

ANNUAL REPORT – 2004 SEASON

DRY TORTUGAS NATIONAL PARK SEA TURTLE MONITORING PROGRAM MONROE COUNTY, FLORIDA

November 27, 2004

Report by:
Kerry L. Grimshaw

Field Research by:
Kerry L. Grimshaw and Tammie L. Campbell
Biological Science Technicians, National Park Service

Dry Tortugas National Park
P.O. Box 6208
Key West, Florida 33041
(305) 293-0152

ABSTRACT

The 2004 Dry Tortugas Sea Turtle Monitoring Program documented a total of 645 sea turtle crawls during its ninth year. Of the 645 crawls, 458 (71.0%) were identified as being loggerhead sea turtle (*Caretta caretta*) crawls, 184 (28.5%) were identified as green sea turtle (*Chelonia mydas*) crawls, and for the first time ever documented at Dry Tortugas National Park there were 3 (0.5%) leatherback sea turtle (*Dermochelys coriacea*) crawls. Throughout the season there were a documented 134 loggerhead nests, 59 green nests, 3 leatherback nests, 324 loggerhead false crawls and 125 green false crawls. The majority of sea turtle activity was recorded on East Key (49.3%), followed by Loggerhead Key (38.8%). Loggerhead turtle activity peaked in June, while green turtle activity peaked in July. The average incubation period was 54.3 days for loggerhead turtles (SD=5.0; r=47-71; n=34) and 53.9 days for green turtles (SD=4.5; r=47-64; n=12). The average clutch size for loggerhead nests was 106.2 eggs (SD=17.0; r=69-148; n=53), while the average clutch size for green nests was 116.8 eggs (SD=28.0; r=62-173; n=16). For the 2004 nesting season at Dry Tortugas National Park there was an average hatching success rate of 73.8% (SD=27.0%; r=0.0-99.2%; n=69) and an average release rate of 73.0% (SD=25.2%; r=0.0-99.2%; n=69). For loggerhead turtle nests the average hatching success rate of 76.9% (SD=25.2%; r=0.0-99.2%; n=53), with an average release rate of 76.0% (SD=25.0%; r=0.0-99.2%; n=53). The green turtle nests had an average hatching success rate of 63.7% (SD=23.8%; r=22.6-97.4%; n=16), and an average release rate of 62.9% (SD=23.8%; r=22.6-97.4%; n=16). In the Dry Tortugas National Park 2004 nesting season 69 nests were inventoried yielding an estimated 7,494 eggs were evaluated with an estimated 5,386 hatchlings entering the Gulf of Mexico.

This season, Dry Tortugas National Park experienced an unusually high number of tropical weather systems, including four major hurricanes (Charley, Frances, Ivan, and Jeanne). The impact of these storms affected the nesting season substantially with 96 nests lost, and salt water inundation of the majority of the remaining nests.

During the past nine seasons (1995, 1996, 1997, 1998, 1999, 2000, 2001, 2003, and 2004) of daily monitoring, the Dry Tortugas Sea Turtle Monitoring Program has documented 5,330 turtle crawls, comprised of 2,125 nests and 3,205 false crawls. To date an estimated 165,572 eggs have been excavated, with an estimated 121,589 hatchlings entering the Gulf of Mexico. Researchers have recorded 6,408 sea turtle crawls – 2,485 nests and 3,923 false crawls – within the park since 1982 (adapted from Reardon, 2000; Smith, 2001).

PREFACE AND ACKNOWLEDGMENTS

This annual report contains the results of sea turtle nesting activity documented in Dry Tortugas National Park during the 2004 nesting season. In order to facilitate future data comparisons among sea turtle nesting seasons in Dry Tortugas National Park, this report closely follows the content and form of previous annual reports by Russell Reardon, Kate Mansfield, and Chad Smith.

The 2004 Dry Tortugas Sea Turtle Monitoring Program operated under the National Park Service. Monitoring efforts were authorized by Marine Turtle Permit TP#148 issued to Nicole Ryan, Kerry Grimshaw, and Tammie Campbell by the Florida Fish and Wildlife Conservation Commission.

Every season there are several people who make the data collection possible. The Dry Tortugas **staff, residents, and volunteers** are a very important asset to the program and are owed special recognition for their contributions. This season the program utilized the help of 17 volunteers, providing over 792 hours of service (Appendix H). Their time, man power, support, and all of their other assistance has allowed for another successful nesting season. Additionally, a very special thanks is extended to:

Eloise Pratt: for consistently spending your mornings helping us survey and acting as photographer for this season. Your help was greatly appreciated.

Niki Ryan: for your constant enthusiasm and support. We couldn't have done it without you!

Ed & Sandy Moss, Lee & Donna Saylor, and Dawne Laraway: year after year saving us numerous hours at Loggerhead Key with all of your assistance. The program looks forward to your arrival and help every summer.

Russell Reardon: my sounding board. Thank you for your continued guidance and being an outstanding resource. Your continued support is extraordinary.

Sonny Bass: for the continued understanding and support you have shown for the program over the years, it wouldn't have continued this year if it wasn't for you.

Joy, Hannah, and Caleb Griffin: for teaching me as much, if not more than I hopefully shared with you. Your enthusiasm and compassion for all living things is remarkable. It was an honor to have worked with you; I only wish you could have stayed longer.

Kerry Grimshaw
Dry Tortugas National Park
November 2004

TABLE OF CONTENTS

ABSTRACT	ii
PREFACE AND ACKNOWLEDGMENTS	iii
TABLE OF CONTENTS	iv
LIST OF FIGURES	vi
LIST OF TABLES	viii
INTRODUCTION	1
Dry Tortugas National Park	1
Physical and vegetative features of the Dry Tortugas	3
Species overview	4
Previous sea turtle research	6
METHODS AND MATERIALS	8
Beach indexing	8
Beach patrols	9
Crawl data	9
Hatching data	12
Exotic plant data	13
Stranding data	13
RESULTS	14
Nest and false crawl data	14
Park overview	14
Species overview	15
Monthly distribution of crawl activity	17
Geographic distribution of crawl activity	20
Tidal impacts and inundation	24
Hatching data	26
Park overview	26
Species overview	27
Geographic distribution of hatching activity	28
Embryonic development of unhatched eggs	29
Tidal impacts and inundation	30

Exotic plant data	31
Stranding data	32
DISCUSSION AND RECOMMENDATIONS	34
LITERATURE CITED	38
APPENDIX A: Dry Tortugas National Park Island Physiography: Bush Key, East Key, Garden Key, Hospital Key, Loggerhead Key, Long Key and Middle Key.	43
APPENDIX B: Sample Data Sheet: 2004 Dry Tortugas National Park Sea Turtle Nesting Survey Form.	45
APPENDIX C: Sample Data Sheet: 2004 Dry Tortugas National Park Nest Inventory Form.	46
APPENDIX D: Sample Data Sheet: 2004 Dry Tortugas National Park Development Survey Form.	47
APPENDIX E: The Criteria for Determining Embryonic Development in Unhatched Eggs.	48
APPENDIX F: Sample Data Sheet: Sea Turtle Stranding and Salvage Network Report Form.	49
APPENDIX G: Loggerhead (<i>Caretta caretta</i>) and Green Turtle (<i>Chelonia mydas</i>) Nesting Activity Impacted by Australian Pine (<i>Casuarina equisetifolia</i>) on Loggerhead Key, Dry Tortugas National Park, 2004 (N indicates nest, FC indicates false crawl).	50
APPENDIX H: 2004 Dry Tortugas Sea Turtle Monitoring Program Volunteer Hours.	51

LIST OF FIGURES

1.	The Location of the Dry Tortugas in Reference to the Florida Keys and Mainland Florida (adapted from NOAA, 1995).	1
2.	The Islands within Dry Tortugas National Park, Dry Tortugas, Florida (NPS, Park Regulations, 2003).	2
3.	The Location of Channels and Shoals within Dry Tortugas National Park, Dry Tortugas, Florida (NPS, Photograph Collection, Dry Tortugas National Park).	4
4.	Location of Beach Index Markers and Sectors on East Key, Dry Tortugas National Park, (adapted from Reardon, 2000).	10
5.	Location of Beach Index Markers and Sectors on Loggerhead Key, Dry Tortugas National Park, (adapted from Reardon, 2000).	11
6.	Geographic Distribution of Sea Turtle Crawls, Dry Tortugas National Park, 2004.	14
7.	Monthly Distribution of Sea Turtle Crawl Activity, Dry Tortugas National Park, 2004.	18
8.	Monthly Distribution of Loggerhead Turtle (<i>Caretta caretta</i>) Activity, Dry Tortugas National Park, 2004.	18
9.	Monthly Distribution of Green Turtle (<i>Chelonia mydas</i>) Activity, Dry Tortugas National Park, 2004.	19
10.	Monthly Distribution of Leatherback Turtle (<i>Dermochelys coriacea</i>) Activity, Dry Tortugas National Park, 2004.	19
11.	Geographic Distribution of Sea Turtle Crawl Activity, East Key, Dry Tortugas National Park, 2004.	20
12.	Geographic Distribution of Loggerhead Turtle (<i>Caretta caretta</i>) Activity, East Key, Dry Tortugas National Park, 2004.	21
13.	Geographic Distribution of Green Turtle (<i>Chelonia mydas</i>) Activity, East Key, Dry Tortugas National Park, 2004.	21
14.	Geographic Distribution of Leatherback Turtle (<i>Dermochelys coriacea</i>) Activity, East Key, Dry Tortugas National Park, 2004.	22

15.	Geographic Distribution of Sea Turtle Crawl Activity, Loggerhead Key, Dry Tortugas National Park, 2004.	23
16.	Geographic Distribution of Loggerhead Turtle (<i>Caretta caretta</i>) Activity, Loggerhead Key, Dry Tortugas National Park, 2004.	23
17.	Geographic Distribution of Green Turtle (<i>Chelonia mydas</i>) Activity, Loggerhead Key, Dry Tortugas National Park, 2004.	24
18.	Geographic Distribution of Sea Turtle Nests Inundated by Seawater, East Key, Dry Tortugas National Park, 2004.	25
19.	Geographic Distribution of Sea Turtle Nests Inundated by Seawater, Loggerhead Key, Dry Tortugas National Park, 2004.	26
20.	Distribution of Embryonic Development in Unhatched Sea Turtle Eggs ($n=1,361$), Dry Tortugas National Park, 2004 [numbers in () indicate unhatched eggs].	30
21.	Percentage of Unhatched Sea Turtle Eggs per Embryonic Development Category for 27 Nests Inundated with Seawater (grouped by number of days incubation prior to initial inundation), Dry Tortugas National Park, 2004.	31
22.	Geographic Distribution of Sea Turtle Crawls Impacted by <i>Casuarina equisetifolia</i> on Loggerhead Key, Dry Tortugas National Park, 2004.	31

LIST OF TABLES

1.	2004 Sea Turtle Crawl Activity, Dry Tortugas National Park.	15
2.	2004 Loggerhead Turtle (<i>Caretta caretta</i>) Activity, Dry Tortugas National Park.	16
3.	2004 Green Turtle (<i>Chelonia mydas</i>) Activity, Dry Tortugas National Park.	16
4.	2004 Leatherback Turtle (<i>Dermochelys coriacea</i>) Activity, Dry Tortugas National Park.	17
5.	2004 Summary of Loggerhead (<i>Caretta caretta</i>) and Green Turtle (<i>Chelonia mydas</i>) Hatching Data, Dry Tortugas National Park.	28
6.	2004 Sea Turtle Strandings, Dry Tortugas National Park.	33

INTRODUCTION¹

Dry Tortugas National Park:

Dry Tortugas National Park (DRTO) is located at 24°38' N latitude and 82°52' W longitude, approximately 113 kilometers (70 mi.) west of Key West, Florida (Figure 1). DRTO is comprised of seven islands and 260 square kilometers (100 mi²) of ocean. The islands that make up DRTO include Bush Key, East Key, Garden Key, Hospital Key, Loggerhead Key, Long Key, and Middle Key (Figure 2). This area was originally named "Las Tortugas" in 1513 by the Spanish explorer Ponce de Leon, due to its abundance of sea turtles. The name was later changed to "Dry Tortugas" to serve as a warning to mariners of the lack of fresh water on the islands.

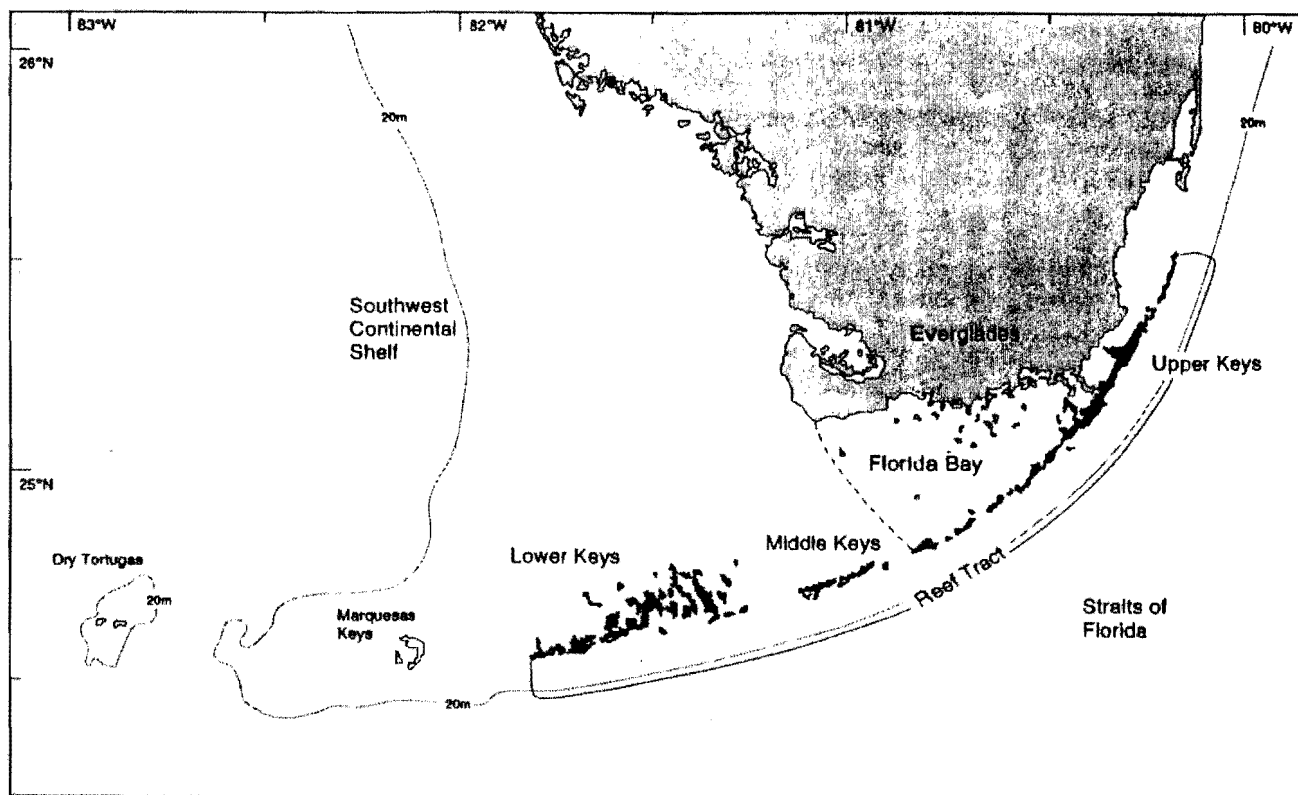


FIGURE 1. The Location of the Dry Tortugas in Reference to the Florida Keys and Mainland Florida (adapted from NOAA, 1995).

¹ The INTRODUCTION has been adapted from Reardon, 2000; Smith, 2001 and Grimshaw, 2003.

Islands in Dry Tortugas National Park

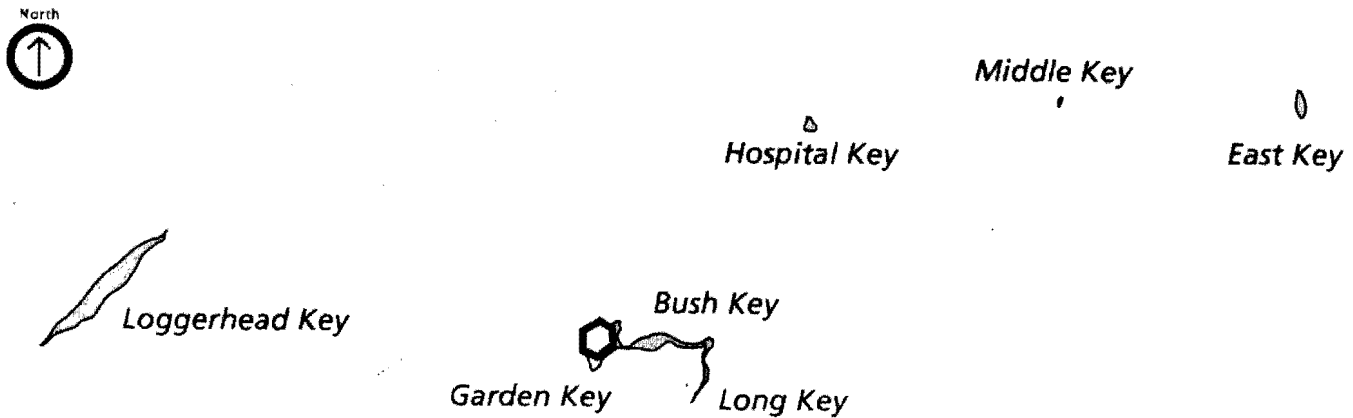


FIGURE 2. The Islands of Dry Tortugas National Park, Dry Tortugas, Florida (adapted from NPS, Park Regulations, 2003).

There have been numerous references made by mariners, soldiers, and prisoners to the great number of loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles found within the Dry Tortugas. For hundreds of years sea turtles provided food for mariners in this region. It was documented that Ponce de Leon harvested 170 green turtles from these waters, provisioning boats to feed his crew (Gifford, 1934). With the construction of Fort Jefferson on Garden Key between 1846 and 1875, regular harvesting of sea turtles began by workers and soldiers stationed in the Dry Tortugas. The garrison commissary kept turtles fresh for slaughter by constructing a “turtle corral” within the moat of the fort (Dawson & Williams, 1985). On Loggerhead Key turtle eggs were often collected from nests and were used in foods such as puddings (Holder, 1892). Records in the National Archives indicate that soldiers stationed at Fort Jefferson consumed over 39,588 pounds of turtle meat between 1858 and 1859 (Dawson & Williams, 1985).

In the 1800s, the market for sea turtle eggs and meat arose in Key West, which consequently developed into a full-scale fishery by the early 1900s. During the 1950s, the Dry Tortugas became the primary fishing ground for the Key West-based pink shrimp (*Penaeus duorarum*) industry. Mortality of sea turtle populations increased within the Dry Tortugas through the incidental catch of turtles in shrimp trawls. It has been documented that among “juveniles, subadults, and breeders in coastal waters, the most important human-associated source of mortality is incidental capture in shrimp trawls, accounting for more deaths than all other human activities combined” (National Research Council, 1990).

