustainable, non-consumptive, alternative use, an individual trained in international and/or community development would be more suitable in a managerial role. Accordingly, the manager's scientific responsibilities would diminish and community-based site supervisors would be responsible for beach management and data collection (see also *Project Staff*). DomSeTCO, a nationally registered NGO dedicated to sea turtle conservation, is increasingly well-positioned to coordinate the island's independent, but nationally integrated, community-led conservation programmes. A biologist associated with DomSeTCO could be very effective in playing a role akin to the traditional science-role of the RoSTI Project Manger. WIDECAST should continue to function as a scientific advisor, providing technical assistance and access to the international network's resources and expertise.

Every effort should be made to identify a Dominican to fill any managerial position that becomes available. Simply put, Dominicans should lead the way in the conservation of Dominica's natural resources, and professional opportunities are all the more important given the current state of employment on the island.

Outreach and Education-- In Dominica, as in other Caribbean islands, target groups for conservation education span the demographic spectrum: adults and school children, east coast country folk and Roseau city dwellers, business professionals and farmers. A diverse population requires diverse education methods. Accordingly, RoSTI utilizes a variety of outlets in outreach and educational programming, including 2007 summer camp activities, traditional classroom presentations, regular local government and community group gatherings, and a publicly displayed conservation mural.

The project must continue to develop novel education approaches while maintaining aspects of current efforts to reach the various segments of society. A community focus in outreach efforts must underscore all programming. Regular meetings with community groups will maintain an open dialogue and project transparency, helping to ensure that community interests are recognized and community needs are met. Investment in the communities of La Plaine, the Northeast, and the Salisbury region on the West Coast would prove particularly beneficial. Additionally, collaboration with NGOs and government agencies such as the Youth Development Division, Dominica Youth Environ-

mental Organization, the Dominica State College Environmental Club, and the Waitikubuli Ecological Foundation would strengthen conservation education efforts by increasing resources and the audience reached.

Project Staff

Periodic spot checks revealed several unacceptable staff practices ranging from leaving the beach prior to the end of patrols to arriving late and sleeping through patrols. One staff member was additionally involved in poaching. Penalties were implemented at the start of the field season to curb these behaviors and initially proved effective. However, some staff persons resumed unacceptable practices towards the latter half of the field season. It was and will remain logistically impossible for project management to constantly spot check all patrol teams. One option is that a responsible 'beach manager' be appointed to oversee research and staff on individual beaches; stiffer penalties may also help to limit inappropriate behavior. Regular staff evaluations should be conducted and should be reflected in hiring and firing practices.

It is apparent that training of field staff is necessary and critically important on an on-going basis. Brief, annual refresher sessions addressing research techniques (e.g., tagging to follow the protocols of Eckert and Beggs 2006) and marine ecology should become a regular practice prior to the commencement of the each field season. RoSTI should also invest in 'staff development' courses (e.g., computer skills, driving) as a means of capacity building. Several staff expressed an interest in such classes, but, unfortunately, time did not permit course development during 2007.

Project Administration

RoSTI management made a concerted effort during 2007 to establish standard organizational components necessary for a successful conservation progamme. Administrative progress included the creation of a comprehensive and computerized inventory of project assets, a project contact list, a detailed budget, a catalogue of relevant correspondence and materials developed, an outreach schedule, an indexed library, an educational collection (e.g., preserved eggs, embryos, and hatchlings), and appropriate organizational files. This administrative approach eases transition between project management and maintains necessary project transparency (e.g., fiscal accountability).

These administrative responsibilities should become standard practice for future RoSTI management.

Finally, a central data repository should be identified and staff should be trained in sea turtle population data management; software and training are available from WIDECAST.

VII. LITERATURE CITED

Bolten, A. B. 1999. Techniques for Measuring Sea Turtles. Pp. 110-114 In K. L. Eckert, K. A. Bjorndal, F. A. Abreu-Grobois, and M. Donnelly (Editors), Research and Management Techniques for the Conservation of Marine Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

Boulon, R. H. 1999. Reducing Threats to Eggs and Hatchlings: In Situ Protection. Pp. 169-174 In K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (Editors), Research and Management Techniques for the Conservation of Marine Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

Bräutigam, A. and K. L. Eckert. 2006. Turning the Tide: Exploitation, Trade and Management of Marine Turtles in the Lesser Antilles, Central America, Colombia and Venezuela. TRAFFIC International, Cambridge, UK. 550 pp.