The Dry Tortugas was designated as a bird preserve in 1908, the Dry Tortugas Keys Reservation, for the protection of the several migratory and pelagic species that utilize the islands. In 1935, President Franklin Delano Roosevelt declared Fort Jefferson a National Monument, falling under the care and jurisdiction of the National Park Service, Department of the Interior. Due to the establishment of Fort Jefferson as a National Monument, sea turtles and their nests became protected within its boundaries. Robert Budlong, one of the first Monument Superintendents/Custodians stationed at the fort, referenced the sea turtle activity found on East and Hospital keys during the early 1940’s,

citing efforts to protect the turtle nests within Fort Jefferson National Monument from poaching. In 1943, Budlong estimated that very few sea turtle nests went unmolested. Fort Jefferson National Monument became Dry Tortugas National Park in 1992.

While historically most sea turtle nests were disturbed predominately by poaching, this is no longer the case. In the past several years there have been no documented cases of poaching within DRTN. Along with decreased poaching new regulations set forth by the National Marine Fisheries Service in order to protect marine turtles from incidental catch by shrimp trawlers. Shrimp trawlers were shown to have sea turtle mortality that was an estimated 10 times that of all other human-related factors combined (NMFS and USFWS, 2002). In order to reduce sea turtle by-catch, Turtle Excluder Devices were required to be placed in all nets in 1989 for all off shore fisheries and then 1994 for all inshore fisheries (NMFS & USFWS, 2002).

Physical and vegetative features of the Dry Tortugas:

The islands of Dry Tortugas National Park were formed by the accumulation of calcareous sand and coralline rubble generated by the fringing coral reefs that protect and cover a large area within DRTN (Stone, 1993). The islands are arranged in "a loose ring around an elliptical lagoon" situated within three large reef formations and accessible by three channels up to 25 meters (80 ft.) in depth (Williams & Dawson, 1984) (Figure 3). Seagrass beds can be found bordering all islands within the Dry Tortugas. Turtle, shoal, and manatee (*Thalassia*, *Halodule*, and *Syringodium spp.*) seagrasses are most commonly found, with *Thalassia* being the dominant species for DRTN (ibid.). The islands are extremely dynamic, changing size and shape seasonally on account of winds, currents, and wave action. With the exception of Garden and Loggerhead keys, the islands have an elevation of less than 1.2 meters (4 ft.) above mean high tide (Davis, 1942; Robertson, 1964). The total beach length within the Dry Tortugas is estimated to vary seasonally between 4.8 – 6.4 kilometers (3 – 4 mi.).

There are over 200 species of terrestrial plants that have been documented in Dry Tortugas National Park. Of the 200 species, approximately 25% of them are considered to be native to the area. The most abundant native species found on the smaller islands (including Bush, East and Hospital keys) are beachberry (*Scaevola plumieri*), dune elder (*Iva imbricata*), sea oats (*Uniola paniculata*), and sea lavender (*Argusia gnaphalodes*) (Davis, 1942; Stoddart & Fosberg, 1981). In 1910, Australian pine (*Casuarina equisetifolia*) was introduced to Loggerhead Key, rapidly spreading throughout the island by the 1940s, becoming the dominant island vegetation by the 1980s. Ongoing efforts to eradicate *Casuarina* were begun in the mid 1990s. Other exotic species inhabiting Loggerhead Key include sisal (*Agave spp.*) and Pacific beachberry (*Scaevola taccada*). Descriptions of the physiography of each key can be found in Appendix A.

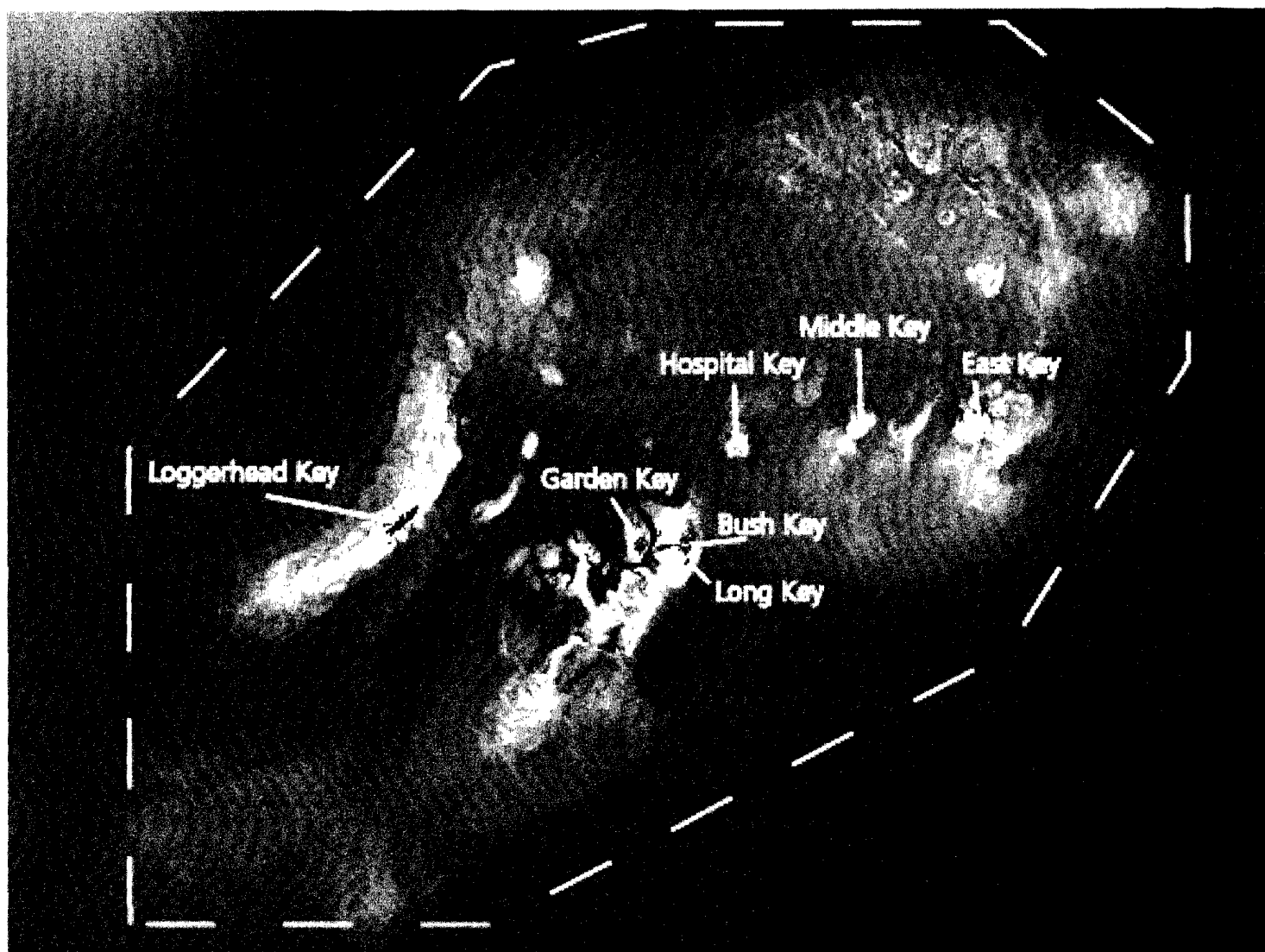


FIGURE 3. The Location of Channels and Shoals within Dry Tortugas National Park, Dry Tortugas, Florida (NPS, Photograph Collection. Dry Tortugas National Park).

Species Overview:

All sea turtles that nest within the state of Florida are protected by both Florida Statutes (Chapter 370.12) and at a federal level under the United States Endangered Species Act of 1973 (ESA) (Meylan et al, 1995). Of the five species of sea turtles that can be found in the waters surrounding the Dry Tortugas, all are listed as either threatened or endangered. Three species, the Loggerhead turtle (*Caretta caretta*), the Green Turtle (*Chelonia mydas*), and the Leatherback turtle (*Dermochelys coriacea*) nested within Dry Tortugas National Park this season. These three species nest regularly in Florida and their nesting has been recorded since statewide monitoring began in 1979 (Meylan et al, 1995). The

remaining two species, the Hawksbill turtle (*Eretmchelys imbricata*) and the Kemp's Ridley turtle (*Lepidochelys kempii*) have been documented in the park.

Loggerhead Sea Turtle (*Caretta caretta*):

Loggerhead turtles are distributed worldwide in temperate, tropical, and sub-tropical waters of the Atlantic, Pacific, and Indian Oceans (Pearce, 2001). The loggerhead population nesting in the southeastern United States, predominately in Florida is the second largest population in the world and accounts for about 35-40% of loggerhead nesting world wide (NMFS & USFWS, 1991; Meylan et al, 1995; Bjorndal et al 1983; Pearce, 2001). Their nesting season in Florida begins the end of April / early May and continues through August (Meylan et al, 1995).

Studies carried out on nesting females has shown that the Florida nesting population can be further divided into smaller sub-populations and later classified into recovery units. Genetic research involving the analysis of mitochondrial DNA has identified four different loggerhead nesting subpopulations in the southeastern US: (1) the Northern sub-population ranges from North Carolina through northeast Florida; (2) the South Florida sub-population ranging from just north of Cape Canaveral on Florida's east coast and extending around to Sarasota on Florida's west coast; (3) the Dry Tortugas sub-population; (4) the Northwest Florida sub-population occurring at Florida's panhandle beaches (Bowen et al, 1993; Bowen, 1994; Bowen, 1995; Encalada et al, 1998; Pearce, 2001; NMFS & USFWS, 200_). The Dry Tortugas has a highly distinct population of loggerhead turtles (Pearce, 2001).

Green Sea Turtle (*Chelonia mydas*):

Florida's nesting population of green turtles is one of the largest remaining in the Caribbean Sea and the western Atlantic Ocean (Ogren, 1989; Meylan et al, 1995). Parsons (1962) considered the Dry Tortugas to have been a historically important rookery for green turtles, which suffered greatly from the fisheries established in the early 1900's which apparently suffered a similar fate when turtles were nearly completely extirpated by man during the course of the new world's colonization, and now only supports occasional nesting (Meylan et al, 1995). Nesting season begins in June and continues through the end of September / early October (Meylan et al, 1995). There is no indication that the once-sizable population that nested at the Dry Tortugas has ever recovered from it's extensive exploitation (Meylan et al, 1995).

Leatherback Sea Turtle (*Dermochelys coriacea*):

Leatherback turtles display the greatest latitudinal distributions. Adult leatherbacks forage in temperate and sub-polar waters from 71°N to 47°S latitude in all oceans (Pritchard & Trebbau, 1984) and undergo extensive migrations to nesting beaches between 30°N and 20°S latitude (Starbird et al., 1993; NMFS, 2001). Florida is the only site in the continental US where the leatherback turtle regularly nests (Meylan et al, 1995). These turtles nest from late February through August (Meylan et al, 1995). There have been reports from seaplane pilots and local fishermen of these turtles traveling through Gulf waters in and around Dry Tortugas National Park. Until 2004 there have been no records of nesting activity within DRTN. Florida Marine Research Institute

records show that there has been no recorded leatherback nesting activity in Monroe County, FL since statewide surveys began in 1979.

Previous turtle research:

Since the early 1980s, National Park Service (NPS) biologists have been monitoring sea turtle nesting activity within DRTO; however 1995 was the first year that personnel performed season-long nesting surveys on each island. Each year since 1995, excluding 2002, the season-long surveys have been carried out. Sea turtle research and monitoring that preceded 1995 occurred sporadically from 1980 through 1985 as well as 1990 through 1994. Based on unpublished records of this research on file at Fort Jefferson, seasonal surveys prior to 1995 did not encompass the entire nesting season and ranged from just five days of survey to three months of monitoring – including some nest inventories.

From 1980 through 1983, aerial population surveys were conducted along with limited daytime beach surveys. During the 1983, 1984, and 1985 nesting seasons, Richard Dawson and David Williams of the NPS conducted nighttime tagging surveys of nesting loggerhead and green sea turtles on East Key and daytime nesting surveys on Loggerhead Key. Their efforts were targeted at the historic regional peak of the nesting season: June and July. In total 44 loggerhead and two green turtles were tagged. From this data Dawson conservatively estimated an East Key population of 40 loggerhead and two green turtles (Dawson & Williams, 1985).

Starting in 1990, Student Conservation Association and AmeriCorps personnel, along with park volunteers, refined monitoring techniques, increased frequency of field sampling, and increased the amount of data collected in a process that has produced a long term, comprehensive sea turtle monitoring program for Dry Tortugas National Park. In 1996 a standardized and site specific monitoring protocol manual was developed and later revised in 1997. The protocol manual was created to be compatible with Florida Fish and Wildlife Conservation Commission (FFWCC) marine turtle permit regulations as well as the monitoring protocol developed and implemented at Biscayne National park. This compatibility between the two water-based National Parks will help facilitate data comparisons and possibly the sharing of monitoring personnel.

The Dry Tortugas Sea Turtle Monitoring Program (DTSTMP) was established to accomplish four primary functions: 1) to establish and maintain a baseline inventory and monitoring program for sea turtle nesting and hatching activities within DRTO, 2) to identify and monitor the temporal and spatial distributions of sea turtle activity within the park and its waters, 3) to participate in and support the Sea Turtle Stranding and Salvage Network (STSSN) year-round and 4) to identify the natural and anthropogenic threats to sea turtles, their nests and hatchlings, devising means to mitigate these threats.

Loggerhead and green turtles both nest within Dry Tortugas National Park, though the loggerhead turtles are significantly more common. Since season-long monitoring began in 1995, the data collected suggests that the Dry Tortugas supports the largest loggerhead rookery within the Florida Keys and the largest green turtle rookery in Monroe County,

Florida (Boykin, 1995; Mansfield & Reardon, 1996; Reardon & Mansfield, 1997; Reardon, 1998, 1999, 2000; Smith, 2001). During the 1995 through 2003 nesting seasons, 4,026 loggerhead crawls and 659 green turtle crawls were documented. Juvenile and sub-adult hawksbill turtles (*Eretmochelys imbricata*) are frequently seen throughout the grassbeds and reefs bordering Fort Jefferson; however adult hawksbills are rarely observed. Seldom are leatherbacks (*Dermochelys coriacea*) and kemp's ridley (*Lepidochelys kempii*) turtles observed within Dry Tortugas National Park.

METHODS AND MATERIALS²

The 2004 Dry Tortugas Sea Turtle Monitoring Program was conducted by two biological science technicians from the National Park Service. The two researchers were assisted by 17 volunteers contributing over 792 hours of service. Daily nesting and hatching surveys were conducted on beaches within Dry Tortugas National Park from April 19, 2004 through October 1, 2004. Additional nesting surveys were conducted on alternating days through November 5, 2004.

Beach indexing:

Before the beginning of the 2004 nesting season, the beaches of East and Loggerhead keys were surveyed for replacement of PVC reference markers lost to erosion since the 2003 nesting season. The reference markers were located at 30 meter intervals from starting points designated in 1995; they are used to geographically reference each instance of sea turtle activity. The 30 meter intervals are marked with a numbered PVC pipe driven into the sand one to three meters landward of the vegetation line. The GPS position was recorded for each index marker both new and preexisting.

The index markers on East Key for the 2004 nesting season ranged from 1 to 8 on the eastern shore and 9 to 16, 16A, and 16B on the western shore. These index markers delineated approximately 540 meters of shoreline. During the 2004 nesting season the southern tip of East Key eroded resulting in the loss of reference markers 16, 16A, and 16B. Accretion occurred on the northern tip of the island; however, no new index marker was needed.

On Loggerhead Key the index markers ranged from 1 to 40 on the western shore and 40 to 80, 80A, and 80B on the eastern shore. The index markers on Loggerhead Key delineated approximately 2490 meters of shoreline. Similar to East Key, erosion occurred on the southern end of Loggerhead resulting in the loss of reference markers 80A and 80B. Accretion also occurred on the northern end, but no new index markers were established.

On both East and Loggerhead keys, the 30-meter intervals were grouped into “sectors” with alphabetically ascribed letters. The 30-meter intervals were grouped into 60-meter sectors on East Key and 90-meter sectors on Loggerhead Key. This grouping established eight such sectors on East Key ranging from Sector A located between index markers 16 and 2, including the south tip of the island, to Sector H between index markers 14 and 16. East Key’s index markers and sectors are illustrated in Figure 4.

On Loggerhead Key, 27 sectors were established ranging from Sector A between index markers 1 and 4, continuing around the island in 90-meter intervals to Sector AA, between index markers 79 and 1. Loggerhead Key’s index markers and sectors are illustrated in Figure 5.

² The METHODS AND MATERIALS section was adapted from Reardon, 2000; Smith, 2001 and Grimshaw, 2003. Complete monitoring protocols and detailed methodology can be found in the Dry Tortugas National Park Sea Turtle Monitoring Program Manual (Mansfield & Reardon, 1997).

Bush, Garden, Hospital, Long, and Middle keys were not indexed due to their small size, historic lack of significant turtle activity and/or extensive tidal influences on their beach profiles. During the 2004 nesting season, Middle Key was submerged through most of the season (May 27th to September 17th); during August of this season Hospital Key eroded to approximately half of the size it was during the beginning of the season. The beaches of Bush, Garden, and Long keys had some minor erosion or accretion during the nesting season. Total beach length within the Dry Tortugas is estimated to vary seasonally between 4.8 – 6.4 kilometers (3-4 mi.).

Beach patrols:

The beaches of Bush, East, Garden, Hospital, Loggerhead, Long, and Middle keys were patrolled daily – weather and seas permitting – from April 19, 2004 through October 1, 2004. After October 1, 2004 patrols were continued alternating daily through November 5, 2004.

The beaches of East, Garden, and Loggerhead keys were surveyed on foot. Hospital Key was surveyed by boat to ensure that the masked boobies (*Sula dactylatra*) were not disturbed. Landfall was not made on Hospital Key unless crawl activity was observed. Middle Key was awash during the most of the nesting season, although daily monitoring occurred by boat to check for land above the waterline. Bush and Long keys were surveyed by kayak or by foot periodically. Landfall was not made on Bush Key unless crawl activity was observed as to minimize disturbance to nesting sooty terns (*Sterna fuscata*), brown noddies (*Anous stolidus*), and brown pelicans (*Pelicanus occidentalis*). Once the bird nesting had ended, Bush Key was surveyed by foot. Long Key was also surveyed on foot in its entirety several times each week, as the turtle tracks in the coral rubble could be difficult to discern from the water. Care was taken to avoid disturbing nesting noddies and magnificent frigatebirds (*Fregata magnificens*) when patrolling Long Key.

Crawl Data:

Beach patrols began in the morning (approximately 0700 hours) and continued until late afternoon. All instances of crawl activity occurring the previous night were recorded on a standardized data sheet (Appendix B). Crawls were evaluated to determine if nesting took place. The criteria for the positive identification of a nest included the presence of a sand escarpment created by the front flippers of the turtle during nest site camouflaging, as well as the corresponding misted mound of sand covering the nest site and the emergence tracks (FFWCC, 1996). All loggerhead nests were confirmed for exact clutch location as defined by the protocol for the Index Nesting Beach Surveys. Crawls meeting such criteria were recorded as nests, while crawls lacking these defining characteristics were identified as false crawls.

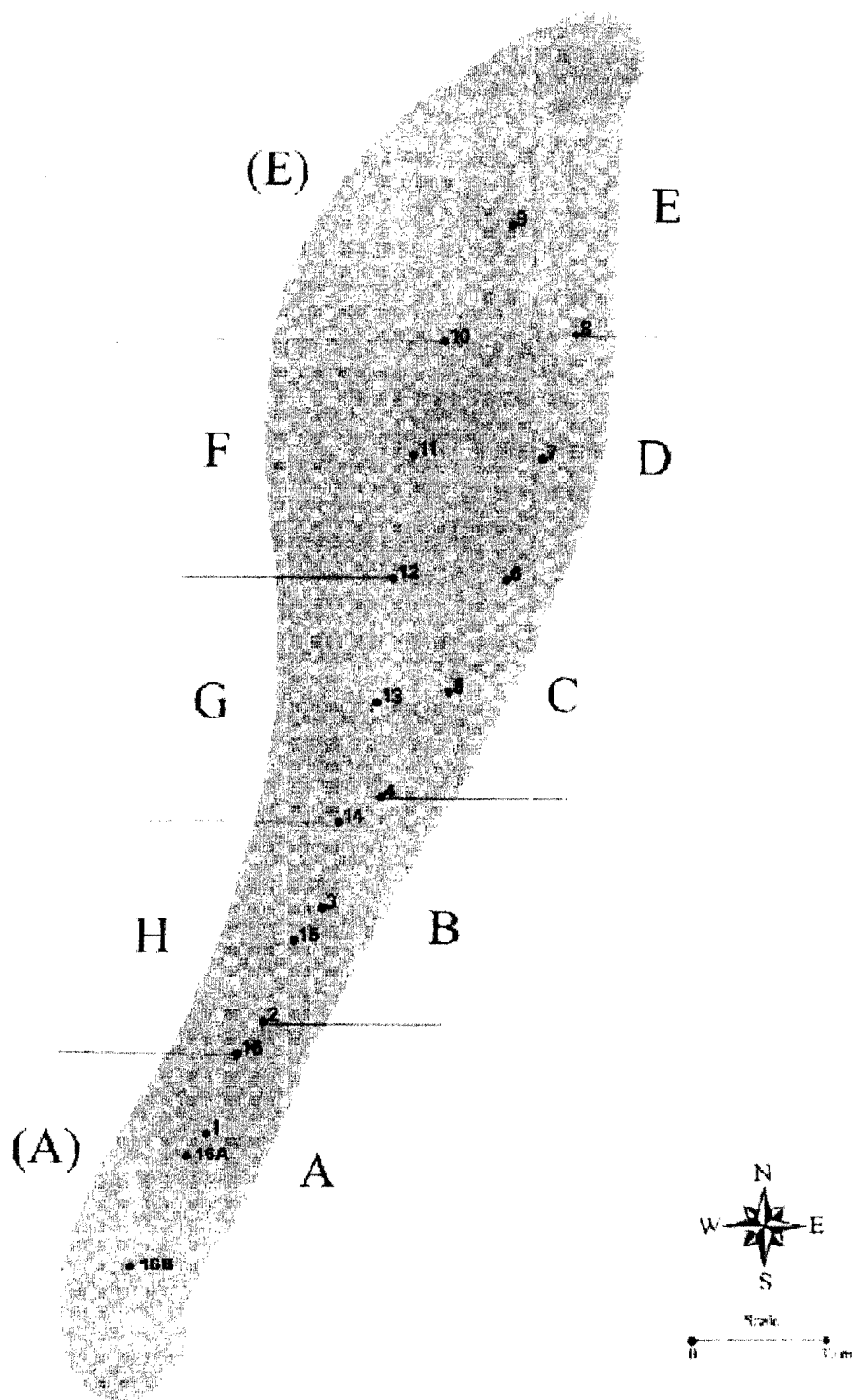


FIGURE 4. Location of Beach Index Markers and Sectors on East Key, Dry Tortugas National Park (Adapted from Reardon, 2000).

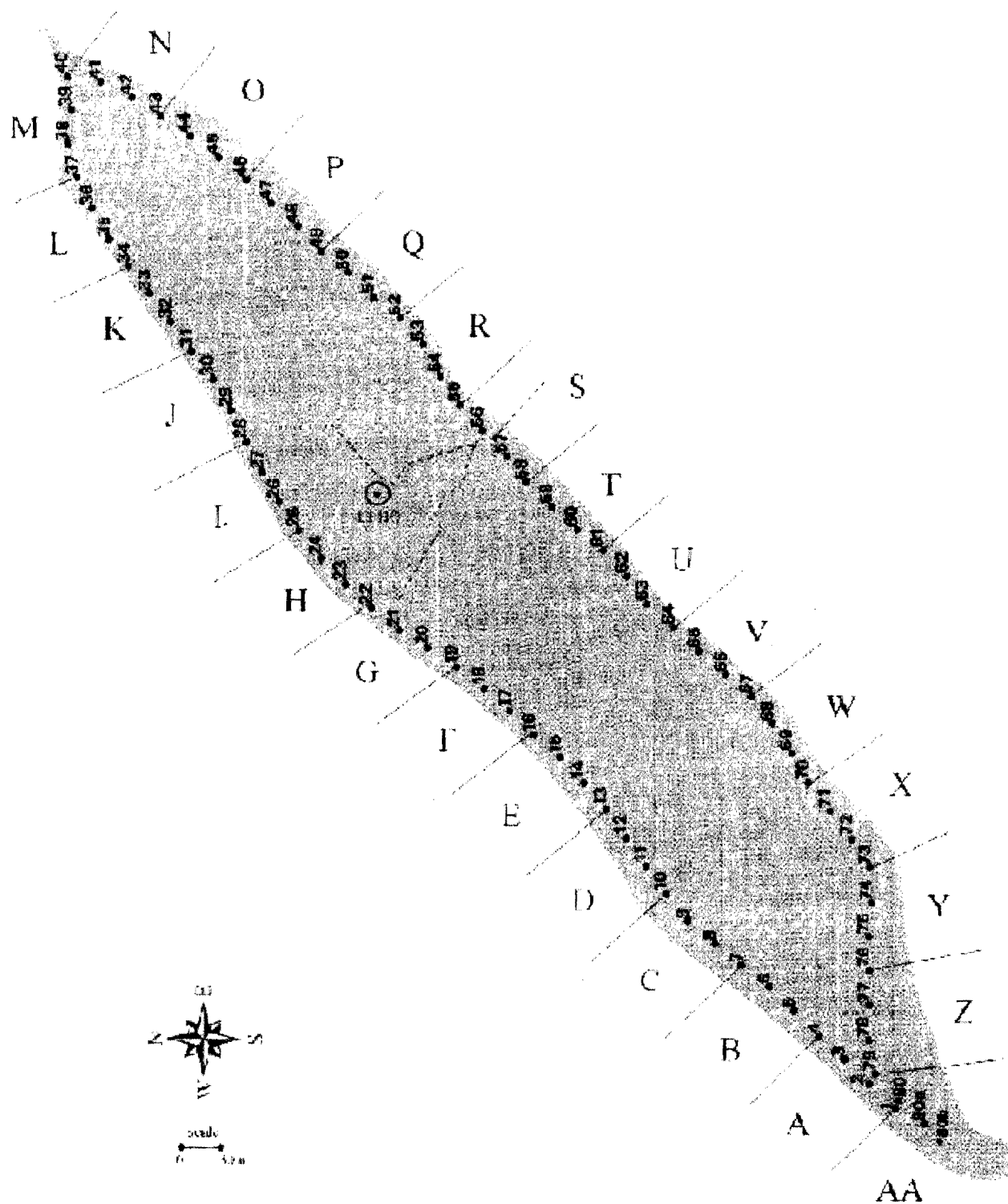


FIGURE 5. Location of Beach Index Markers and Sectors on Loggerhead Key, Dry Tortugas National Park (Adapted from Reardon, 2000).

Every crawl was assigned a number representing the chronological order in which it was observed (note: crawl numbers represented both nests and false crawls). Each nest site was marked with a wooden stake bearing the crawl number. The stakes were placed landward of the confirmed or estimated clutch location. All nests were left *in situ*. A crawl that could not be positively identified as a nest – but in which the possibility of nesting could not be ruled out – was recorded as “undetermined” and staked as a potential nest.

Distance and direction measurements were recorded from the two closest index markers to the turtle crawl. Measurements were made using a 50-meter transect tape and a handheld bearing compass. Nests were measured from the stake marking the clutch to the index markers, while false crawls that showed evidence of digging were measured to the last abandoned body pit. On Bush, Garden, Hospital, and Long keys which lacked index markers crawls were measured to permanent structures or other points of reference along the beach. These objects included prominent features such as signposts, large bushes, and trees.

Each nest was monitored throughout its incubation period and its condition recorded. All signs of predation, tidal wash, erosion, or accretion were recorded on the data sheets. All data was entered into a computerized database (MS[®] Excel 97) located at Fort Jefferson, Garden Key.

Hatching data:

After 45 days incubation, each nest was monitored closely for evidence of hatchling emergence. Emergence was characterized by a small bowl-like depression in the sand and hatchling tracks in the immediate vicinity. Special care was taken to check nests following rain and other weather conditions that may have induced daytime emergence. Evidence of first emergence and any subsequent emergences was noted for each nest on a standardized nest inventory sheet (Appendix C).

Three days post emergence, researchers performed nest inventories and embryonic development surveys of clutch contents. After 70 days of incubation if no hatchling emergence was observed, the nest was excavated by hand. While after 85 days post-deposition, shovels were used in attempt to locate elusive clutches. Subsequently, sites initially categorized as “undetermined” were reclassified as “nests” or “false crawls” as appropriate.

Dates of depression, emergence, and excavation were recorded for each nest, as well as any inundation or predation events that may have occurred. All nests contents were examined and documented, including numbers of live and dead hatchlings, live and dead pipped eggs, egg fragments (50% in size or larger), and unhatched eggs. If live hatchlings were found, they were placed seaward of the excavation site and allowed to crawl to the water. Any live pipped eggs were placed in a sand-filled bucket and transported to Fort Jefferson to allow for complete hatching and absorption of the yolk

sack. Release of all hatchlings was in accordance with the FFWCC marine turtle permit guidelines (FFWCC, 2002).

The number of hatched eggs in each nest was estimated by counting egg fragments 50% in size or greater. The total number of eggs in the clutch was determined by adding the number of hatched eggs to the total number of pipped, depredated, and unhatched eggs. The hatching success rate was calculated by dividing the number of hatched eggs by the total number of eggs. The estimated number of hatchlings released from each nest was determined by subtracting the number of dead hatchlings from the sum of hatched and live pipped eggs. The release rate was then calculated by dividing the number of hatchlings released by the total number of eggs in the clutch. The incubation period was the number of days that had elapsed from egg deposition to the first observed emergence.

Embryonic development surveys were conducted on all unhatched eggs. Every unhatched egg was opened and examined. The percentage of embryonic development in each egg was recorded on a standardized data sheet (Appendix D). The embryonic development categories were based on criteria established by the Caretta Research Project based in Savannah, Georgia (Appendix E).

Once nest inventories and embryonic development surveys were conducted, the nest contents were reburied in the original egg chamber and the nest stakes removed. All hatching data was transferred to a computerized database (MS[®] Excel 97) located at Fort Jefferson, Garden Key.

Exotic plant data:

One of the primary environmental threats to sea turtles nesting within Dry Tortugas National Park is the presence of Australian pine (*Casuarina equisetifolia*) on Loggerhead Key. The trees reduced suitable turtle nesting habitat and impeded the efforts of nesting females and emerging hatchlings. To accompany an ongoing *Casuarina* eradication project on Loggerhead Key, data was collected throughout the nesting season chronicling the negative impacts to sea turtle activity resulting from the downed trees, woody debris and roots. (Appendix G) The type of disturbance was noted for each impacted crawl. Activity was considered impacted if the turtle encountered *Casuarina* at anytime.

Stranding data:

The location and condition of stranded sea turtles found on the beaches or in the waters of DRTO were recorded on standardized data sheets provided by the Sea Turtle Stranding and Salvage Network (STSSN) based in Tequesta, Florida (Appendix F). Each stranded turtle was checked for flipper and living tags, with numbers recorded if possible. Curved length and width measurements of each stranded turtle's carapace were taken. Any other distinguishing marks or items such as the presence of monofilament line, fishing hooks, and injuries to the carcass were noted. Carcasses were photographed when possible. The completed standing forms were sent to the STSSN coordinator with the FFWCC in Tequesta, Florida.

RESULTS³

Nest and False Crawl Data

Park Overview:

During the 2004 nesting season sea turtle activity was observed on six of the seven islands within Dry Tortugas National Park. On Bush, East, Garden, Hospital, Loggerhead, and Long Keys researchers documented 196 nests and 449 false crawls, for a total of 645 sea turtle crawls. In concurrence with past records East Key was home to the majority of the parks turtle activity, with 49.3% of this season's total crawls. The second most active island within the park was Loggerhead Key, hosting 38.8% of the turtle activity, then subsequently Bush Key, Hospital Key, Long Key and Garden Key (Figure 6). No sea turtle activity was observed on Middle Key which was awash most of the season.

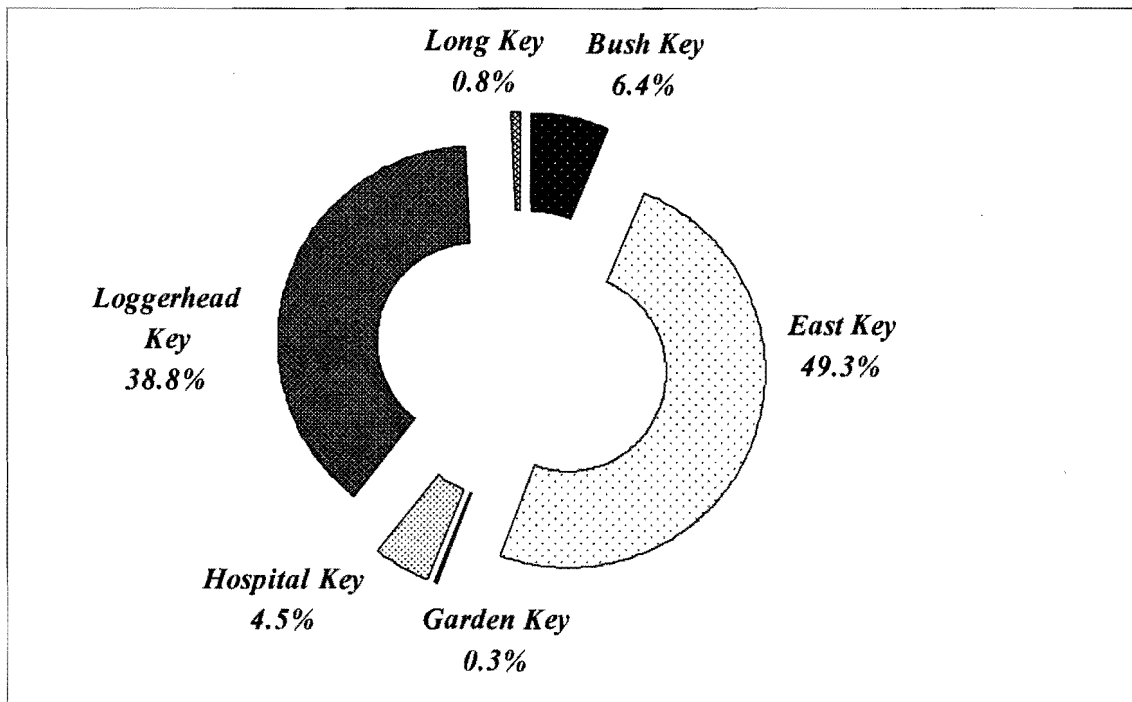


FIGURE 6. Geographic Distribution of Sea Turtle Activity, Dry Tortugas National Park, 2004.

³ The RESULTS section was adapted from Reardon, 2000; Smith, 2001 and Grimshaw, 2003.

One hundred eleven (56.6%) of the 196 nests within DRTO occurred on East Key, with 70 nests (35.7%) on Loggerhead Key, 11 (5.6%) on Bush Key, three (1.5%) on Hospital Key, and one (0.5%) on Garden Key. No nests were recorded on Long and Middle Keys. Out of the 449 false crawls documented, 207 (46.1%) were found on East Key, 180 (40.1%) on Loggerhead Key, 30 (6.7%) on Bush Key, 26 (5.8%) on Hospital Key, 5 (1.1%) on Long Key and one (0.2%) on Garden Key. The greatest nest success occurred on Garden Key, East and Loggerhead keys, respectively (Table 1). During the 2004 nesting season the average nest success for Dry Tortugas National Park was 30.4%.

TABLE 1. 2004 Sea Turtle Crawl Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	41	11	30	26.8%
East Key	318	111	207	34.9%
Garden Key	2	1	1	50.0%
Hospital Key	29	3	26	10.3%
Loggerhead Key	250	70	180	28.0%
Long Key	5	0	5	0.0%
Middle Key	0	0	0	N/A
Park Totals	645	196	449	30.4%

* Nest Success = (number of nests/total activity) x 100

Species Overview:

Six hundred and forty-five turtle crawls were documented belonging to three different species of sea turtles. 458 (71.0%) crawls were identified as being from loggerhead turtles, 184 (28.5%) were identified as green turtle crawls, and 3 (0.5%) were identified as being from leatherback turtles. Of the 196 nests recorded this season, 134 of those nests being identified by track and nest characteristics as belonging to loggerhead turtles. Fifty-nine nests were identified by track and nest characteristics to be from green turtles, and the remaining three were identified as leatherback nests. Of the 449 false crawls, 324 were identified by track and body pit as loggerhead, 125 were identified as green turtle false crawls, and there were no observed leatherback false crawls.

Loggerhead turtles:

Loggerhead turtle activity was documented on six of the seven islands within DRTO this season. Coinciding with past seasons East and Loggerhead keys hosted the majority of the loggerhead activity at a combined 88.1%. The overall nest success for loggerhead turtles was 29.3%. The greatest loggerhead nest success rates took place on Garden (50.0%) and East (32.4%) keys (Table 2).

TABLE 2. 2004 Loggerhead Turtle (*Caretta caretta*) Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	39	10	29	25.6%
East Key	225	73	152	32.4%
Garden Key	2	1	1	50.0%
Hospital Key	18	3	15	16.7%
Loggerhead Key	172	47	125	27.3%
Long Key	2	0	2	0.0%
Middle Key	0	0	0	N/A
Park Totals	458	134	324	29.3%

Nest Success = (number of nests/total activity) x 100

Green turtles:

Green turtle activity was observed on five of the islands within DRTN this season. East and Loggerhead keys besides hosting the majority of loggerhead turtle activity also hosted most of the green turtle activity this season. Overall nest success for green turtles was 32.1%. The greatest nest success rate occurred on Bush Key (50.0%) (Table 3).