Byrne, R. 2006. 2006 Annual Project Report: Rosalie Sea Turtle Initiative (RoSTI). Prepared by WIDECAST for the Ministry of Agriculture and the Environment (Forestry, Wildlife and Parks Division). Roseau, Dominica, West Indies. 25 pp.

Byrne, R. and K. Eckert. 2006. 2004-2005 Biennium Project Report: Rosalie Sea Turtle Initiative (RoSTI). Prepared by WIDECAST for the Ministry of Agriculture and the Environment (Forestry, Wildlife and Parks Division). Roseau, Dominica, West Indies. 51 pp.

Eckert, K. L. 1987. Environmental unpredictability and leatherback sea turtle (*Dermochelys coriacea*) nest loss. Herpetologica 43(3):315–323.

Eckert, K. L. and J. Beggs. 2006. Marine Turtle Tagging: A Manual of Recommended Practices. WIDECAST Technical Report No. 2. Revised Edition. Beaufort, North Carolina. 40 pp.

Franklin, A., R. Byrne, and K. Eckert. 2004. 2003 Annual Report: Rosalie Sea Turtle Initiative (RoSTI). Prepared by WIDECAST for the Ministry of Agriculture and the Environment (Forestry, Wildlife and Parks Division). Roseau, Dominica, West Indies. 57 pp.

Frazer, N.B. 198). Survival from egg to adulthood in a declining population of loggerhead turtles, *Caretta caretta*. Herpetologica 42(1):47–55.

Government of Dominica, Ministry of Agriculture and the Environment. 2002. First National Report to the Conference of Parties - Convention on Biological Diversity. Roseau, Commonwealth of Dominica. 44 pp.
URL: www.cbd.int/doc/world/dm/dm-nr-01-en.doc. Accessed 2007.

Gulko, D. A. and K. L. Eckert. 2003. Sea Turtles: An Ecological Guide. Mutual Publishin., Honolulu, HI. 128 pp.

IUCN 2007. 2007 IUCN Red List of Threatened Species. URL: www.redlist.org. Accessed 2007.

Pritchard, P. C. H. and J. A. Mortimer. 1999. Taxonomy, External Morphology, and Species Identification. Pp. 21-38 In K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (Editors), Research and Management Techniques for the Conservation of Marine Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

Schroeder, B. and S. Murphy. 1999. Population Surveys (Ground and Aerial) on Nesting Beaches. Pp. 45-55 In K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (Editors), Research and Management Techniques for the Conservation of Marine Turtles. IUCN/SSC Marine Turtle Specialist Group Publication No. 4.

Witherington, B.E. and R.E. Martin. 2000. Understanding, Assessing, and Resolving Light Pollution Problems on Sea Turtle Nesting Beaches. Second edition. Florida Marine Research Institute Technical Report TR-2. 73 pp.

Appendix 1

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

2007 Sea Turtle Sighting Form

Rosalie Sea Turtle Initiative (RoSTI)
Dominica, West Indies

Page Number _____

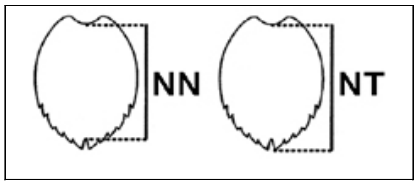
Date _____ Time _____ AM / PM Time Out _____ AM / PM

Observer_____ Tel/contact: _____

Location: _____ Section: _____

Turtle Species: _____ Gender: Female / Male / unknown

Identified by: ☐ Adult ☐ Juvenile ☐ Hatchling ☐ Alive ☐ Dead
or, ☐ Crawl/Nest Pit Crawl Width: _____ m Pattern: Symmetrical / Alternating



Size: CCL NT _____ cm CCL NN _____ cm CCW _____ cm

Carapace Intact? Y / N

Description / Illustration: Parasites and/or Injuries:

Flipper Tag #1: _____ OLD or NEW

Flipper Tag #2: _____ OLD or NEW

Tag Scars or tears present? _____

Destroyed or Lost tags?_____

Result: ☐ Nest (eggs confirmed) ☐ Suspected Nest ☐ False Crawl (no eggs)

Egg Counts: Yolked (large) eggs: _____ Unyolked (small) eggs: _____

Guests: _____

Notes (e.g. evidence of poaching or other threats, contact information for observer):
_____
_____
_____
_____

Appendix 2

WIDECAST
Wider Caribbean Sea Turtle Conservation Network

2007 Nest Excavation Form
Rosalie Sea Turtle Initiative (RoSTI)
Dominica, West Indies

Date Emerged: _____ Date Observed: _____ Date Excavated: _____
Time Emerged: _____ Time Observed: _____ Time Excavated: _____

Observers: _____
Location: _____
Turtle Species: _____

Hatch Results

Live Hatchlings out of nest: _____ Counted OR Estimated

Dead Hatchlings out of nest: _____

Predated Hatchlings: _____

Suspected Predator: _____

Predated Eggs: _____

Suspected Predator: _____

Nest Contents

Live Hatchlings in Nest: _____

Dead Hatchlings in Nest: _____

Pipped Alive: _____

Pipped Dead: _____

Full-Term Embryo Alive: _____

Full-Term Embryo Dead: _____

Mid-Term Embryo: _____

Early-Term Embryo: _____

Undeveloped: _____

Rotten: _____

Shells: _____

Yolkless: _____

Deformed (List: Twins, Albino, etc.):_____

Hatchling Release

Date: _____

Time: _____

Quantity: _____

Guests: _____

Notes (e.g. bacteria, evidence of poaching):

_____
_____
_____

Appendix 3

Turtle Watching Guidelines

Observing a nesting sea turtle is a magical experience! Sea turtles only come ashore to lay their eggs, and they are highly vulnerable while on land. It is very important to maintain a safe viewing environment for the turtle, as a startled turtle may return to the sea without successfully depositing her eggs. To ensure a fantastic turtle watching experience, please adhere to the following rules:

1. Please follow all instructions provided by RoSTI, Forestry, and Fisheries staff.
2. Please give the turtle adequate space – at least 30 feet – before she begins laying her eggs and after she has completed laying her eggs. When a turtle is laying eggs, she enters a nesting "trance" and may be viewed more closely. Only approach a turtle when she is laying her eggs, as instructed by RoSTI, Forestry, or Fisheries staff.
3. Nesting sea turtles are protected in Dominica. Please do not touch the turtle without permission to do so.
4. Lights disorient both adult and hatchling sea turtles. Lights may only be used while the turtle is laying her eggs. No lights can be used while the turtle is digging her nest or concealing the nest site. The light should be dim, and should never be directed to the face of the turtle.
5. Flash photography may disorient or temporarily blind a turtle. Only take photographs while the turtle is depositing her eggs, and then only from behind and when you have permission to do so.
6. Limit noise and movement to minimize disturbance to the turtle.
7. View the nesting turtle in small groups and limit viewing time to ensure that all visitors have a chance to see the nesting process!
8. Please do not leave your litter at the beach. Adult turtles and hatchlings may become trapped or entangled in any rubbish found on the beach.

Please remember that all sea turtles engaged in nesting activities - and their nests - are protected year-round by Dominican law! **Questions?** Please call the national *Sea Turtle Hotline*: 616-TOTI (616-8684).

Appendix 4: Current Sea Turtle Regulations in Dominica

Laws of Dominica

Forestry and Wildlife Act

Chapter 60:02, Act 12 of 1976

Amended by Act 35 of 1982

Amended by Act 12 of 1990

Chapter 60:02

Section 21

Ninth Schedule

Regulations for the taking of sea turtles

1. The word 'turtle' shall be deemed not to include the tortoise or land turtle (*Geochelone carbonaria*).

2. No person shall:
   - Catch or take or attempt to catch or take any turtle between the 1st June and the 30th September both dates inclusive,
   - Catch or take or attempt to catch or take any turtle which is under twenty pounds in weight
   - Disturb any turtle nest or eggs or take any turtle eggs, or take or attempt to take any turtle laying eggs or on the shore engaged in nesting activities.