TABLE 3. 2004 Green Turtle (*Chelonia mydas*) Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	2	1	1	50.0%
East Key	90	35	55	38.9%
Garden Key	0	0	0	N/A
Hospital Key	11	0	11	0.0%
Loggerhead Key	78	23	55	29.5%
Long Key	3	0	3	0.0%
Middle Key	0	0	0	N/A
Park Totals	184	59	125	32.1%

Nest Success = (number of nests/total activity) x 100

Leatherback turtles:

The 2004 nesting season was the first in the history of the Dry Tortugas Sea Turtle Monitoring Program in which leatherback nesting activity has been recorded. There are also no records of leatherback nesting in DRTO prior to the inception of the monitoring program in 1995. Furthermore, upon checking FWC's records dating back to 1979, this year will be the first recorded leatherback activity in Monroe County, Florida. East Key was the sole island where three crawls were observed and identified as nests. Nesting success for the leatherback turtles was 100.0% on East Key (Table 4).

Table 4. 2004 Leatherback Turtle (*Dermochelys coriacea*) Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	0	0	0	N/A
East Key	3	3	0	100.0%
Garden Key	0	0	0	N/A
Hospital Key	0	0	0	N/A
Loggerhead Key	0	0	0	N/A
Long Key	0	0	0	N/A
Middle Key	0	0	0	N/A
Park Totals	3	3	0	100.0%

*Nest Success = (number of nests/total activity) x 100

Monthly distribution of crawl activity:

The loggerhead nesting season began on April 28, 2004 with a false crawl on Loggerhead Key. The first loggerhead nest was recorded on May 3, 2004 on East Key. The final loggerhead nest documented for the season occurred on August 28, 2003 on East Key. In contrast, the first green turtle activity began on June 15, 2004 with a nest on Loggerhead Key. The final green activity, a nest and a false crawl was documented on September 1, 2004 on East Key.

The monthly distribution of nests and false crawls occurring within Dry Tortugas National Park is shown in Figure 7. The months July and June hosted the majority of sea turtle activity within DRTO with 248 and 231 total crawls respectively. Overall nesting peaked in July this season, with 77 nests. Similarly, in 1998 and 2000 nesting peaked in July, whereas the 1995, 1996, 1997, 1999, 2001, and 2003 seasons nesting peaked in June.

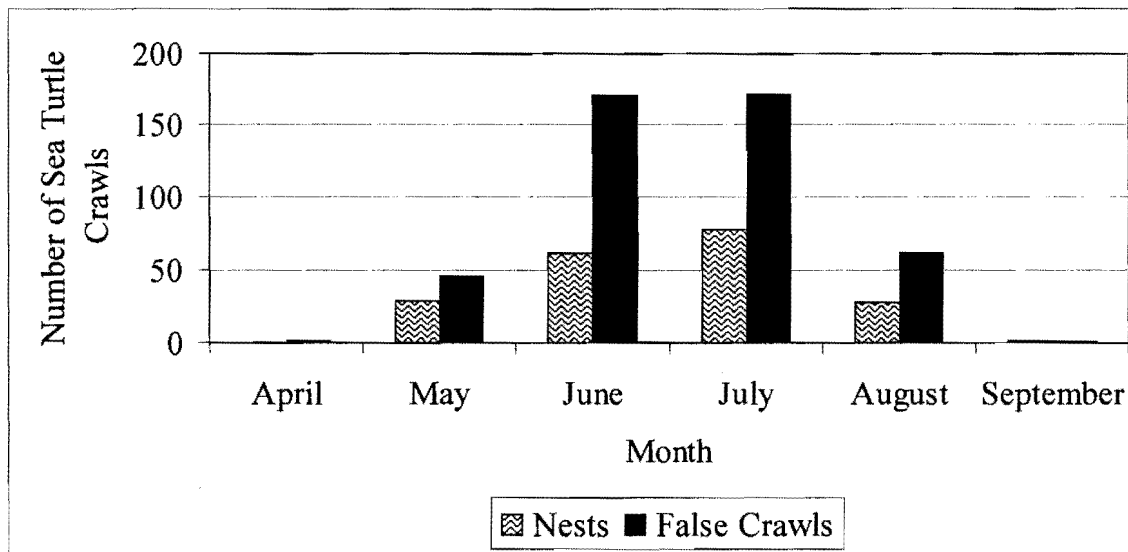


FIGURE 7. Monthly Distribution of Sea Turtle Crawl Activity, Dry Tortugas National Park, 2004.

Loggerhead nesting activity was observed from the end of April through the end of August with activity peaking in June (Figure 8). June has been recorded as the peak month for loggerhead nesting activity each season that daily monitoring has occurred since 1995. Green turtle nesting activity was observed from the beginning of June through the end of August, with activity peaking in July (Figure 9). July marked the height of green turtle activity in 1995, 1996, 1998, 1999, and 2000, while in 1997 and 2003 green turtle activity peaked in August. Leatherback nesting activity was only document during May this season (Figure 10).

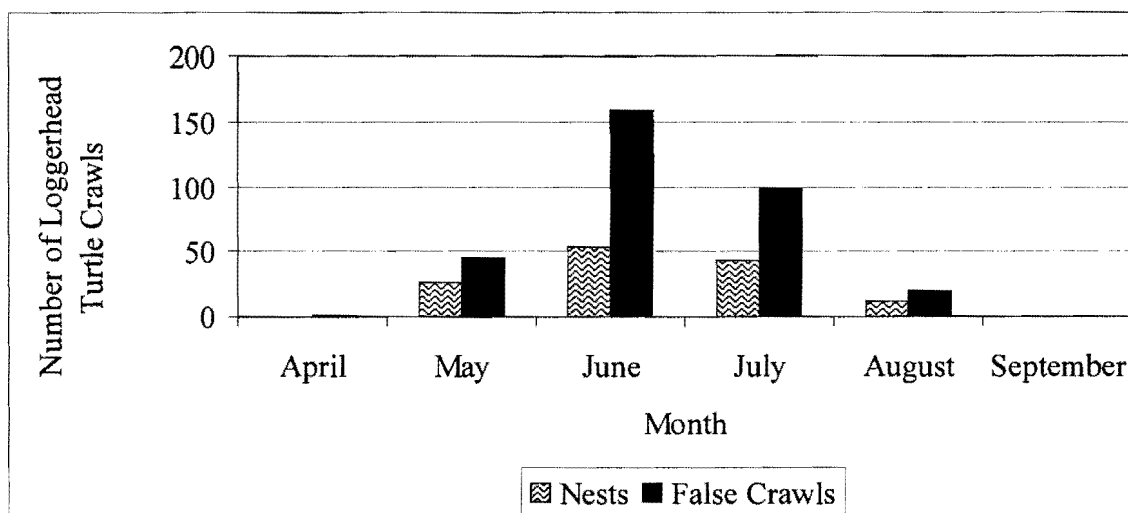


FIGURE 8. Monthly Distribution of Loggerhead Turtle (*Caretta caretta*) Activity, Dry Tortugas National Park, 2004.

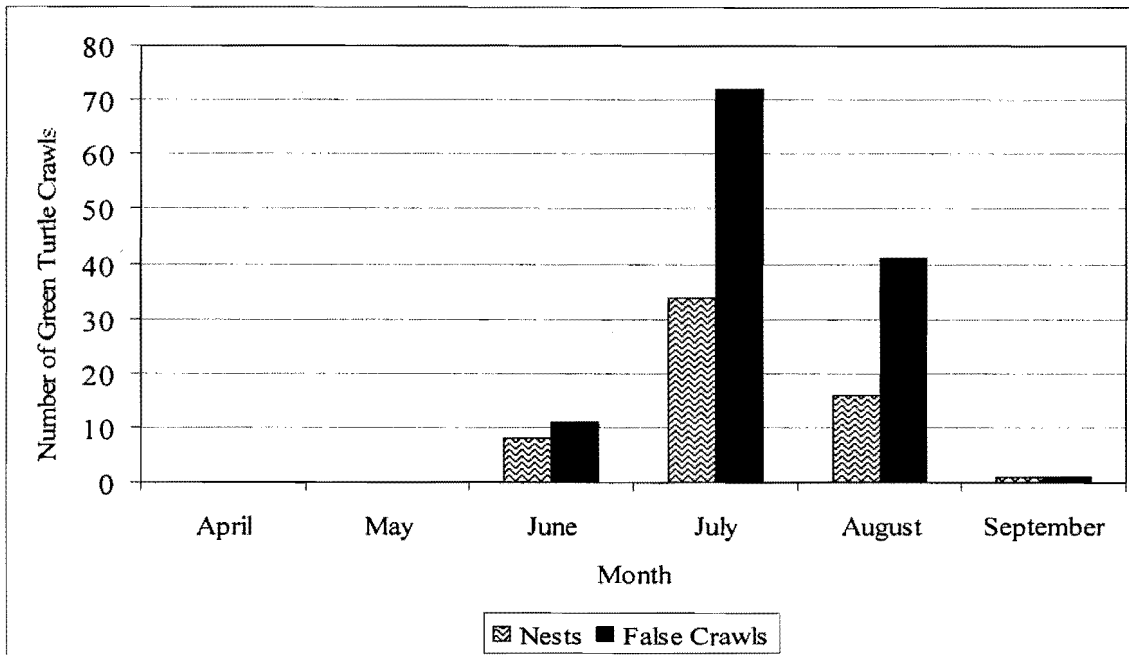


FIGURE 9. Monthly Distribution of Green Turtle (*Chelonia mydas*) Activity, Dry Tortugas National Park, 2004.

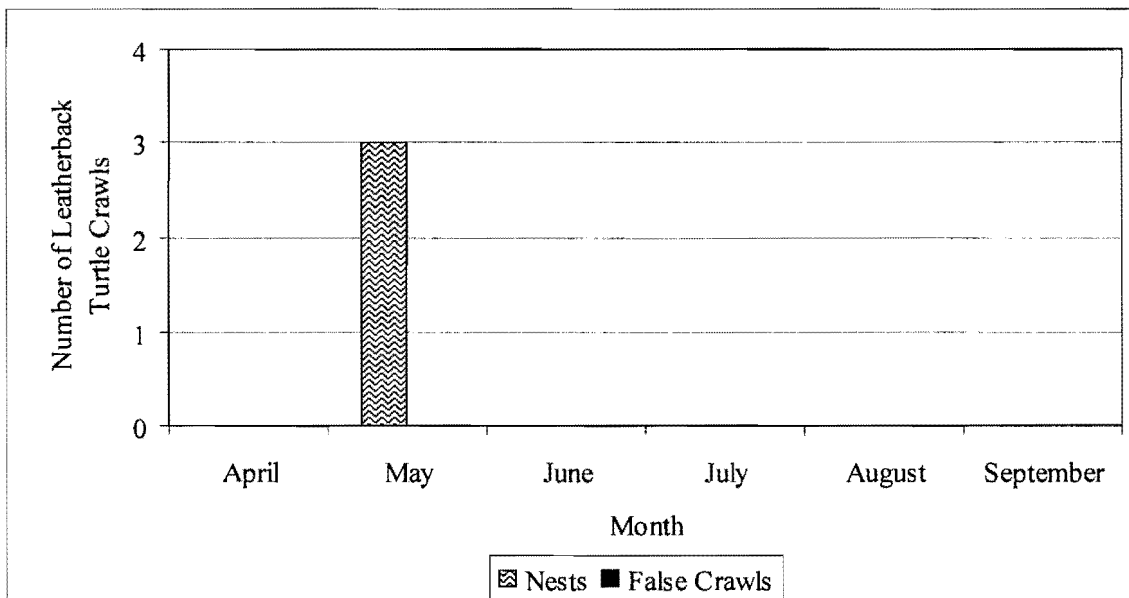


FIGURE 10. Monthly Distribution of Leatherback Turtle (*Dermochelys coriacea*) Activity, Dry Tortugas National Park, 2004.

During the 18 weeks of the 2004 nesting season an average of 6.3 loggerhead nests were documented in Dry Tortugas National Park per calendar week. The three full weeks of June (beginning June 6) hosted 14, 8, and 14 nests. An average of 4.9 green turtle nests were recorded per calendar week though during the 12 weeks of green turtle nesting. The four full weeks in July hosted 5, 10, 11, and 6 nests respectively.

Geographic distribution of crawl activity:

East Key:

Sea turtle crawl activity was documented within every sector of beachfront on East Key (Figure 11). The majority of the 318 crawls observed occurred on the southern end in Sector A which hosted 131 crawls (41.2%). The north and south ends of the island varied greatly throughout the season often containing more or less than the standard 60-meter sector. The least amount of turtle activity with 17 (5.3%) crawls was documented in Sector E. A species examination of crawl distribution on East Key shows that loggerhead (Figure 12), green (Figure 13), and leatherback turtle (Figure 14) nesting activity was concentrated on the south end side of the island.

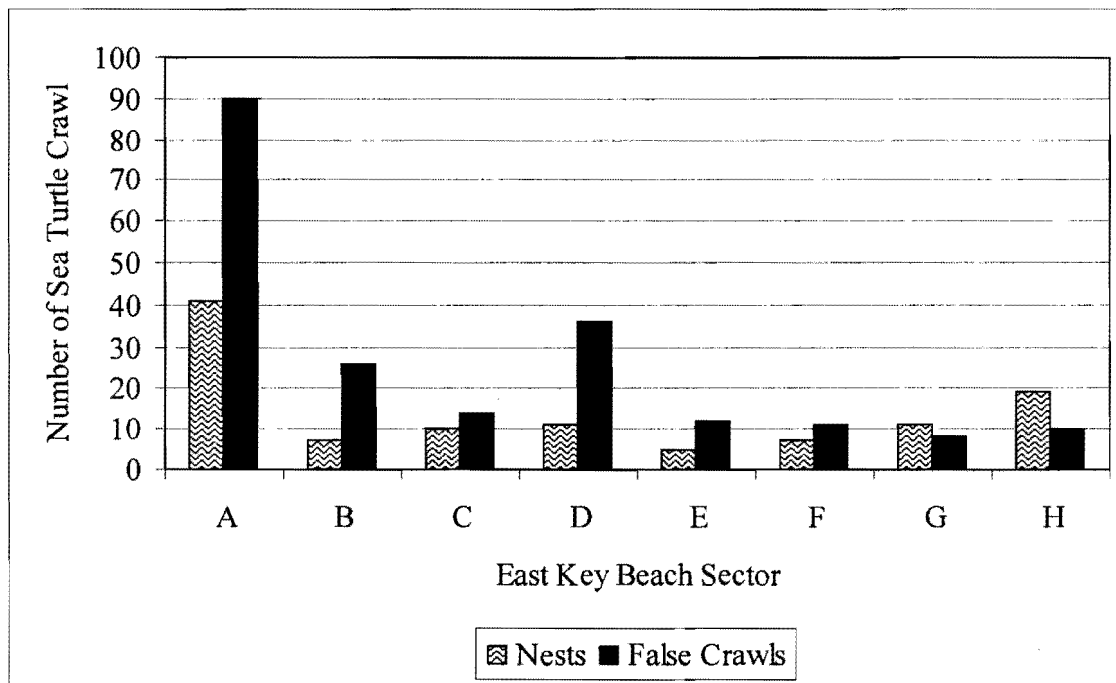


FIGURE 11. Geographic Distribution of Sea Turtle Crawl Activity, East Key, Dry Tortugas National Park, 2004.

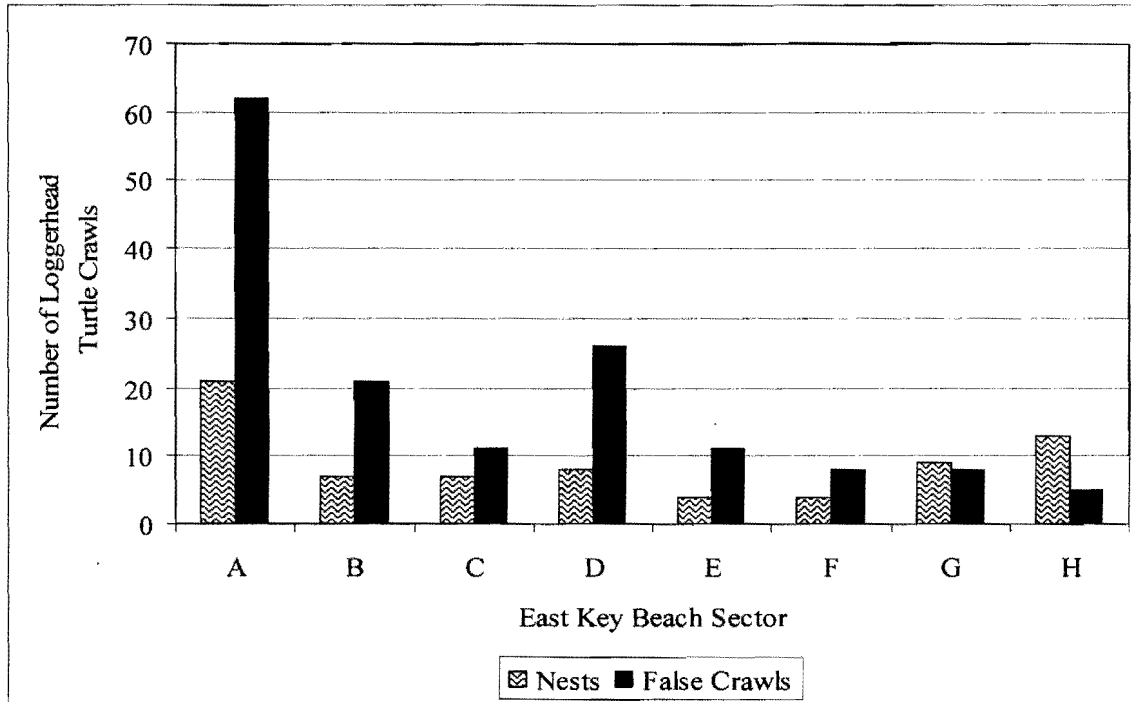


FIGURE 12. Geographic Distribution of Loggerhead Turtle (*Caretta caretta*) Activity, East Key, Dry Tortugas National Park, 2004.

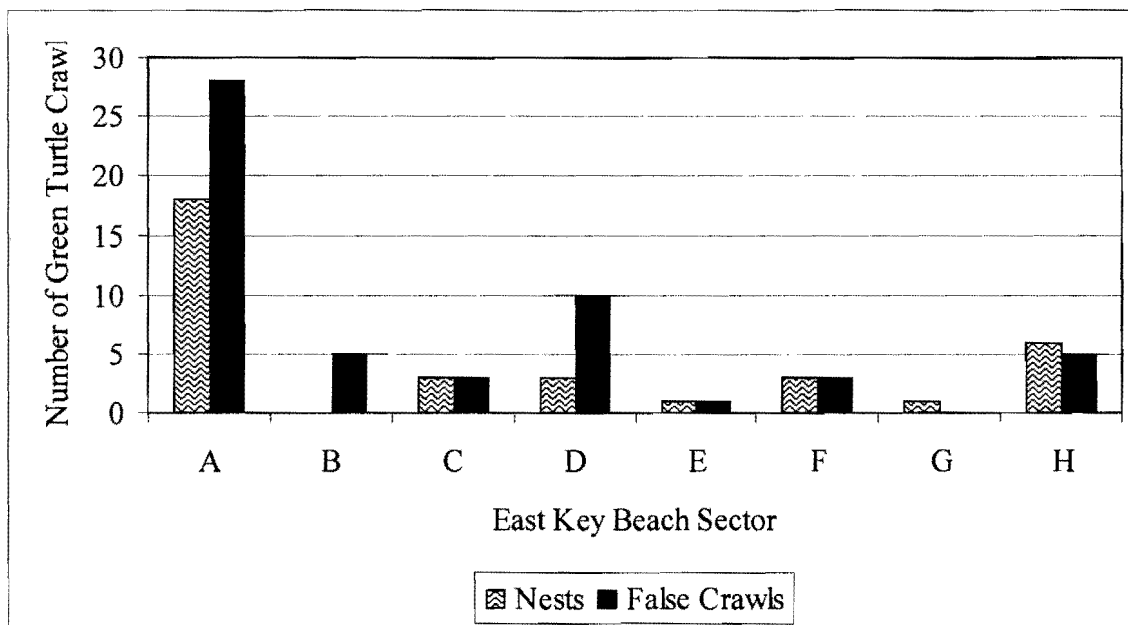


FIGURE 13. Geographic Distribution of Green Turtle (*Chelonia mydas*) Activity, East Key, Dry Tortugas National Park, 2004.

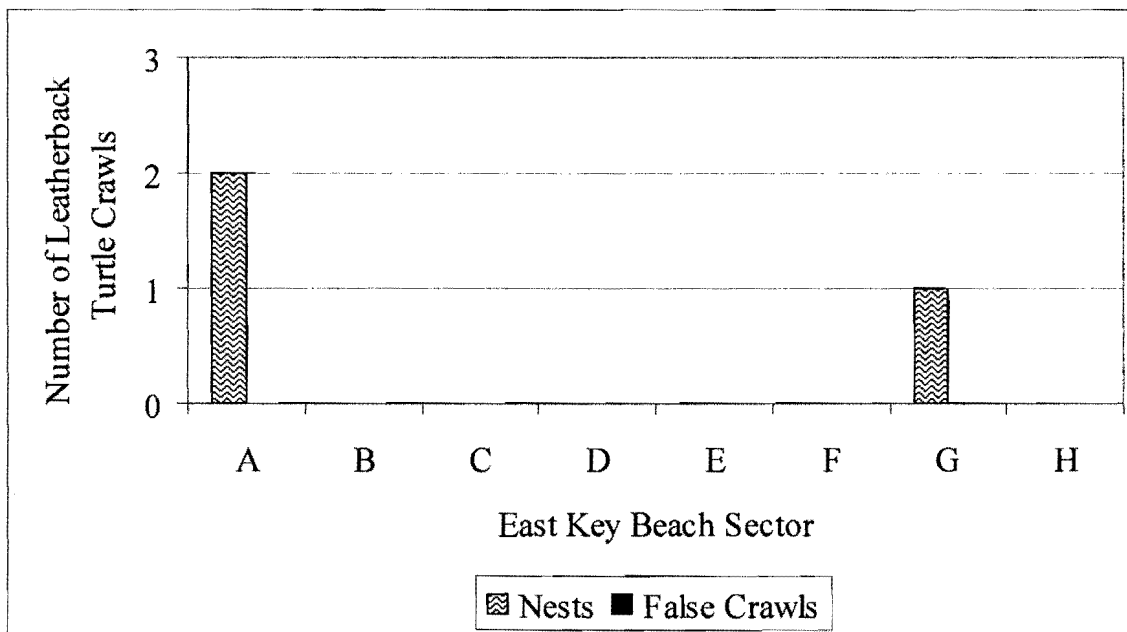


FIGURE 14. Geographic Distribution of Leatherback Turtle (*Dermochelys coriacea*) Activity, East Key, Dry Tortugas National Park, 2004.

Loggerhead Key:

Sea Turtle crawl activity occurred throughout the beachfront on Loggerhead Key (Figure 15). Crawl activity was greatest at the ends of the island. The south end of the island – Sector AA, Z, A – contained 20.4%, 9.6%, 6.0% of the crawl activity, correspondingly. Sectors M and N – the north end – contained 8.0% and 4.4% of the crawl activity, respectively. The greatest number of nests (10) were recorded in Sectors A and AA, while the greatest number of false crawls (41) was recorded in Sector AA. The least amount of nesting activity was documented for the sectors on the northwestern side of Loggerhead Key. Loggerhead turtle activity was documented within all sectors. (Figure 16). The south and north ends hosted the majority of the loggerhead nests, whereas the green turtle nests (Figure 17) were primarily concentrated on southeastern beach and southern end of the island.

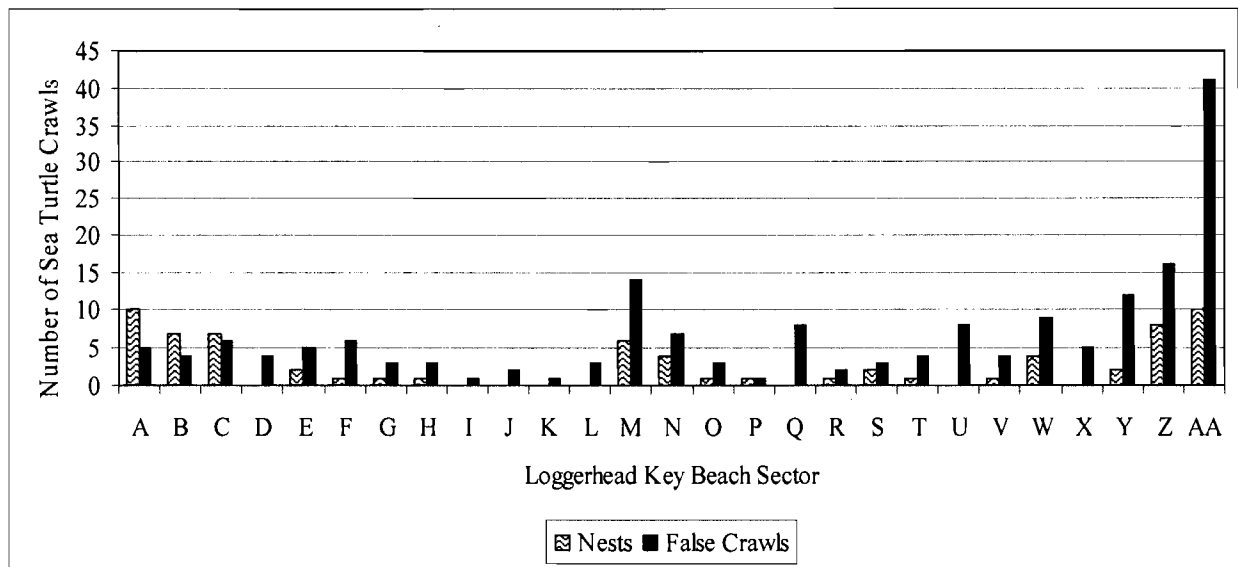


FIGURE 15. Geographic Distribution of Sea Turtle Activity, Loggerhead Key, Dry Tortugas National Park, 2004.

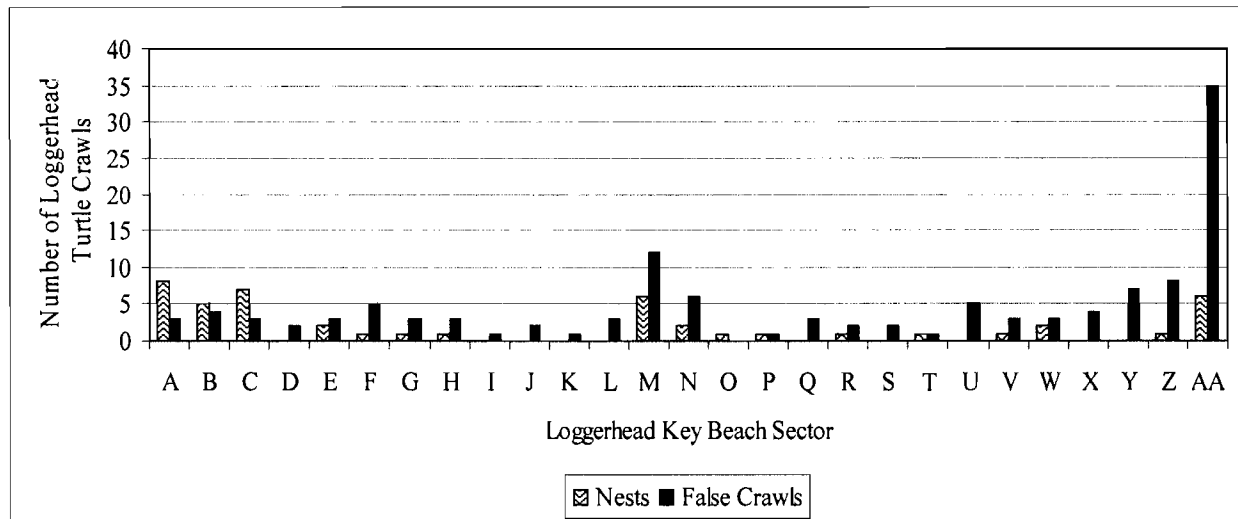


FIGURE 16. Geographic Distribution of Loggerhead Turtle (*Caretta caretta*) Activity, Loggerhead Key, Dry Tortugas National Park, 2004.

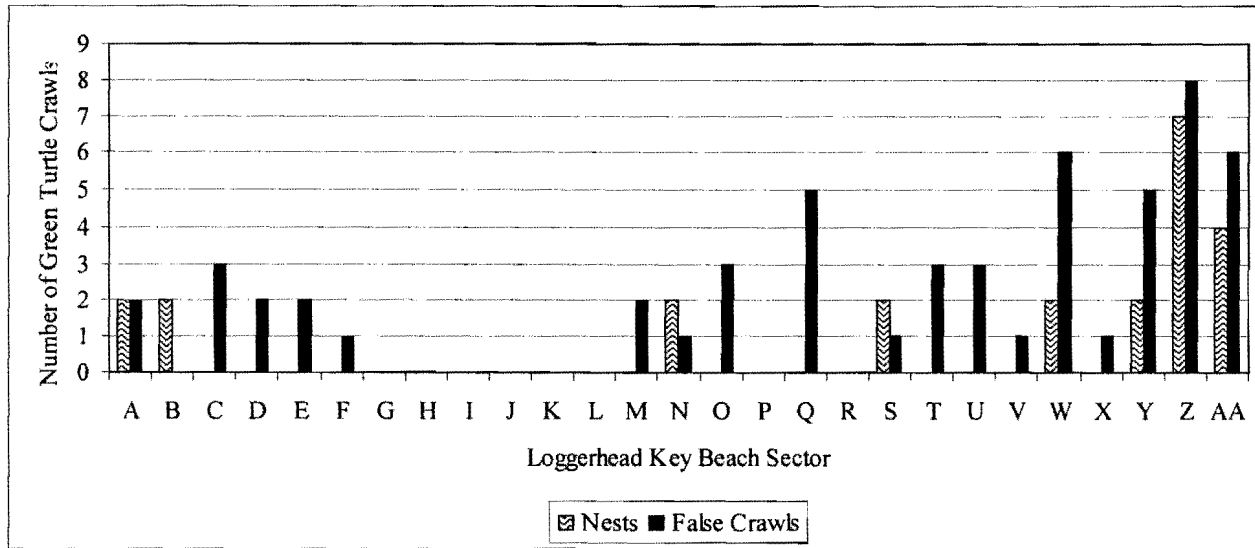


FIGURE 17. Geographic Distribution of Green Turtle (*Chelonia mydas*) Activity, Loggerhead Key, Dry Tortugas National Park, 2004.

Bush Key:

Crawl activity on Bush Key occurred on both the northeastern and southwestern shores. Ten loggerhead nests and 39 false crawls, as well as one green turtle nest and one false crawl were documented. This is the third season that green turtle activity has been observed on Bush Key in the nine seasons of monitoring.

Garden Key:

Loggerhead crawl activity on Garden Key consisted of a single nest. The lone nest was located on the south “swim” beach. One loggerhead false crawl was observed on the north beach. No green turtle activity was documented on Garden Key.

Hospital Key:

Hospital key hosted 3 nests and 15 false crawls identified as being from loggerhead turtles. There were also 11 green false crawls observed.

Long Key:

Crawl activity on Long Key consisted of two loggerhead false crawls and three green false crawls on the rubbly eastern shore north of the magnificent frigatebird rookery. This is the sixth season that sea turtle activity has been documented on Long Key in the past nine seasons of monitoring.

Tidal Impacts and Inundation:

Throughout the 2004 nesting season, 148 nests (75.5%) of the total 196 nests were inundated with seawater as a result of high tides, island water tables, or storm surges. Of these 148 nests 96 (64.8%) were lost to beach erosion, 52 (35.1%) nests were washed over, but remained in tact, and one was inundated to due to seawater intrusion from island water tables. Dry Tortugas National Park was severely impacted by tropical storm

systems this season. On August 13, 2004 Hurricane Charley's path went through DRTO with the eye of the storm passing directly over the park. From Hurricane Charley alone 61 nests were lost to erosion. Effects of the three other hurricanes (Frances, Ivan and Jeanne) that passed over Florida were experienced here at DRTO mainly in the form of moderately high winds and seas.

Erosion claimed 96 (49.0%) of the 196 DRTO nests this season. This is the most nests lost to erosion in the past nine seasons of monitoring; however no other season has been impacted by as many major storms. Similar to previous seasons the north and south ends of both East Key and Loggerhead Key had the greatest amounts of washed and eroded nests. Geographic distribution of nests inundated with seawater on East Key and Loggerhead Key are displayed in Figures 18 and 19, respectively. All nests on Hospital Key were lost to erosion; the island was reduced in size by approximately half after Hurricane Charlie. Bush Key also lost several nests due to Hurricane Charley; this island was completely washed over during the storm.

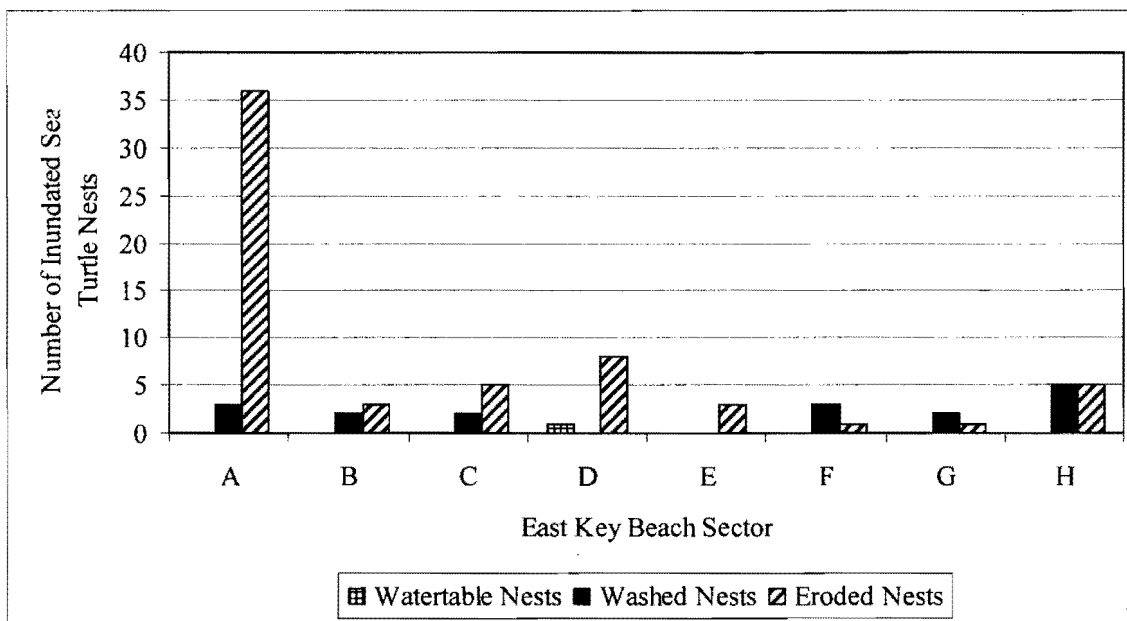


FIGURE 18. Geographic Distribution of Sea Turtle Nests Inundated by Seawater, East Key, Dry Tortugas National Park, 2004.

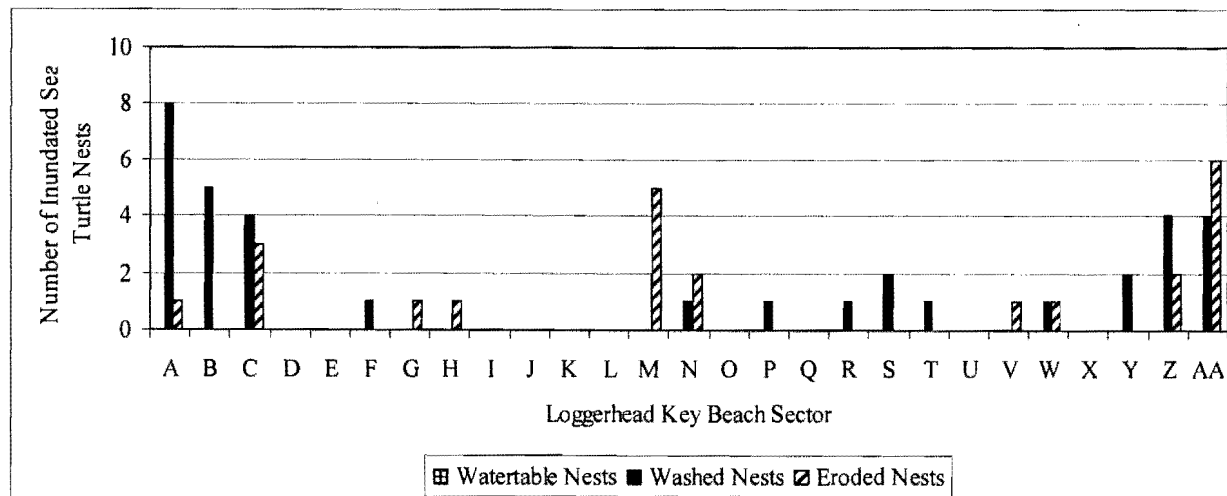


FIGURE 19. Geographic Distribution of Sea Turtle Nests Inundated by Seawater, Loggerhead Key, Dry Tortugas National Park, 2004.

Hatching Data

Park overview:

Clutch contents were examined from 69 (35.2%) of the 196 nests documented during the 2004 nesting season within Dry Tortugas National Park. Of the 127 nests that were not inventoried, 96 nests could not be inventoried as they were eroded by tidal activity or storm surges before excavation. The remaining 31 nests not inventoried had clutch contents that could not be relocated after all of the significant storm events.

From the 69 nests that were inventoried 7,494 eggs were documented, including 1,361 (18.2%) unhatched eggs. Eighty dead hatchlings were found: 76 within nest cavities and 4 post-emergence. Five hundred nineteen eggs (6.9% of total eggs) were identified as being depredated. Four hatchlings were also depredated; however the number of depredated hatchlings remained minimal at 5.0% of the total dead hatchlings. Ghost crabs (*Ocypode quadrata*) were the exclusive source of depredation during the 2004 season.

An estimated 5,457 hatched eggs were excavated, with an estimated 5,386 hatchlings entering the Gulf of Mexico. This yielded an average hatching success of 73.8% (SD=27.0%; $r=0.00-99.2\%$; $n=69$) and an average release rate of 73.0 (SD=25.2%; $r=0.0-99.2\%$; $n=69$). Excluding the 28 nests that were inundated with seawater, the average hatching success increased to 81.3% (SD=22.8%; $r=6.8-97.5\%$; $n=40$), while the average release rate increased to 80.2% (SD=19.4%; $r=6.8-97.5\%$; $n=4$). The average incubation period for nests within Dry Tortugas National Park this season is 54.2 days (SD=4.9; $r=47-71$; $n=46$).

Species overview:

A summary of hatching data is shown in Table 5.

Loggerhead turtles:

Of the 134 loggerhead turtle nests recorded for this season, 53 (39.6%) were inventoried post-emergence. An estimated 5,626 eggs were examined upon excavation. Out of the 5,626 excavated eggs, 835 eggs (14.8%) failed to hatch. Research technicians observed 53 dead hatchlings within nest cavities and 4 post-emergence. Four hundred eggs (7.1% of total loggerhead eggs) were observed to have signs of predation, as well as 4 hatchlings (7.0% of dead loggerhead hatchlings). Depredation occurred solely from ghost crabs this season. An estimated 4,285 eggs hatched with 4,237 loggerhead hatchlings entering the Gulf of Mexico. The average loggerhead hatching success and release rates were 76.9% (SD=25.2%; $r=0.0-99.2\%$; $n=53$) and 76.0% (SD=25.2%; $r=0.0-99.2\%$; $n=53$), respectively. Excluding the 16 nests that were inundated with seawater, the hatching success increased to 80.5% (SD=21.7%; $r=6.8-97.5\%$; $n=37$) and the average release rate increased to 79.4% (SD=21.5%; $r=6.8-96.2\%$; $n=37$). The average loggerhead clutch size was 106.2 eggs (SD=17.0; $r=69-148$; $n=53$). The average incubation time for loggerhead turtle nests during the 2004 season was 54.3 days (SD=5.1; $r=47-71$; $n=34$).

Green turtles:

Of the 59 green turtle nests documented during the 2004 nesting season, 16 were inventoried, recording an estimated 1,868 eggs. A total of 528 eggs (28.3% of total eggs) failed to hatch. Twenty three dead hatchlings were observed within nest cavities. One hundred nineteen eggs (6.4% of total green turtle eggs) were determined to show signs of predation. Ghost crabs were responsible for the documented depredation of green turtle eggs. An estimated 1,172 eggs hatched, with 1,149 hatchlings entering the Gulf of Mexico. The average hatching success and release rates for green turtles were 63.7% (SD=23.8%; $r=22.6-97.4\%$; $n=16$) and 63.0% (SD=23.8%; $r=22.6-97.4\%$; $n=16$), respectively. Excluding the 12 nests that were inundated with seawater, hatching success increased to 73.9% (SD=19.7%; $r=51.2-97.4\%$; $n=4$) and the average release rate increased to 72.7% (SD=20.1%; $r=49.6-97.4\%$; $n=4$). The average green turtle clutch size was 116.8 eggs (SD=28.0; $r=62-173$; $n=16$). The average incubation period for green turtle nests was 53.9 days (SD=4.5; $r=47-64$; $n=12$).

Leatherback turtles:

None of the three leatherback nests were inventoried due to the lack of observing hatchling emergence as well as the removal of all visual characteristics of nest presence or due to erosion by the storms this season.

Table 5. 2004 Summary of Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), and Leatherback Turtle (*Dermochelys coriacea*) Hatching Data, Dry Tortugas National Park.

Data Category	Loggerhead Turtle (<i>Caretta caretta</i>)	Green Turtle (<i>Chelonia mydas</i>)	Leatherback Turtle (<i>Dermochelys coriacea</i>)
Total Nests	134 nests	59 nests	3 nests
Total Nests Inventoried (n)	53 nests	16 nests	0 nests
Total Eggs	5626 eggs	1868 eggs	N/A
Total Unhatched Eggs	835 eggs	528 eggs	N/A
Total Depredation	400 eggs	119 eggs	N/A
Total Eggs Hatched	4285 eggs	1172 eggs	N/A
Average Hatching Success	76.9% (SD=25.2%; r=0.0-99.2%)	63.7% (SD=23.8%; r=22.6-97.4)	N/A
Total entering Gulf	4237 hatchlings	1149 hatchlings	N/A
Average Release Rate	76.0% (SD=25.2%; r=0.0-99.2%)	62.9% (SD=23.8%; r=22.6-97.4)	N/A
Average Incubation	54.3 days (SD=5.1; r=47-71; n=34)	53.9 days (SD=4.5; r=47-64; n=12)	N/A
Average Clutch Size	106.2 eggs (SD=17.0; r=69-148)	116.8 eggs (SD=28.0; r=62-173)	N/A

Geographic distribution of hatching activity:

Bush Key:

Of the 11 nests on Bush Key, three were inventoried. These three nests yielded an estimated 324 eggs, with 103 eggs (31.8%) that failed to hatch. There were 21 eggs were depredated by ghost crabs. An estimated 193 eggs hatched, with 193 hatchlings entering the Gulf of Mexico. The average hatching success and release rates were 58.9% (SD=36.5%; r=21.6-94.4%; n=3) and 58.9% (SD=36.5%; r=21.6-94.4%; n=4), respectively. The incubation period was recorded for only one of the nests on Bush Key, 51.0 days.

East Key:

Of the 111 nests on East Key, 33 were inventoried. They yielded an estimated 2,733 eggs, with 486 eggs (17.8%) that failed to hatch. There were 44 dead hatchlings found within nest cavities and three post-emergence. Three hatchlings (6.4% of total dead hatchlings) and 177 eggs were depredated by ghost crabs. An estimated 2,620 eggs hatched, with 2,693 hatchlings entering in the Gulf of Mexico. The average hatching success and release rates were 79.0% (SD=22.7%; $r=0.0-97.5$; $n=33$) and 77.8% (SD=22.6%; $r=0.0-96.2$; $n=33$), respectively. The average incubation period for nests on East Key was 56.0 days (SD=5.3; $r=47-71$; $n=22$).

Garden Key:

The single nest on Garden Key was inventoried. It yielded an estimated 106 eggs, with 12 eggs (11.3%) that failed to hatch. One dead hatchling was found within the nest cavity. Predation by ghost crabs on 3 eggs was observed. An estimated 86 eggs hatched, with 86 hatchlings entering the Gulf of Mexico. The hatching success and release rates were 81.9% and 81.9%, respectively. The incubation period for the single nest on Garden Key was 48.0 days.

Loggerhead Key:

Of the 70 nests on Loggerhead Key, 32 were inventoried. They yielded an estimated 3,621 eggs, with 762 eggs (21.0%) that failed to hatch. Thirty-one dead hatchlings were found in nest cavities and one post-emergence. One hatchling (3.1% of total dead hatchlings) and 318 eggs were depredated by ghost crabs. An estimated 2,445 egg hatched, with 2,414 hatchlings entering the Gulf of Mexico. The average hatching success and release rates were 69.6% (SD=26.7%; $r=6.8-99.2$; $n=32$) and 69.0% (SD=26.7%; $r=6.8-99.2$; $n=32$), respectively. The average incubation period for nests on Loggerhead Key was 52.8 days (SD=3.8; $r=47-64$; $n=20$).

Embryonic development of unhatched eggs:

Each of the 1,361 unhatched eggs from the 69 inventoried nests was examined for the percentage of embryonic development. The development categories and corresponding numbers of unhatched eggs are shown in Figure 20. Four hundred ninety-one (36.1%) of the unhatched eggs had zero development. Bacterial growth was characterized by the presence of a bright, pinkish-purple coloration, which was observed in 63 (4.6%) of the unhatched eggs. Forty-one (65.1%) of the eggs with bacterial growth were from nests inventoried which had been inundated with seawater.

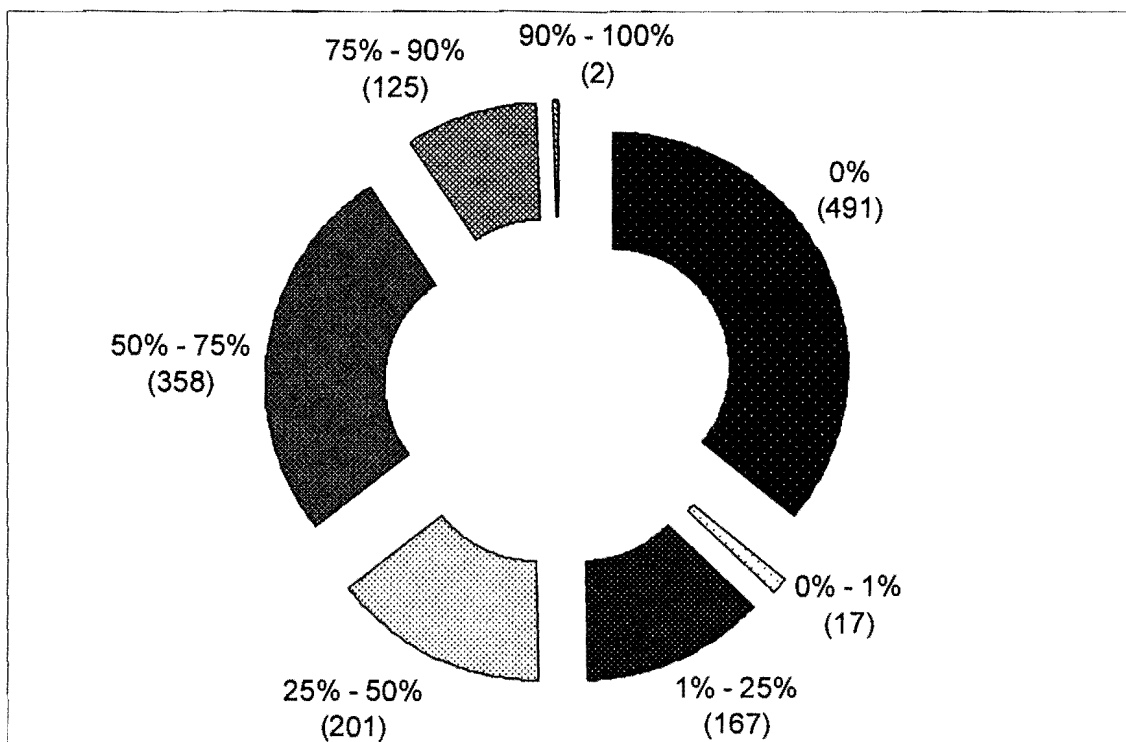


FIGURE 20. Distribution of Embryonic Development in Unhatched Sea Turtle Eggs ($n=1,361$), Dry Tortugas National Park, 2004 [numbers in () indicate unhatched eggs].

Tidal impacts and inundation:

Twenty-eight of the 53 nests inundated with seawater were inventoried and clutch contents recorded. These 28 nests had an average hatching success of 64.5% (SD=27.8%, $r=0.0-99.2\%$; $n=28$). The average incubation period for nests inundated with seawater was 53.6 days (SD=4.4; $r=48-64$; $n=13$). One nest was inundated by seawater intrusion from island water tables. Post-emergence excavations and inventories were conducted during low tides to reduce standing water in the egg chamber. The one nest impacted by island water tables observed a hatching success of 24.2%.

The date of initial washing was recorded for 27 nests. Figure 21 illustrates the embryonic development for these nests, grouped by the number of days prior to the initial inundation. The number of days elapsing from nest deposition to first recorded washing ranged from seven to sixty-five days.

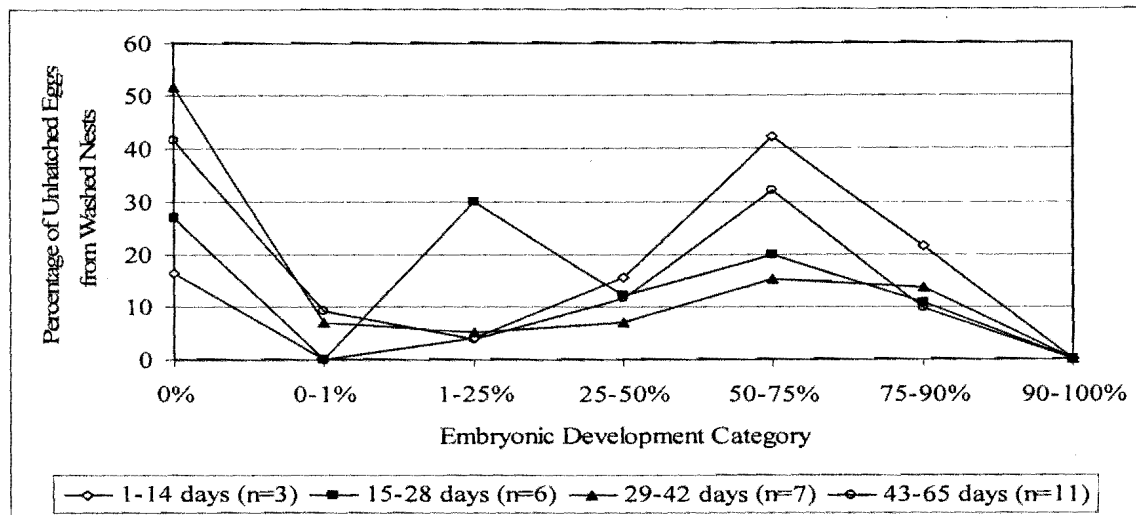


FIGURE 21. Percentage of Unhatched Sea Turtle Eggs per Embryonic Development Category for 27 Nests Inundated with Seawater (grouped by number of days incubation prior to initial inundation), Dry Tortugas National Park, 2004.

Exotic plant data:

Fallen *Casuarina* trees, branches, or roots adversely impacted nineteen crawls on Loggerhead Key this season. This constitutes for 7.6% of the islands sea turtle crawl activity. Three nests (4.3%) and sixteen false crawls (8.9%) were impacted by *Casuarina*. Documentation of each observed impacted crawl is shown in Appendix G.

The majority of the impacted crawls occurred along the western and northern beachfronts. Nine impacted crawls were observed in Sectors B through H. The remaining ten impacted crawls occurred in Sectors L, M, U and V (Figure 22).

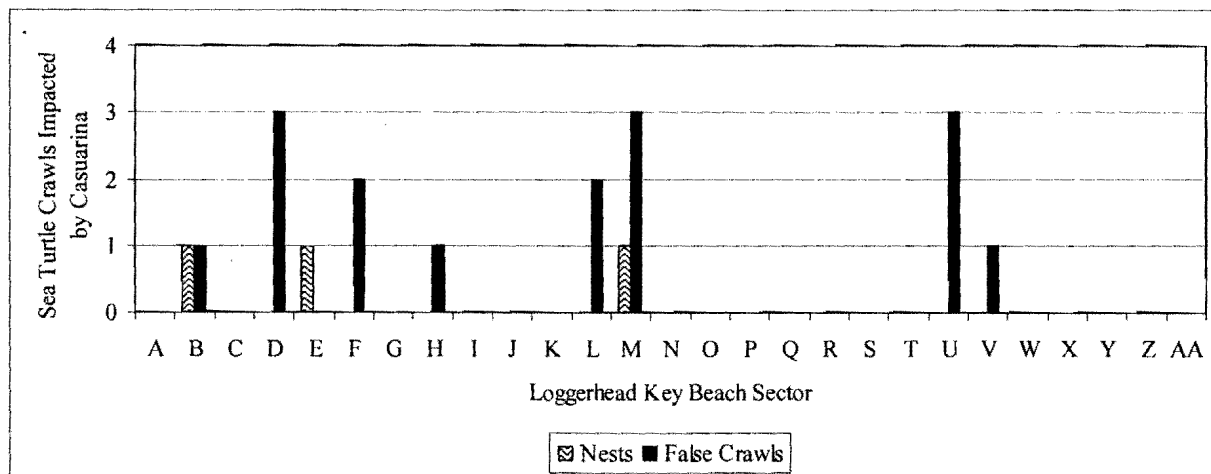


FIGURE 22. Geographic Distribution of Sea Turtle Crawls Impacted by *Casuarina equisetifolia* on Loggerhead Key, Dry Tortugas National Park, 2004.

Stranding data:

To date, six sea turtles, of three different species have been reported as stranded in 2004 (Table 6). This is one less than the number documented during the 2003 season. The first stranding occurred on February 3, 2004. A fresh dead, loggerhead carcass washed ashore on the southeastern shoreline of Loggerhead Key. Curved length of the carapace was 84.5 cm. Once documented the remains were buried on the beach.

The second stranding of the season, on May 29, was discovered on the eastern beach just north of the dock on Loggerhead Key. The fresh dead, immature hawksbill (curved length of carapace = 24.1 cm) was documented and the remains were left on the beach above the high tide line.

The third stranding, was an alive, immature loggerhead turtle (curved length = 17.6 cm), was found in the surf line near the dock at Loggerhead Key on July 6th. The turtle was entangled in a nylon mesh bag. The turtle was retrieved, the bag removed, documented, and then released.

The fourth stranding on July 21 was discovered floating near marker #3 of the Southwest Channel. The moderately decomposed immature, hawksbill (curved length = 31.0 cm) was recovered and transported to Garden Key. Once documented the carcass was buried on the beach near the land-bridge.

The fifth stranding, a moderately decomposed, hawksbill turtle, was found on the east side of Loggerhead Key on October 11. The curved carapace length was 28.0 cm. The carcass was documented and then buried on the beach.

The sixth stranding of the season, on November 8, was found off the southwest beach on Garden Key. The moderately decomposed, large green turtle had a missing left front flipper, with shredded muscle exposed. The remains were documented and buried on the beach near the land bridge.

Table 6. 2004 Sea Turtle Stranding, Dry Tortugas National Park.

Number	Date	Species*	Location	Condition Found
1	02/03/2004	CC	Southeast Beach of Loggerhead Key	Fresh Dead
2	05/29/2004	EI	Floating East of Loggerhead Key, ~150 yds. North of Dock	Fresh Dead
3	07/06/2004	CC	South of Dock at Loggerhead Key, In the Surf Line	Alive, Released
4	07/21/2004	EI	Floating near Marker 3 Southwest Channel	Moderately Decomposed
5	10/11/2004	EI	East side of Loggerhead Key	Moderately Decomposed
6	11/08/2004	CM	Southwest beach of Garden Key	Moderately Decomposed

* CC = *Caretta caretta* (Loggerhead Turtle), CM = *Chelonia mydas* (Green Turtle),
EI = *Eretmochelys imbricata* (Hawksbill Turtle)

DISCUSSION AND RECOMMENDATIONS

With the close of the 2004 season, the Dry Tortugas Sea Turtle Monitoring Program has completed nine years of nesting season monitoring since its inception in 1995. The project was abandoned in 2002, and then reinstated for the 2003 season.

Notably, this season experienced: a) fewer loggerhead nests than the average of years past, b) reduced green turtle nesting, than expected c) the first ever documented leatherback nests for Dry Tortugas National Park and Monroe County and d) the worst hurricane season that has occurred since the beginning of the DTSTMP.

The nesting season began on April 28, 2004, and continued with the last nest recorded on September 1, 2004. The season appeared to start off slower this year, but then picked up by the end of May. Reports around the state have noted that the number of loggerhead, green and leatherback nests has been dramatically lower this year (Wentley, 2004).

Of the 449 total loggerhead crawls only 134 resulted in nests. This is approximately 37% fewer loggerhead nests than the annual average (212.4 nests, 1995-2001) at DRTO. This is the third season in which a noticeable decline in nesting has been observed. The exact causations for the decreases in nesting are unknown. A decline of approximately 15% and 23% was noted for the 2001 and 2003 nesting seasons. A comparison for 2002 cannot be made since data was not collected that season. There have been no known causes for this year's reduction in nesting. Some researchers are suggesting that there may be a downward trend in the population, or at least the nesting population (Wentley, 2004).

There has been speculation as to why loggerhead nesting has declined over the past years. Possible causes lie in environmental causes such as the after affects of the mysterious illness that affected loggerhead turtles not only in the Florida Keys but throughout the state in 2000-2001 or the severe cold water upwelling in 2003.

Data collected since 1995 show trends of great annual variability in green turtle nesting. Small amounts of nesting activity are typically seen in odd-numbered years (1995, 1997, 1999, 2001), with large amounts of nesting in even-numbered years (1996, 1998, 2000) (Reardon, 2000; Smith, 2001). Trends in green turtle nesting appear to be cyclic, with two to three years elapsing between nesting (Van Meter, 1983). This year 59 green turtle nests were documented within DRTO. Because this was an even-year season, a relatively large number of green turtle nests were anticipated. There were fewer nests than expected this year when compared to averages from prior seasons. The past seven seasons of data yield an average of 4.5 nests in odd numbered years, with an average of 75.6 nests recorded in even numbered years. There is a suggested two-year nesting pattern for green turtles within DRTO, with a larger nesting population returning in even numbered years. Similarly, data compiled by Florida Marine Research Institute, suggests that a similar pattern holds true for the entire state of Florida (Witherington & Koeppel, 1999; Meadows, 2000). The decrease in nesting experienced this year and a record number of green nests in 2003 have been seen through out the state. Some scientists believe that the

green turtles may be changing their trend. If data had been collected for the 2002 season, there might possibly be other evidence to help explain what we are observing in nesting.

A minimum approximation of the number of nesting females in DRTO this season can be established by determining the maximum number of nests recorded within a single nesting interval throughout the course of the season (Reardon, 2000). The average loggerhead nesting interval in Florida is 13 days (LeBuff, 1990). This corresponds with a tagging study conducted on East Key in the early 1980s observed an average loggerhead nesting interval of 13.1 days (Williams & Dawson, 1984). A more conservative 10-day interval was used to ensure that no individual nesting female was counted twice (Reardon, 2000). Employing these criteria, it is likely that a minimum of 20 loggerhead turtles utilized park beaches this season.

The interval for green turtle nesting is between 11 and 14 days (LeBuff, 1990). Again, a more conservative 10-day interval was used to determine the minimum number of nesting green turtles. Based on the number of nests observed in a single 10-day period, a minimum of 13 green turtles nested on the beaches within Dry Tortugas National Park this season.

This season marked the first in the history of the DTSTMP that leatherback nesting activity has been documented. While daily nesting surveys only date back to 1995, no other data collected prior to then has documented activity from this species. Similarly, data compiled by the Florida Marine Research Institute shows no documented leatherback activity in Monroe County since 1979. Leatherback nesting is primarily confined to the east coast of Florida and is concentrated in the southeast region; also there are a few records of leatherback nesting activity on the gulf coast in more recent years (Meylan et al, 1995). Other areas where leatherback nesting is regularly observed are on the western coast of Africa, some islands of the Caribbean, and along the gulf coast of Costa Rica. The causation for leatherback turtles to nest within DRTO remains a mystery. In some areas it has been observed that turtles will abandon their natal beaches for other beaches near by, when there is loss of suitable nesting habitat.

The nesting surveys performed for the DTSTMP is the only data collected about the turtles in this area. It has been recently discovered through genetic analysis that the loggerheads nesting within DRTO are a genetically distinct sub-population (Pearce, 2001). Along with this information, the National Marine Fisheries Service has distinguished the Dry Tortugas population of loggerheads, as their own recovery unit. (NMFS & USFWS, 200_). With such distinction this will allow for specialized management decisions to be made regarding the local population. In seasons past there also have been similar studies, looking at the genetics of nesting green turtles from DRTO. While no conclusive evidence has been reported, it could be possible that the local green turtles may indeed be a genetically different sub-population (personnel communication with R. Reardon, 2003). In the future, tagging studies would be an informative addition for determination of actual sizes of DRTO sea turtle populations. Relevant to conservation of these species, since marine turtles exhibit natal homing

behavior, a decimated nesting population in one location may not be replenished by turtles from other areas (Pearce, 2001).

Dry Tortugas National Park was hit hard by hurricanes this season. The first, Hurricane Charley, passed directly over the park. This storm was responsible for the majority of nests lost to erosion, as well as the majority of nests inundated with seawater. In addition to Charley three other Hurricanes (Frances, Ivan, and Jeanne) affected the park producing high winds and surf. This season we experienced a loss of approximately 49% of all nests, while many more were negatively affected by inundation. While our loss was substantial, sea turtles have evolved a strategy to offset these natural events by laying large numbers of eggs and distributing their nests both spatially and temporally (NMFS & USFWS, 200_). Thus rarely is the total annual hatchling production affected by storm-generated beach erosion and inundation (NMFS & USFWS, 200_).

Since its inception in 1995 the Dry Tortugas Sea Turtle Monitoring Program has had a primary goal been to “identify and monitor the temporal and spatial distributions of sea turtle activity. Over the past nine seasons, data has shown insight to patterns of DRTO sea turtle nesting activity:

- 1) East Key and Loggerhead Key have hosted 90% or more of the park’s sea turtle activity each season.
- 2) Loggerhead activity remained fairly stable until 2001, where it is now beginning to slowly decline.
- 3) Green turtle activity is highly variable, recording higher numbers of nests in even-numbered years while recording lower numbers of nests in odd-numbered year.
- 4) Annual loggerhead activity has peaked in June, where green activity typically peaks in July.

A secondary goal of the DTSTMP has been “to identify the natural and anthropogenic threats to sea turtles, their nests and hatchlings, devising means to mitigate these threats.” With this in mind, the following needs to be addressed. As part of the development of a new General Management Plan (GMP) for DRTO, the NPS has published a Final General Management Plan Amendment, Environmental Impact Statement to be used as guidelines until the new GMP is established. It is under these amendments that lie the possibility of increasing threats to sea turtle nests located on the beaches of East Key, unless measures are taken to protect this important nesting ground.

Under the new GMP a central focus is the implementation of a Resource Natural Area (RNA) (NPS, 2000). The boundaries of the proposed RNA align with longitude 82°51’ W, and latitude 24°36’ N encompassing more than 50% of the western side of the park. The preferred alternative will prohibit anchoring, fishing and consumptive activities and also limit non-consumptive activities such as snorkeling and wildlife viewing within the RNA. By strictly regulating or not allowing these activities in the western 50-60% of the park, any visitors wishing to explore the park on their own will have to do so outside of the RNA. This has the potential to increase utilization of the eastern portion of the park,

where the only island open for visitation is East Key. Increased human visitation will further threaten the island's densely distributed sea turtle nests.

Presently, East Key hosts more than 50% of sea turtle activity for DRTO. This island typically receives little visitation, but with implementation of the RNA this may no longer be the case. With the historically significant amount of sea turtle activity on this island and the anticipated ramifications of the proposed RNA, a need for further protection of East Key is imminent. The proposed consequences may warrant a seasonal closure of the island. Closures of this type already exist to protect the avian wildlife on Bush Key. Without protection to this vitally important nesting ground, the GMP may lead to decreased hatching success and eventually to a decrease in nesting volume on East Key due to increased pedestrian traffic.

The future of the Dry Tortugas Sea Turtle Monitoring Program is unstable at best. The DTSTMP is supposed to be included in the goals of the new GMP; however funding continues to be an issue. Due to lack of funding the program did not operate during the 2002 season, consequently important and irreplaceable data was lost. The absence of the program in 2002 season provides complications not only when interpreting data, but also to the consistency and continuity of the program. Hopefully with the installation of the new GMP, there will be firm support and funding allowing the program to continue in future years. The program should be continued – at minimum – for one additional year, at the same scope it has been operating under for the past nine seasons. Thus, bringing the dataset to 10 years so that trends and cycles can be realistically inferred, enabling informed management decisions.

Dry Tortugas National Park provides exceptional nesting habitat, supporting the largest loggerhead and green sea turtle rookeries in the Florida Keys and Monroe County, Florida, respectively (Boykin, 1995; Mansfield & Reardon, 1996; Reardon & Mansfield, 1997; Reardon, 1998, 1999, 2000; Smith, 2001). DRTO is devoid of the many anthropogenic disturbances found on the mainland and nests within the park achieve great hatching success. The DTSTMP has the ability to provide valuable life history data on these endangered and threatened species. Though the project has been primarily focused on monitoring and conservation, the possibility to expand research efforts exists. With continued cooperation and support, along with dedicated personnel the Dry Tortugas Sea Turtle Monitoring Program has the ability to become a premiere sea turtle research program. The relatively untouched resources in this study-site lend themselves well to this prospect. However, it will take a serious commitment on behalf of the National Park Service to ensure the future success of this program.

LITERATURE CITED

- Austin, D.F. 1978. Exotic Plants and their Effects in Southeastern Florida. *Environmental Conservation* 5(1):25-34.
- Bjorndal, K.A., A.B. Meylan, and B.J. Turner. 1983. Sea Turtle Nesting at Melbourne Beach, Florida, I. Size, growth, and reproductive biology. *Biological Conservation* 26:65-77.
- Bowen, B.W. 1994. Letter dated November 17, 1994, to Sandy MacPherson, National Sea Turtle Coordinator, U.S. Fish and Wildlife Service, Jacksonville, Florida. University of Florida, Gainesville, Florida.
- Bowen, B.W. 1995. Letter dated October 26, 1995, to Sandy MacPherson, National Sea Turtle Coordinator, U.S. Fish and Wildlife Service, Jacksonville, Florida. University of Florida, Gainesville, Florida.
- Bowen, B.W., J.C. Avise, J.I. Richardson, A.B. Meylan, D. Margaritoulis, and S.R. Hopkins-Murphy. 1993. Population Structure of Loggerhead Turtles (*Caretta caretta*) in the Northwestern Atlantic Ocean and Mediterranean Sea. *Conservation Biology* 7:834-844.
- Boykin, C.S., 1995. Results of the 1995 nest success evaluation of loggerhead and green sea turtle nests in Dry Tortugas National Park. Dry Tortugas, Monroe County, Florida. National Park Service Unpublished Report. 44p.
- Budlong, R., 1943. The Budlong Report. Fort Jefferson Historic Documents. Dry Tortugas National Park. Dry Tortugas, Florida.
- Davis, J.H., Jr., 1942. The ecology of the vegetation and topography of the sand keys of Florida. *Papers from the Tortugas Laboratory*, 33:176-194.
- Dawson, R.H. and D.E. Williams, 1985. Project completion report: Results of the 1985 sea turtle nesting survey at Fort Jefferson National Monument, Dry Tortugas, Florida. USFWS Endangered Species Field Station, Jacksonville, Florida. National Park Service. Southeast Regional Office. Atlanta, Georgia.
- Dodd, C.K., Jr. 1988. Synopsis of the Biological Data on the Loggerhead Sea Turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service, Biological Report 88(14). 110p.
- Encalada, S.E., K.A. Bjorndal, A.B. Bolten, J.C. Zurita, B. Schroeder, E. Possardt, C.J. Sears, and B.W. Bowen. 1998. Population Structure of Loggerhead Turtle (*Caretta caretta*) Nesting Colonies in the Atlantic and Mediterranean Regions as Inferred from mtDNA Control Region Sequences. *Marine Biology* 130:567-575.

- Epperly, S.P. and W.G. Teas. 2002. Turtle Excluder Devices – Are the Escape Openings Large Enough? *Fishery Bulletin* 100(3):466-474.
- Florida Fish and Wildlife Conservation Commission, 2002. Marine Turtle Conservation Guidelines, Revised April 2002. Bureau of Protected Species Management. Tequesta Field Station, Tequesta, Florida.
- Francisco A.M., K.A. Bjorndal, A.B. Bolten, R. Reardon, M. Lamont, J. Foote, and B.W. Bowen. Stock Structure and Nesting Site Fidelity in Florida Loggerhead Turtles (*Caretta caretta*) Resolved with mtDNA Sequences. Submitted.
- Gifford, J.C., 1934. The Keys and Glades of South Florida. Books Inc. New York, New York.
- Grimshaw, K.L. 2003. Annual Report – 2003 Season. Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Monroe County, Florida. National Park Service Unpublished Report. 44p.
- Hanson, J., T. Wibbels, and R.E. Martin. 1998. Predicted Female Bias in Sex Ratios of Hatchling Loggerhead Sea Turtles from a Florida Nesting Beach. *Canadian Journal of Zoology* 76(10):1850-1861.
- Holder, E., 1892. Personal Diary. The Californian Illustrated. Fort Jefferson Historic Documents. Dry Tortugas National Park. Dry Tortugas, Florida.
- LeBuff, C.R., 1990. The Loggerhead Sea Turtle in the Eastern Gulf of Mexico. *Caretta Research Incorporated*. Sanibel Island, Florida.
- Mansfield, K.L. and R.T. Reardon, 1996. Annual Report – 1996 Season. Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Monroe County, Florida. National Park Service Unpublished Report. 36p.
- Mansfield, K.L. and R.T. Reardon, 1997. Manual: Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Monroe County, Florida. National Park Service. 100p.
- Marcus, S.J., and C.G. Maley. 1987. Comparison of Sand Temperatures between a Shaded and Unshaded Turtle Nesting Beach in South Florida. (abstract) Seventh Annual Workshop on Sea Turtle Biology and Conservation, February 1987, Wekiva Springs State Park, Florida.
- Meadows, K., 2000. "Turtle have a fondness for even-numbered years, statistics show." Associated Press. *Florida Keys Keynoter*. August 23, 2000.

- Meylan, A.B., B. Schroeder, A. Mosier. 1995. Sea Turtle Nesting Activity in the State of Florida 1979-1992. Florida Marine Research Publications Number 52. Florida Marine Research Institute, St. Petersburg, Florida.
- National Marine Fisheries Service. 2001. Stock Assessments of Loggerhead and Leatherback Sea Turtles and an Assessment of the Impact of the Pelagic Longline Fishery on the Loggerhead and Leatherback Sea Turtles of the Western North Atlantic. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-455.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991a. Recovery Plan for the U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington D.C. 64p.
- National Marine Fisheries Service and U.S. Fish and Wildlife Service. 200_. Recovery Plan for the North Atlantic population of Loggerhead Turtle (*Caretta caretta*). Second Revision. National Marine Fisheries Service. Washington D.C. _p + appendices.
- National Oceanic and Atmospheric Administration, 1995. Florida Keys National Marine Sanctuary Draft Management Plan/Environmental Impact Statement. Volume 2: Management Plan. NOAA Sanctuaries and Reserves Division.
- National Park Service, 2003. Park Regulations. Dry Tortugas National Park. Dry Tortugas, Florida. NPS, DOI.
- National Park Service, 2000. Dry Tortugas National Park General Management Plan Amendment/Environmental Impact Statement. Dry Tortugas National Park, Monroe County, Florida. NPS, DOI.
- National Park Service. Photograph Collection. Dry Tortugas National Park. Dry Tortugas, Florida.
- National Research Council, 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press. Washington, DC.
- Parsons, J.J. 1962. The Green Turtle and Man. University of Florida Presses, Gainesville, Florida. 126p.
- Pearce, A.F. 2001. Contrasting Population Structure of the Loggerhead Turtle (*Caretta caretta*) using mitochondrial and nuclear DNA markers. M.S. thesis. University of Florida, Gainesville, Florida. 71p.
- Pritchard, P.C.H. and P. Trebbau. 1984. Family Dermochelyidae, *Dermochelys coriacea*. In the Turtles of Venezuela, Society for the Study of Amphibians and Reptiles, Contribution to Herpetology No. 2:249-267.

- Reardon, R. T. 2003. Personnel communication. 22 November 2003. Key West, FL.
- Reardon, R.T., 2000. Annual Report – 2000 Season. Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Monroe County, Florida. National Park Service Unpublished Report. 49p.
- Reardon, R.T., 1999. Annual Report – 1999 Season. Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Monroe County, Florida. National Park Service Unpublished Report. 46p.
- Reardon, R.T., 1998. Annual Report – 1998 Season. Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Monroe County, Florida. National Park Service Unpublished Report. 41p.
- Reardon, R.T. and K.L. Mansfield, 1997. Annual Report – 1997 Season. Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Monroe County, Florida. National Park Service Unpublished Report. 37p.
- Robertson, W.B. Jr., 1964. The Terns of the Dry Tortugas. Bull. Fla. St. Mus. 8(1): 1-95.
- Smith, C.D., 2001. Annual Report – 2001 Season. Dry Tortugas National Park Sea Turtle Monitoring Program. Dry Tortugas, Florida. 36p.
- Starbird, C.H., A. Baldrige, and J.T. Harvey. 1993. Seasonal Occurrence of Leatherback Sea Turtles (*Dermochelys coriacea*) in the Monterey Bay Region, with notes on other sea turtles, 1986-1991. California Fish and Game 79:54-62.
- Stoddart, D.R. and F.R. Fosberg, 1981. Topographic and floristic change, Dry Tortugas, Florida, 1904-1977. Atoll Research Bulletin No. 253. The Smithsonian Institution. Washington, DC.
- Stone, P.A., 1993. Dry Tortugas and South Florida geological development and environmental succession in the human era. Dry Tortugas National Park Submerged Cultural Resources Assessment. L. E. Murphy, editor. Submerged Cultural Resource Unit, NPS. Southwest Cultural Resource Center. Southwest Region, NPS, DOI.
- Van Meter, V.B., 1983. Florida's Sea Turtles. Florida Power and Light Company. Miami, Florida.
- Wentley, Suzanne. "Sea Turtle Nests may be 20-Year Low." TCPalm Online. 7 July 2004. <http://www.tcpalm.com/tcp/local_news/article/0,1651,TCP_16736_3017169,00.html>.

Williams, D.E. and R.H. Dawson, 1984. Project completion report: Sea turtle monitoring study, Fort Jefferson National Monument, Dry Tortugas, Florida. USFWS Endangered Species Field Station, Jacksonville, Florida. National Park Service. Everglades National Park, Homestead, Florida.

Witherington, B.E. and C.M. Koeppel, 1999. Florida Marine Research Institute Presentation: "Sea Turtle Nesting in Florida, USA, During the Decade 1989-1998: An Analysis of Temporal Trends, Spatial Shifts, and Nest-Survey Strategy." The 19th Annual Symposium on Sea Turtle Biology and Conservation, South Padre Island, Texas. March 4, 1999.

APPENDIX A

Dry Tortugas National Park Island Physiography: Bush Key, East Key, Garden Key, Hospital Key, Loggerhead Key, Long Key, and Middle Key.

The following island descriptions have been adapted from Davis, 1942 and Boykin, 1995.

Bush Key: Approximately 8 hectares (20 acres) in size, Bush Key is host to native plant species such as sea purslane (*Sesuvium portulacastrum*), bay cedar (*Suriana maritima*), and sea lavender (*Argusia gnaphlodes*). Two stands of red and black mangrove (*Rhizophora mangle* and *Avicennia germinans*) are also present on the island. A sand spit extends westward forming a land bridge that connects to Garden Key, and a coralline rubble ridge extends eastward and connects with Long Key.

East Key: Ranging in size from nine to 3.6 – 4.8 hectares (9 - 12 acres), East Key is dominated by sea lavender, native beach-berry (*Scaevola plumieri*), bay cedar, sea oats (*Uniola paniculata*), dune elder (*Iva imbricata*), sandbur (*Cenchrus spp.*), sea purslane, and railroad vine (*Ipomea pes-caprae*). East Key fluctuates in size and shape seasonally, but it has maintained a dune plateau of approximately one meter (3 ft.) in elevation.

Garden Key: Approximately 6.4 hectares (16 acres) in size, Fort Jefferson encompasses all but two hectares (5 acres) of Garden Key. Beaches extend from the northeast shore east and south towards the southwest shore and are punctuated by human-made structures and development. These beaches erode and accrete seasonally and have been altered by dredging operations. In December of 2000 an isthmus connected Garden Key to Bush Key. Presently the islands of Garden and Bush keys remain connected, and vegetation has covered about 50% of the isthmus. Numerous exotic plant species may be found throughout this key.

Hospital Key: This island is a small, shifting sandbar varying in size from 0.2 to 0.4 hectares (0.5 – 1 acre). It is estimated that Hospital Key has an elevation of 0.5 meters (1.5 ft.) and is three quarters surrounded by indurated beach rock. A small patch of sea purslane is present on the highest point of the island. Hospital Key is very dynamic, often completely awash during tropical storms.

Loggerhead Key: Approximately 12 hectares (30 acres) in size, Loggerhead Key is the largest and highest island – approximately 1.25 to 1.75 meters (4 – 6 ft.) in elevation. Beach rock flanks the east central and western shores where the rock is exposed at low tide. Until 1998, the dominant vegetation was Australian pine (*Casuarina equisetifolia*), with prickly pear cactus (*Opuntia stricta*), spider lily (*Hymenocallis latifolia*), Spanish bayonet (*Yucca aloifolia*), and sisal (*Agave spp.*) growing in the under story of these trees. The *Casuarina* has been removed as part of an ongoing exotic species management program. The east and west shores of Loggerhead Key are eroding and accreting seasonally, with sand spits forming and shifting on the south and north tips of the island.

APPENDIX A: continued

Long Key: Located east of Bush and Garden keys, Long Key is approximately 0.4 hectares (1 acre) in size and is composed of coralline rubble. First described as a small, Low-lying shoal, it now has several dune-like ridges of up to one meter (3 ft.) in elevation. A red mangrove stand occupies the southwest region of the island.

Middle Key: This low, crescent shaped sand bar located between East and Hospital keys is primarily awash during the summer months. Due to frequent inundation, Middle Key is unsuitable for vegetative growth.

APPENDIX B

CRAWL#: _____

DATE: _____

NEST#: _____

TIME: _____

DRY TORTUGAS NATIONAL PARK 2004 SEA TURTLE NESTING SURVEY

NAME: _____

PACES/100 meters: _____

ISLAND: _____

BEACH (S,W,NE,etc.): _____

CRAWL TYPE (circle one):

False Crawl

Nest

Undetermined

SPECIES (circle one):

Loggerhead

Green

Hawksbill

Leatherback

Undet.

COMMENTS:

DEPREDATION (circle one):

Total

Partial

None

NUMBER OF EGGS DEPREDATED (count shells 50% and greater): _____ COMMENTS:

LOCATION ON BEACH: (CHANGE UNITS IF PACING DISTANCES)

NEAREST MARKER NUMBER: ^A _____ NEXT NEAREST MARKER: ^B _____

DIRECTION OF CRAWL FROM MARKER: A: _____ B: _____

DISTANCE FROM MARKER TO CRAWL: A: _____ m B: _____ m

DISTANCE FROM HIGH TIDE LINE: _____ m

CRAWL WIDTH: _____ m

CRAWL DIAGRAM:

STAKE#:

STAKE#:

REMARKS:

APPENDIX C

NEST#: _____

Dry Tortugas National Park 2004 Nest Inventory

NAME: _____

TIME OF INVENTORY: _____

ISLAND: _____

BEACH (S,W,NE,etc.): _____

NEST DATA:

NEST DATE: _____

CHECK DATE (+45 DAYS): _____

EMERGENCE DATE: _____

EXCAVATION DATE: _____

NEST COVER (circle one): Full sun Partial shade Full shade

DEPREDAION (circle one): Yes No

EXCAVATION DATA:

SPECIES (circle one): Loggerhead Green Hawksbill Leather back Undetermined

A) TOTAL EGGSHELLS (>50%): _____

B) LESS: LIVE HATCHLINGS INSIDE NEST: _____

C) LESS: DEAD HATCHLINGS INSIDE NEST: _____

D) EQUALS: TOTAL HATCHLINGS EMERGED (A-B-C): _____

HATCHLINGS OUTSIDE NEST: E) LIVE: _____ F) DEAD: _____

G) TOTAL HATCHLINGS ASSUMED TO ENTER THE GULF (A-C-F+H): _____

H) LIVE PIPPED EGGS: _____

I) DEAD PIPPED EGGS: _____

J) DEPREDATED EGGS: _____

K) UNHATCHED EGGS IN NEST: _____

L) TOTAL EGGS EVALUATED IN NEST (A+H+I+J+K): _____

HATCHING SUCCESS (100*A/L): _____ % RELEASE RATE (100*G/L): _____ %

INCUBATION PERIOD: _____ DAYS

REMARKS:

APPENDIX D

Dry Tortugas National Park 2004 Development Survey

Name: _____

Date of Survey: _____

Nest Number: _____

Total Eggs in Nest: _____

Unhatched Eggs: _____

% Dev.	0%	0 - 1%	1 - 25%	25- 50%	50- 75%	75- 90%	90-100%
Tally							
Total							

Total Pipped	Number Depredated	Total Bacteria (Pink)
Live: Dead:		

(3) *Chelonia mydas* _____

Washed _____

Water Table

(3) *Dermochelys coriacea*_____

APPENDIX E

The Criteria for Determining Embryonic Development in Unhatched Eggs

Each unhatched egg must be opened and examined. The degree of embryonic development is based on the following criteria:

0% Development: Presence of a plain yellow yolk; if decomposing, it may have a scrambled egg or cottage cheese-like appearance.

0 to 1% Development: The presence of blood spots only.

1 to 25% Development: The presence of blood spots with surrounding white mass; possibly the presence of small pin-sized eye spot; a turtle shaped embryo up to one quarter the size of a normal hatchling.

25 to 50% Development: These embryos will be one quarter to one half the size of a normal hatchling. These embryos will be small fully formed turtles attached to a yolk sack larger than the embryo.

50 to 75% Development: These embryos will be one half to three quarters the size of a hatchling. Yolk sacks will be slightly smaller than the embryo.

75 to 90% Development: Embryos will appear more than three quarters the size of a hatchling. Yolk sacks will be smaller than the embryo; however, a full sized embryo will still have a relatively large yolk sack attached.

90 to 100% Development: Embryo will be full sized with little to no yolk sack.

The criteria used by the Caretta Research Project (4405 Paulsen St., Savannah, Georgia 31405) for determining the degree of embryonic development in unhatched loggerhead sea turtle eggs is based on the following papers:

Yntema, C.L. & N. Mrosovsky, 1980. Sexual differences in hatchling loggerheads (*Caretta caretta*) incubated at different controlled temperatures. *Herpetologica* (1): 33-36.

McGehee, M.A., 1979. Factors affecting the hatchling success of loggerhead sea turtle eggs. MS Thesis, University of Central Florida. 252p.

Maloney, J.E. et al., 1990. The environment for the development of the embryonic loggerhead turtle (*Caretta caretta*) in Queensland. *Copeia* 1990 (2): 378-387.

APPENDIX F

Sea Turtle Stranding and Salvage Network Report Form.

SEA TURTLE STRANDING AND SALVAGE NETWORK – STRANDING REPORT

OBSERVER'S NAME / ADDRESS / PHONE: First _____ M.I. _____ Last _____ Affiliation _____ Address _____ Area code/Phone number _____	STRANDING DATE: Year 20__ Month __ Day __ Turtle number by day __ __ State coordinator must be notified within 24 hrs; this was done by ☐ phone (561)875-5407 ☐ email ☐ fax (561)743-6228 ☐ FWC Turtle Pager 1-800-241-4853 ID#274-4867
--	---

SPECIES: (check one)

☐ CC = Loggerhead
☐ CM = Green
☐ DC = Leatherback
☐ EI = Hawksbill
☐ LK = Kemp's ridley
☐ UN = Unidentified

Check Unidentified if not positive. Do Not Guess.

Photos taken? ☐ Yes ☐ No
 Species verified by state coordinator? ☐ Yes ☐ No

SEX: (check one)

☐ Immature, undetermined
☐ Female ☐ Male

How was sex determined?
☐ Necropsy
☐ Tail length (adult only)
 Length of tail beyond carapace _____ cm / in

STRANDING LOCATION: ☐ Offshore (Atlantic or Gulf beach) ☐ Inshore (bay, river, sound, inlet, etc.)
 State _____ County _____
 Descriptive location (be specific) _____
 Latitude _____ Longitude _____

CONDITION: (check one)

☐ 0 = Alive
☐ 1 = Fresh dead
☐ 2 = Moderately decomposed
☐ 3 = Severely decomposed
☐ 4 = Dried carcass
☐ 5 = Skeleton, bones only

FINAL DISPOSITION: (check one)

☐ 1 = Left on beach where found; painted? ☐ Yes* ☐ No(5)
☐ 2 = Buried: ☐ on beach / ☐ off beach;
 carcass painted before buried? ☐ Yes* ☐ No
☐ 3 = Salvaged: ☐ all / ☐ part(s), what/why? _____
☐ 4 = Pulled up on beach/dune; painted? ☐ Yes* ☐ No
☐ 6 = Alive, released
☐ 7 = Alive, taken to rehab. facility, where? _____
☐ 8 = Left floating, not recovered; painted? ☐ Yes* ☐ No
☐ 9 = Disposition unknown, explain _____
**If painted, what color?* _____

TAGS: Contact state coordinator before disposing of any tagged animal!!
 Flipper tags present? ☐ Yes ☐ No
 Check all 4 flippers. If found, record tag number(s) / tag location / return address _____

PIT tag scan? ☐ Yes ☐ No
 If found, record number / tag location _____

Coded wire tag scan? ☐ Yes ☐ No
 If positive response, record location (flipper) _____

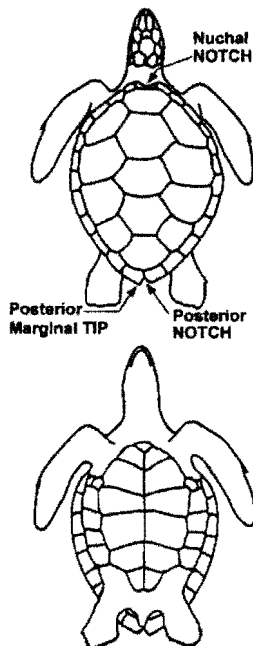
Checked for living tag? ☐ Yes ☐ No
 If found, record location (scute number & side) _____

CARAPACE MEASUREMENTS: (see drawing)

Using calipers Circle unit
 Straight length (NOTCH-TIP) _____ cm / in
 Minimum length (NOTCH-NOTCH) _____ cm / in
 Straight width (Widest Point) _____ cm / in

Using non-metal measuring tape Circle unit
 Curved length (NOTCH-TIP) _____ cm / in
 Minimum length (NOTCH-NOTCH) _____ cm / in
 Curved width (Widest Point) _____ cm / in

Weight ☐ actual / ☐ est. _____ kg / lb



Mark wounds / abnormalities on diagrams at left and describe below (note tar or oil, gear or debris entanglement, propeller damage, epibiota, papillomas, emaciation, etc.). Please note if no wounds / abnormalities are found.

APPENDIX G

Loggerhead (*Caretta caretta*) and Green Turtle (*Chelonia mydas*) Nesting Activity Impacted by Australian Pine (*Casuarina equisetifolia*) on Loggerhead Key, Dry Tortugas National Park, 2004 (N indicates nest, FC indicates false crawl).

Crawl #	Beach Sector	Impact of <i>Casuarina equisetifolia</i>
35 FC	L	Encountered branches; returned to the water.
54 N	E	Encountered stumps and roots; altered course.
82 N	B	Encountered branches; altered course.
117 N	M	Encountered stumps and down trees; altered course and nested beside down tree.
130 FC	B	Encountered log when digging; abandoned body pit and returned to the water.
219 FC	F	Encountered stumps; returned to the water.
230 FC	H	Encountered stumps and debris; abandoned body pit and returned to the water.
338 FC	D	Encountered stumps and debris; returned to the water.
402* FC	U	Encountered stumps; altered course and returned to the water.
406 FC	M	Encountered down tree; abandoned body pit and returned to the water.
452 FC	M	Encountered downed tree; returned to the water.
453 FC	L	Encountered stump; crawled over it and returned to the water.
464* FC	D	Encountered stump; returned to the water.
471* FC	U	Encountered stump; abandoned body pit and returned to the water.
488 FC	U	Encountered stumps; returned to the water.
499*FC	D	Encountered stump; abandoned body pit and returned to the water.
550* FC	F	Encountered stumps; returned to the water.
589 FC	V	Encountered downed tree; returned to the water.
596 FC	M	Encountered downed tree; returned to the water.

* Denotes green turtle (*Chelonia mydas*) activity.

APPENDIX H

2004 Dry Tortugas Sea Turtle Monitoring Program Volunteer Hours.

Volunteer	Dates of Service	Hours
Eloise Pratt	4/25 – 10/1	282
Niki Ryan	4/10 – 10/1	40
Dawne Laraway	4/27 – 6/3	70
Sandy Moss	6/1 – 7/1	62
Ed Moss	6/1 – 7/1	62
Russell Reardon	5/19, 5/30, 6/13, 9/25-27	40
Joy Griffin	5/20 – 5/30	40
Hannah Griffin	5/20 – 5/30	40
Caleb Griffin	5/20 – 5/30	40
Donna Saylor	8/31 – 9/16	34
Lee Saylor	8/31 – 9/16	34
Karla Pedersen	6/27 – 6/28	16
Chad Smith	5/30	8
Aleta Boroski	8/30-8/31	8
Dave Boroski	8/30-8/31	8
Mike Jester	6/4	4
Phil Trepiccione	6/8	4
Total Volunteer Hours		792

Table 1. 2004 Sea Turtle Crawl Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	41	11	30	26.8%
East Key	318	111	207	34.9%
Garden Key	2	1	1	50.0%
Hospital Key	29	3	26	10.3%
Loggerhead Key	250	70	180	28.0%
Long Key	5	0	5	0.0%
Middle Key	0	0	0	N/A
Park Totals	645	196	449	30.4%

*** Nest Success = (number of nests/total activity) x 100**

Table 2. 2004 Loggerhead Turtle (*Caretta caretta*) Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	39	10	29	25.6%
East Key	225	73	152	32.4%
Garden Key	2	1	1	50.0%
Hospital Key	18	3	15	16.7%
Loggerhead Key	172	47	125	27.3%
Long Key	2	0	2	0.0%
Middle Key	0	0	0	N/A
Park Totals	458	134	324	29.3%

***Nest Success = (number of nests/total activity) x 100**

Table 3. 2004 Green Turtle (*Chelonia mydas*) Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	2	1	1	50.0%
East Key	90	35	55	38.9%
Garden Key	0	0	0	N/A
Hospital Key	11	0	11	0.0%
Loggerhead Key	78	23	55	29.5%
Long Key	3	0	3	0.0%
Middle Key	0	0	0	N/A
Park Totals	184	59	125	32.1%

***Nest Success = (number of nests/total activity) x 100**

Table 4. 2004 Leatherback Turtle (*Dermochelys coriacea*) Activity, Dry Tortugas National Park.

Location	Total Activity	Nests	False Crawls	Nest Success*
Bush Key	0	0	0	N/A
East Key	3	3	0	100.0%
Garden Key	0	0	0	N/A
Hospital Key	0	0	0	N/A
Loggerhead Key	0	0	0	N/A
Long Key	0	0	0	N/A
Middle Key	0	0	0	N/A
Park Totals	3	3	0	100.0%

***Nest Success = (number of nests/total activity) x 100**

Table 5. 2004 Summary of Loggerhead (*Caretta caretta*), Green (*Chelonia mydas*), and Leatherback Turtle (*Dermochelys coriacea*) Hatching Data, Dry Tortugas National Park.

Data Category	Loggerhead Turtle (<i>Caretta caretta</i>)	Green Turtle (<i>Chelonia mydas</i>)	Leatherback Turtle (<i>Dermochelys coriacea</i>)
Total Nests	134 nests	59 nests	3 nests
Total Nests Inventoried (n)	nests	Nests	0 nests
Total Eggs	eggs	Eggs	N/A
Total Unhatched Eggs	eggs	Eggs	N/A
Total Depredation	eggs; hatchlings	eggs; hatchlings	N/A
Total Eggs Hatched	eggs	Eggs	N/A
Average Hatching Success			N/A
Total entering Gulf	hatchlings	hatchlings	N/A
Average Release Rate			N/A
Average Incubation	days	Days	N/A
Average Clutch Size	eggs	Eggs	N/A

Table 6. 2004 Sea Turtle Stranding, Dry Tortugas National Park.

Number	Date	Species*	Location	Condition Found
1	02/03/2004	CC	Southeast Beach of Loggerhead Key	Fresh Dead
2	05/29/2004	EI	Floating East of Loggerhead Key, ~150 yds. North of Dock	Fresh Dead
3	07/06/2004	CC	South of Dock at Loggerhead Key, In the Surf Line	Alive, Released
4	07/21/2004	EI	Floating near Marker 3 Southwest Channel	Moderately Decomposed
5	10/11/2004	EI	East side of Loggerhead Key	Moderately Decomposed
6	11/08/2004	CM	Southwest beach of Garden Key	Moderately Decomposed

* CC = *Caretta caretta* (Loggerhead Turtle), CM = *Chelonia mydas* (Green Turtle), EI = *Eretmochelys imbricata* (Hawksbill Turtle)